IEEE SSCI 2014

DECEMBER 9-12, 2014
ORLANDO, FLORIDA, U.S.A.

2014 IEEE SYMPOSIUM SERIES ON COMPUTATIONAL INTELLIGENCE

CONFERENCE PROGRAM

IEEE

IEEE Computational Intelligence Society

Tuesday, December 9th, 2014

12:00pm-8:00pm	Registration (Grand Sierra Registration SOUTH): 12:00pm-6:00pm Reception (Grand Sierra A, B & C): 6:00pm-8:00pm

Wednesday, December 10th, 2014

Room Names	Antigua 2	Antigua 3	Antigua 4	Bonaire 1	Bonaire 2	Bonaire 3	Bonaire 4	Bonaire 5	Bonaire 6	Bonaire 7	Bonaire 8	Curacao 1	Curacao 2	Curacao 3	Curacao 4	Curacao 7
8:00-8:10am	Opening Remarks (Grand Sierra D)															
8:10-9:10am	Plenary Talk (Grand Sierra D)															
9:10-9:20am	Break															
9:20-10:00am	CIBD	IES	CIHLI	CCMB	CIPLS	CIComms	SDE	CICS	CIEL	CIR2AT	CIMSIVP	ADPRL	CIDM	SIS	CIASG	DC
10:00-10:20am	Break															
10:20am-12:00pm	CIBD	IES	CIHLI	CCMB	CIPLS	CIComms	SDE	CICS	CIEL	CIR2AT	CIMSIVP	ADPRL	CIDM	SIS	CIASG	DC
12:00-1:30pm	Lunch Break															
1:30-3:10pm	CIBD	IES	CIHLI	CCMB	CIPLS	CIComms	SDE	CICS	CIEL	CIR2AT	CIMSIVP	ADPRL	CIDM	SIS	CIASG	DC
3:10-3:30pm	Break															
3:30-5:10pm	CIBD	IES	CIHLI	CCMB	CIPLS	CIComms	SDE	CICS	CIEL	CIR2AT	CIMSIVP	ADPRL	CIDM	SIS	CIASG	DC

Thursday, December 11th, 2014

Room Names	Antigua 2	Antigua 3	Antigua 4	Bonaire 1	Bonaire 2	Bonaire 3	Bonaire 4	Bonaire 5	Bonaire 6	Bonaire 7	Bonaire 8	Curacao 1	Curacao 2	Curacao 3	Curacao 4	Curacao 7
8:00-9:00am	**Plenary Talk (Grand Sierra D)**															
9:00-9:20am	Break															
9:20-10:00am	**CICA**	**ICES**	**CIBIM**	**MCDM**	**RiiSS**	**CIVTS**	**CIES**	**ISIC**	**FOCI**	**EALS**		**ADPRL Talk**	**Ghosts Competition**	**SIS Talk**	**Big Data Panel**	
10:00-10:20am	Break															
10:20am-12:00pm	CICA	ICES	CIBIM	MCDM	RiiSS	CIVTS	CIES	ISIC	FOCI	EALS	CIMSIVP	ADPRL	CIDM	SIS	CIASG	DC
12:00-1:30pm	Lunch Break															
1:30-3:10pm	CICA	ICES	CIBIM	MCDM	RiiSS	CIVTS	CIES	ISIC	FOCI	EALS	CIMSIVP	ADPRL	CIDM	SIS	CIASG	DC
3:10-3:30pm	Break															
3:30-5:10pm	CICA	ICES	CIBIM	MCDM	RiiSS	CIVTS	CIES	ISIC	FOCI	EALS	CIMSIVP	ADPRL	CIDM	SIS	CIASG	DC Social
5:10-6:45pm	**Poster Session (Grand Sierra E)**															
7:00-9:30pm	**Banquet (Grand Sierra A, B, C & D)**															

Friday, December 12th, 2014

Room Names	Antigua 2	Antigua 3	Antigua 4	Bonaire 1	Bonaire 2	Bonaire 3	Bonaire 4	Bonaire 5	Bonaire 6	Bonaire 7	Bonaire 8	Curacao 1	Curacao 2	Curacao 3	Curacao 4	Curacao 7
8:00-9:00am	**Plenary Talk (Grand Sierra D)**															
9:00-9:30am	Break															
9:30-10:30am	CICA	ICES	CIBIM	MCDM	RiiSS	CIVTS	CIES	ISIC	CIDUE	EALS	CIBCI	ADPRL	CIDM	SIS	CICARE	
10:30-11:00am	Break															
11:00am-12:00pm	CICA	ICES	CIBIM	MCDM	RiiSS	CIVTS	CIES	IA	CIDUE	EALS Talk	CIBCI	ADPRL	CIDM	SIS	CICARE	
12:00-1:30pm	Lunch Break															
1:30-3:10pm	CICA	ICES	CIBIM	MCDM	RiiSS		CIES	IA	CIDUE		CIBCI		CIDM	SIS	CICARE	
3:10-3:30pm	Break															
3:30-5:10pm	CICA	ICES					CIES	IA					CIDM	SIS	CICARE	

Plenary Talk – Wednesday, December 10

Sensor Fault Diagnosis in Cyber-Physical Systems

Marios M. Polycarpou
University of Cyprus, Cyprus

Abstract

Recent advances in information and communication technologies, embedded systems and sensor networks have generated significant research activity in the development of cyber-physical systems, where a large amount of sensor data is collected and processed in real-time in order to achieve smooth and efficient operation of the underlying system. The current trend is towards larger and larger sensor data sets, leading to so called big data environments. However, in situations where faults arise in one or more of the sensing devices, this may lead to a serious degradation in performance or even to an overall system failure, especially as a result of propagating faults in interconnected subsystems. The goal of this presentation is to motivate the need for fault diagnosis in cyber-physical systems and to provide a methodology for detecting and isolating multiple sensor faults in a class of nonlinear dynamical systems. The detection of faults in sensor groups is conducted using robust analytical redundancy relations, formulated by structured residuals and adaptive thresholds. Various estimation and learning algorithms will be presented and illustrated, and directions for future research will be discussed.

Biography

Marios M. Polycarpou is a Professor of Electrical and Computer Engineering and the Director of the KIOS Research Center for Intelligent Systems and Networks at the University of Cyprus. He received the B.A. degree in Computer Science and the B.Sc. degree in Electrical Engineering both from Rice University, Houston, TX, USA in 1987, and the M.S. and Ph.D. degrees in Electrical Engineering from the University of Southern California, Los Angeles, CA, in 1989 and 1992 respectively. Prior to joining the University of Cyprus as founding Department Chair in 2001, he was Professor of Electrical and Computer Engineering and Computer Science at the University of Cincinnati, Ohio, USA. His teaching and research interests are in intelligent systems and networks, adaptive and cooperative control systems, computational intelligence, fault diagnosis and distributed agents. Dr. Polycarpou has published more than 250 articles in refereed journals, edited books and refereed conference proceedings, and co-authored 6 books. He is also the holder of 6 patents.

Prof. Polycarpou is a Fellow of the IEEE and served as the President of the IEEE Computational Intelligence Society between Jan. 2012 – Dec. 2013. He has served as the Editor-in-Chief of the IEEE Transactions on Neural Networks and Learning Systems between 2004-2010. He participated in more than 60 research projects/grants, funded by several agencies and industry in Europe and the United States. In 2011, Prof. Polycarpou was awarded the prestigious European Research Council (ERC) Advanced Grant.

Plenary Talk – Thursday, December 11

Single Frame Super Resolution: Gaussian Mixture Regression and Fuzzy Rule-Based Approaches

Nikhil R. Pal
Indian Statistical Institute, India

Abstract

High quality image zooming is an important problem. There are many methods that use multiple low resolution (LR) frames of the same scene with different sub-pixel shifts as input to generate the high resolution (HR) images. Now a days single frame super resolution (SR) methods that use just one LR image to obtain the HR image has become popular. In this talk we shall discuss a novel fuzzy rule based single frame super resolution method. This is a patch based method, where each LR patch is replaced by a HR patch generated by a Takagi-Sugeno type fuzzy rule-based system. We shall discuss in details the generations of the training data, the initial generation of the fuzzy rules, their refinement and how to use the rules for generation of SR images. In this context we shall also develop a Gaussian Mixture Regression (GMR) model for the same problem. Both the fuzzy rule based system and GMR are found to be quite effective. Comparison of performance of the fuzzy rule-based system with five existing methods as well as with the GMR method in terms of the several quality criteria demonstrates the superior performance of the fuzzy rule-based system.

Biography

Nikhil R. Pal obtained B. Sc. (Physics) and MBM (Operations Research) degrees from the University of Calcutta, and M. Tech. and Ph. D. degrees in Computer Science from the Indian Statistical Institute (ISI), Calcutta. In 1984, after completion of his M. Tech. degree he joined a car manufacturing company and after eight months he moved to a tyre manufacturing company. But in about two and a half years he left industry and joined ISI, where he has been a professor since June 1995 and currently associated with the Electronics and Communication Sciences Unit. He has also served as the Professors-in-Charge of the Computer and Communication Sciences Division of the Institute for a period of two years. In between, he has served as a Chair Professor of the National Chiao-Tung University, Taiwan, and a Visiting Professor of RIKEN Brain Science Institute, Japan and the University of West Florida, USA. His current research interest includes bioinformatics, brain science, fuzzy logic, pattern analysis, neural networks, and evolutionary computation.

He was a Distinguished Lecturer of the IEEE Computational Intelligence Society (CIS) and was a member of the Administrative Committee of the IEEE CIS. At present he is the Vice President for Publications of the IEEE CIS. He is a Fellow of the National Academy of Sciences, India, a Fellow of the Indian National Academy of Engineering, a Fellow of the Indian National Science Academy, a Fellow of the International Fuzzy Systems Association (IFSA), and a Fellow of the IEEE, USA.

Plenary Talk – Friday, December 12

Blast from the Past - Revisiting Evolutionary Strategies for the Design of Engineered Systems

Alice E. Smith
Auburn University, USA

Abstract

This plenary will discuss the potential advantages of using one of the most venerable, but currently underutilized, evolutionary computation paradigms, that of Evolutionary Strategies (ES). Developed some 50 years ago with the aim of improving engineering design, this paradigm has often been overlooked in favor of the more popular paradigms of genetic algorithms, ant colony optimization, particle swarm optimization and others. However, ES is an appealing combination of simplicity and effectiveness, especially for real valued variables. This talk will discuss the motivations of and experiences with using ES for three diverse domains in engineering design – aircraft airfoil design, optimal configurations for order picking warehouses, and design of resilient ad hoc wireless communications networks. These applications integrate the ES with other computational methods including simulation to form comprehensive and pragmatic design tools. The "Old School" paradigm of ES has much to offer contemporary users of meta-heuristics and deserves a higher profile within the computational intelligence community.

Biography

Alice E. Smith is the W. Allen and Martha Reed Professor of the Industrial and Systems Engineering Department at Auburn University, where she served as Department Chair from 1999-2011. She also has a joint appointment with the Department of Computer Science and Software Engineering. Previously, she was on the faculty of the Department of Industrial Engineering at the University of Pittsburgh from 1991-99, which she joined after industrial experience with Southwestern Bell Corporation. Dr. Smith has degrees from Rice University, Saint Louis University and Missouri University of Science and Technology.

Dr. Smith's research focus is analysis, modeling and optimization of complex systems with emphasis on computation inspired by natural systems and has attracted over $6M in research funding. She holds one U.S. patent and several international patents and has authored more than 200 publications which have garnered over 2,100 citations and an H Index of 21 (ISI Web of Science). Several of her papers are among the most highly cited in their respective journals including the most cited paper of Reliability Engineering & System Safety and the 2nd most cited paper of IEEE Transactions on Reliability. Dr. Smith is an Area Editor of both INFORMS Journal on Computing and Computers & Operations Research and an Associate Editor of IEEE Transactions on Evolutionary Computation. She is a senior member of IEEE and a current IEEE CIS Ad Com member.

Keynote Talk: ADPRL'14

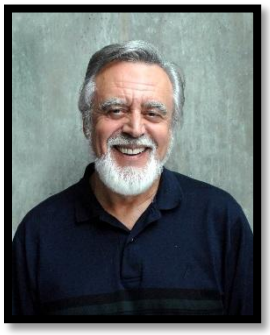
Approximate Dynamic Programming Methods: A Unified Framework

Dimitri P. Bertsekas
Massachusetts Institute of Technology, USA

Abstract

Approximation of cost functions within a low-dimensional space of basis functions in a major approach in approximation dynamic programming. It may be implemented by well-established methods such as temporal differences, aggregation, and Bellman error. We show that all of these methods can be viewed within a unified framework, based on an extended form of Galerkin approximation approach that involves projected equations. However, there are two major differences: the first is that the implementation is simulation-based, and the second is that the projection is done using a (weighted) Euclidean seminorm (rather than norm). This extension carries over to weighted multistep projected Bellman equations, similar to those of multistep TD(λ)-type methods. An important new feature is that the associated weights need not be geometrically distributed and may be state-dependent. This allows greater flexibility to design simulation methods with desirable bias-variance and exploration characteristics, in the context of standard and optimistic policy iteration methods. Moreover, it allows us to establish a close connection between projected equation and aggregation methods, and to develop for the first time multistep aggregation methods of the TD(λ)-type.

Biography



Dr. Bertsekas has held faculty positions with the Engineering-Economic Systems Dept., Stanford University (1971-1974) and the Electrical Engineering Dept. of the University of Illinois, Urbana (1974-1979). Since 1979 he has been teaching at the Electrical Engineering and Computer Science Department of the Massachusetts Institute of Technology (M.I.T.), where he is currently McAfee Professor of Engineering. He has held editorial positions in several journals. His research at M.I.T. spans several fields, including optimization, control, large-scale computation, and data communication networks, and is closely tied to his teaching and book authoring activities. He has written numerous research papers, and fifteen books, several of which are used as textbooks in MIT classes.

Professor Bertsekas was awarded the INFORMS 1997 Prize for Research Excellence in the Interface Between Operations Research and Computer Science for his book "Neuro-Dynamic Programming" (co-authored with John Tsitsiklis), the 2000 Greek National Award for Operations Research, the 2001 ACC John R. Ragazzini Education Award, the 2009 INFORMS Expository Writing Award, the 2014 ACC Richard E. Bellman Control Heritage Award, and the 2014 Khachiyan Prize for Life-Time Accomplishments in Optimization.

Keynote Talk: CCMB'14

Toward Physics of the Mind

Leonid I. Perlovsky
Harvard University

Abstract

Is physics of the mind possible? How would it differ from biophysics or neural networks?

Physics looks for the first principles describing a wide area of reality. Physics develops testable predictive theories. The talk describes steps towards a physical theory of the mind. I summarize known first principles: mechanisms of concepts, emotions, the knowledge instinct, the mind hierarchy, and dynamic logic combining the first principles into a hierarchical system of mental processes. Brain imaging experiments (Bar et al 2006; Kveraga et al 2007) confirmed this as an adequate model of the mind perception and cognition.

Dynamic logic overcame the difficulty of computational complexity plaguing modeling of the mind, artificial intelligence, and machine learning since the 1960s. I relate this difficulty to Gödelian problems in logic: computational complexity is a manifestation of Gödelian incomplet-eness in finite systems. Engineering applications demonstrate orders of magnitude improvement.

The dual hierarchy model of language and cognition discusses "mysteries" in this interaction. The model is confirmed in brain imaging (Binder et al 2005; Price 2012). The knowledge instinct is a foundation of higher cognitive abilities. Its satisfaction is experienced as aesthetic emotions (experimentally confirmed in Cabanac et al 2010). Contradictions in knowledge are experienced as cognitive dissonances counteract the knowledge instinct and would prevent accumulation of knowledge and the entire human evolution, if not a special ability evolved for overcoming these emotions. It follows from the dual hierarchy model that this mechanism is music. This theoretical prediction has been experimentally confirmed (Masataka et al 2012, 2013). This explains the origin and evolution of music, what Darwin called the greatest mystery.

Biography

Dr. Perlovsky is Professor at Northeastern University Psychology Department and CEO LP Information Technology, past Visiting Scholar at Harvard Engineering and Medical School, Technical Advisor at the AF Research Lab. Created a new area of cognitive mathematics, dynamic logic, which models the mind and solves problems in engineering and cognitive science unsolvable for decades. Invited as a keynote plenary speaker and tutorial lecturer worldwide, at most prestigious venues such as the Nobel Forum; 485 papers, 17 book chapters, 4 books. Serves as Chair for the IEEE Task Force on The Mind and Brain, on the INNS Board of Governors, has founded and serves as Editor-in-Chief for "Physics of Life Reviews," the IF=9.5, #4 in the world. Awarded: The Gabor Award, the John McLucas Award, and the highest US Air Force Award for basic research.

Keynote Talk: CIASG'14

Computational Systems Thinking for Transformation of Smart Grid Operations

Ganesh Kumar Venayagamoorthy
Clemson University, USA

Abstract

The smart grid can be viewed as a digital upgrade of the existing electricity infrastructure that minimizes the cost of energy and reduces emissions. A vast amount of data is generated and must be processed, so that the pertinent information is communicated to the appropriate control centers in time for necessary decisions to be made and adaptations to take place. The monitoring, optimization and control systems for smart grids will require computerized intelligent systems or computational systems thinking machines (CSTMs) to handle the increased variability and uncertainties caused by increased penetration of variable renewable energy resources. What principles will govern the design of such systems and where do we find them? Such CSTMs will require three basic capabilities: sense-making, decision-making and adaptation. Realization of those capabilities will depend in turn on subsystems that continuously improve their knowledge of the grid dynamics and not just gather data. This keynote talk will provide insight into the design and development of CSTMs for real-time smart grid operations.

Biography

Ganesh Kumar Venayagamoorthy received his Ph.D. degree in electrical engineering from the University of Natal, Durban, South Africa, in 2002. He is the Duke Energy Distinguished Professor of Electrical and Computer Engineering at Clemson University, Clemson, USA. Prior to that, he was a Professor of Electrical and Computer Engineering at the Missouri University of Science and Technology (Missouri S&T), Rolla, USA. He was a Visiting Researcher with ABB Corporate Research, Sweden, in 2007. He has published 2 edited books, 8 book chapters, and over 450 refereed journal and conference proceeding papers. His publications have received over 8000 citations and with an h-index of 45. Dr. Venayagamoorthy has been involved in over 60 research projects totaling about $10 million.

Dr. Venayagamoorthy is a recipient of several awards including a 2008 US National Science Foundation (NSF) Emerging Frontiers in Research and Innovation Award, a 2007 US Office of Naval Research Young Investigator Program Award, a 2004 NSF CAREER Award, the 2010 Innovation Award from St. Louis Academy of Science, the 2010 IEEE Region 5 Outstanding Member Award, the 2006 IEEE Power and Energy Society Outstanding Young Engineer Award, the 2005 SAIEE Young Achievers Award and the 2003 International Neural Network Society's Young Investigator Award.

Keynote Talk: CIBD'14

Big Data and Analytics at Verizon

Ashok N. Srivastava
Chief Data Scientist, Verizon, USA

Abstract

The talk will give an overview of the development of a new capability at Verizon that focuses on large-scale machine learning applied to massive data sets. We will discuss the technology, products, and the business drivers for these developments in the context of a Fortune 15 company. Several areas of potential development including advertising, network optimization and analytics, as well as aerospace applications will be discussed.

Biography

Ashok N. Srivastava, Ph.D. is the Chief Data Scientist at Verizon. He leads a new research and development center in Palo Alto focusing on big data and analytics to build new revenue streams for Verizon. In this capacity he sets the strategic direction for big data and analytics for the corporation. He is the Editor-in-Chief of the AIAA Journal of Aerospace Information Systems. Ashok is a Fellow of the IEEE, the American Association for the Advancement of Science (AAAS), and an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA). Prior to joining Verizon he was the Principal Scientist for Data Sciences at NASA Ames Research Center and led the System-Wide Safety and Assurance Technologies project at NASA which has a 5 year budget of nearly $150M. Ashok has significant experience in the internet, adtech, e-commerce, banking, finance, and securities areas. He served as a Venture Advisor focusing on big-data analytics at Trident Capital, and was on the advisory board of several startups.

Keynote Talk: CIBIM'14

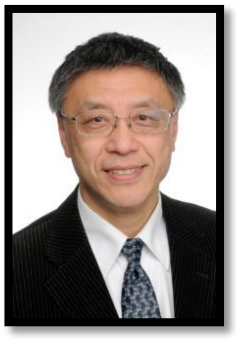
Computational Intelligence and Biometric Technologies: Application-driven development

Qinghan Xiao
Defence Research and Development Canada, Canada

Abstract

Biometrics is the science and technology of recognizing a person based on unique human physiological or behavioral characteristics. The research field of biometrics encompasses a wide range of disciplines such as signal processing, pattern recognition, classification, and decision making. Computational intelligence (CI) is primarily comprised of three interrelated areas of study: artificial neural network (ANN), fuzzy systems (FS), and evolutionary computation (EC), though a precise definition of the field is impossible. Biometrics and CI are both fast growing fields of research and application. The reason they are linked together is because CI provides a powerful tool to deal with various important and pressing challenges in biometrics. This keynote will highlight the IEEE CIS biometrics events and explore how to use CI-based technologies in solving biometric problems, such as CI-based biometric image processing and feature extraction, CI-based biometric matching, and CI-based multi-modal biometric fusion. This talk will give more emphasis to the use of CI methods in solving challenging problems in real-life biometric applications. Biometric technology has been used for many years and is a security technology of the past, present, and future, while CI techniques make it possible for biometric applications to be more reliable and accurate.

Biography



Dr. Qinghan Xiao, IEEE Senior Member, is a Defence Scientist at the Defence R&D Canada-Ottawa Research Centre. He currently serves as the Chair of Task Force on Biometrics of the IEEE CIS Technical Committee on Intelligent Systems Applications. Dr. Xiao is an Associate Editor of the International Journal of Biometrics (IJBM). His research interests include biometrics, radio frequency identification (RFID), smart card, and electronic and cyber warfare technologies. He has been invited as session chair and speaker to many international conferences, co-chaired several special sessions, workshops, and symposiums for IEEE on biometrics, and served as Guest Editor for two special issues on biometrics standardization and computational intelligence in biometrics. Dr. Xiao is the recipient of 2010 IEEE Ottawa Outstanding Engineer Award for his contributions to the area of biometrics. He was the technology lead of the anti-intrusion RFID project which received the 2012 IEEE Ottawa Outstanding Technology Recognition Award.

Keynote Talk: CICA'14

Fuzzy and Fuzzy-Polynomial Systems for Nonlinear Control: Overview and Discussion

Antonio Sala
Universitat Politecnica de Valencia, Spain

Abstract

Next year, Fuzzy Sets will celebrate their 50th birthday. Fuzzy control is almost as old as the fuzzy sets themselves. These 50 years have elapsed not without controversy; in the control area, the main idea started with a model-free ``controlling with words'' approach (heuristic rulebases) in the 70's but research interests shifted from the 90s onwards towards model-based fuzzy control, heavily resorting on nonlinear control tools and convex optimization (LMI). Nevertheless, applications of fuzzy control in the original heuristic setting continue to grow even with no significant theoretical contribution from a scientific point of view has appeared in that context in the last two decades: most human-provided rules are not too different from standard PID ones.

Hence, current fuzzy control research is almost exclusively devoted to Lyapunov-function based fuzzy control methods, which can guarantee stability and robustness of the closed-loop system generalizing the linear robust control results of the 1980s. Using a Taylor-series formalism, a polytopic combination of polynomials can be used to (locally) describe such nonlinear systems in a non-approximate way, being the degree-1 polynomials the particular case, well-known, of Takagi-Sugeno models; this generalizes to non-polynomial nonlinearities the Sum-of-Squares results of early 2000s. The main ideas behind such modeling techniques and the sources of conservatism because of using only the vertex models (membership-shape independent approach) instead of the original nonlinear equations will be reviewed, as well as some issues arising from the local validity of the models, limited computational resources, numerical conditioning, etc. Current ideas (non-quadratic Lyapunov functions, set-membership approaches, asymptotical exactness …) will be contextualized. Research of the speaker's team in this area is financed by project DPI2011-27845-C02-01 from the Spanish Ministry of Economy.

Biography

Prof. Antonio Sala received a Ph.D. in Control Engineering from UPV (Valencia Technical University, Spain). Since 1993, he has been teaching in UPV where he currently is full Professor. He has supervised 7 Ph.D. theses (+3 ongoing ones) and more than 25 final M.Sc. projects.

His current research interests are LMI/SOS approaches to fuzzy control, control applications, optimal and fault-tolerant control. He has published one book, co-edited another two ones, more than 65 journal papers and more than 125 congress papers. Antonio Sala is Associate Editor of *IEEE Transactions on Fuzzy Systems* and Area Editor of *Fuzzy Sets and Systems*.

Keynote Talk: CIComms'14

Dealing with Complexity in Optimization Design

Andrea Massa
University of Trento, Italy

Abstract

In the last decades, the extraordinary growth of the computational capabilities has led to suppose that any problem, despite its complexity, could be effectively dealt with by means of generic numerical optimization strategies. However, many times such techniques are used as "black-box" tools without an adequate knowledge of their peculiarities and functionalities. Therefore, sub-optimal solutions can be obtained or the achievement of reliable solutions prevented, especially when dealing with the optimization of complex functional. In order to avoid these drawbacks, starting from the knowledge of the physics of the problems at hand and the available *a-priori* information, the choice of the most suitable approach is a crucial point enabling the effective retrieval of the problem solution.

In this talk, a review of the most recent techniques developed at the ELEDIA Research Center and suitable to deal with the optimization of complex problems in engineering electromagnetics is presented. In particular, indications will be given about the use of optimization techniques, based on Evolutionary Algorithms (EAs), able to find the global best solution when optimizing - min/max - a cost function; Learning-by-Example (LBE) approaches (e.g., SVM, ANN) suitable for regression or classification; Compressive Sensing (CS) techniques, adapt for reducing the sampling rate when representing signals as well as for reconstructing the original signals from the samples.

Biography

Andrea Massa is Full Professor of Electromagnetic Fields at the University of Trento, where he currently teaches bachelor, master, and Ph.D. courses on electromagnetic fields, inverse scattering techniques, antennas and wireless communications, wireless services and devices, and optimization techniques. Moreover, Prof. Massa is director of the ELEDIA Research Center with a staff of more than 25 researchers.

His research activities are mainly concerned with direct and inverse scattering problems, propagation in complex and random media, analysis/synthesis of antenna systems and large arrays, design/applications of WSNs, cross-layer optimization and planning of wireless/RF systems, semantic wireless technologies, material-by-design (metamaterials and reconfigurable-materials), and theory/applications of optimization techniques to engineering problems (telecommunications, medicine, and biology).

Prof. Massa published more than 600 scientific publications among which more than 260 on international journals and about 360 in international conferences where he presented more than 50 invited contributions. He has organized 45 scientific sessions in international conferences and has participated to several technological projects in the European framework (20 EU Projects) as well as at the national and local level with national agencies (75 Projects/Grants).

Keynote Talk: CICS'14

Post-Breach Cyber Defense

Vipin Swarup
The MITRE Corporation, USA

Abstract

Despite our taking significant strides toward building secure, trustworthy systems, cyber adversaries are successfully using other means of attack to compromise our information systems and the business and mission functions that rely on those systems. Their attack campaigns have been characterized by the cyber-attack lifecycle model (also known as the cyber kill chain) as consisting of seven phases. This talk will focus on the right-of-exploit phases of the lifecycle model. We will examine a framework of the tactics and techniques exhibited by cyber adversaries *after* they have gained an initial foothold in an enterprise network. We will then discuss a range of challenges as well as emerging technologies to detect, prevent, and be resilient to cyber adversaries operating within our networks.

Biography

Dr. Vipin Swarup is the Chief Scientist for Cyber Security in MITRE's Cyber Security Technical Center. He leads MITRE's corporate cybersecurity research program which includes over 25 research projects in cyber analytics, active cyber defense, network security, mobile computing security, cyber-physical systems security, and cyber resiliency. He is responsible for creating and executing MITRE's cybersecurity research strategy and for operationalizing and transitioning resulting innovations. In the past, he has led research projects in trust management, cross-boundary information sharing, context-aware security, security guards, and mobile agent security and has published extensively in these and other areas. He played a lead role on a US Department of Defense (DOD) team that developed a DOD Science and Technology (S&T) strategy for cyber conflict defense against advanced cyber threats — based on this strategy, DOD substantially reshaped its funding priorities in cybersecurity research. Dr. Swarup holds a B.Tech. in Computer Science and Engineering from Indian Institute of Technology, Bombay, and an MS and Ph.D. in Computer Science from the University of Illinois at Urbana-Champaign.

Keynote Talk: CIDM'14

What Might be Predicted from Medical Image Mining

Lawrence O. Hall
University of South Florida, USA

Abstract

Medical imaging provides a noninvasive way of viewing cancerous or precancerous anomalies. The anomalies could be lung polyps or tumors, for instance. They can be brain tumors. The extraction of useful features and building of learned models from CT scans of lungs and magnetic resonance images of brains will be discussed. Experiments will be shown that indicate it is possible to predict disease prognosis or identify a "dangerous" polyp. The challenges of using only images for prediction will be discussed, as well as the combination of clinical and genetic information to improve predictions from medical images.

Biography

Lawrence O. Hall is a Distinguished University Professor and the Chair of the Department of Computer Science and Engineering at University of South Florida. He received his Ph.D. in Computer Science from the Florida State University in 1986 and a B.S. in Applied Mathematics from the Florida Institute of Technology in 1980. He is a fellow of the IEEE. He is a fellow of the AAAS and IAPR. He received the Norbert Wiener award in 2012 from the IEEE SMC Society. His research interests lie in distributed machine learning, extreme data mining, bioinformatics, pattern recognition and integrating AI into image processing. The exploitation of imprecision with the use of fuzzy logic in pattern recognition, AI and learning is a research theme. He has authored or co-authored over 75 publications in journals, as well as many conference papers and book chapters.

Keynote Talk: CIEL'14

What Can Ensemble of Classifiers Do for You?

Robi Polikar
Rowan University, USA

Abstract

Ensemble based systems have now been with us for over couple decades, and have proven their usefulness in a wide spectrum of computational intelligence problems, producing along the way such algorithms as AdaBoost and Random Forests, some of the superstar celebrities of machine learning. These algorithms, and their countless variations, showed that sophisticated models that can realize very complex decision boundaries can in fact be generated from very simple ones that can only solve the simplest of classification problems. But ensemble systems can do a lot more than improving classification performance. In this talk, we will review some obvious and some not-so-obvious problems that can be addressed by ensemble systems, such as analyzing data with missing features, avoiding model over-fitting when you have very little data, incremental learning of new knowledge from streaming data without retaining or memorizing old data, learning new knowledge and knowing what to forget, when to forget and when to remember what you had forgotten, dealing with concept drift and learning from data when the data characteristics change over time, fusion of heterogeneous data sources for intelligent decision making, and learning from grossly unbalanced data. We will then focus on how ensemble systems can provide a very elegant solution to one of the most heavily studied, yet still unresolved problem of optimal feature selection. We will show that, a novel ensemble approach can be used to determine the number and identity of the most relevant features in a dataset even when there is no prior knowledge on the number of relevant features in the dataset for a given classification problem. Furthermore, we will show that such an approach – perhaps surprising for ensemble based systems – can also scale to massive datasets with tens of thousands of features and tens or hundreds of GB of data. And, if that is not enough applications of ensemble systems for you, how about giving you the ability to win $1,000,000? That is enough to pay for over 1000 years of SSCI registrations, ensuring that you will not miss any of these meetings for a very long time. How so, you ask? Well, you will just have to come to this talk to find out how.

Biography

Robi Polikar is a Professor of Electrical and Computer Engineering at Rowan University, in Glassboro, NJ. He has received his B.Sc. degree in electronics and communications engineering from Istanbul Technical University, Istanbul, Turkey in 1993, and his M.Sc and Ph.D. degrees, both co-majors in electrical engineering and biomedical engineering, from Iowa State University, Ames, IA in 1995 and 2000, respectively. His current research interests within computational intelligence include ensemble systems, incremental and nonstationary learning, and various applications of pattern recognition in bioinformatics and biomedical engineering. He is a member of IEEE, ASEE, Tau Beta Pi and Eta Kappa Nu. His current and prior works are funded primarily through NSF's CAREER and Energy, Power and Adaptive Systems (EPAS) programs. He has been heavily involved with IJCNN and SSCI for over a decade with many special sessions, as well as serving as part of organizing committee. He is also an Associate Editor for IEEE Transactions on Neural Networks and Learning Systems, as well as an ABET evaluator for Engineering Accreditation Commission.

Keynote Talk: CIES'14

Verified Computation with Uncertain Numbers: How to Avoid Pretending We Know More Than We Do

Scott Ferson
Applied Biomathematics, USA

Abstract

Applications of probabilistic uncertainty analyses commonly make assumptions for the sake of convenience. For instance, analysts routinely assume most or all variables are independent of one another, without empirical justification for this assumption, or even in the face of evidence to the contrary. They also often assume probabilities and probability distributions can be precisely specified even when relevant empirical data sets are very small. In the past, such assumptions have been necessary in order to get any answer at all. New methods now allow us to compute bounds on estimates of probabilities and probability distributions that are guaranteed to be correct even when one or more of these assumptions is relaxed or removed entirely. In many cases, the results obtained are the best possible bounds, which means that tightening them would require additional empirical information. This talk will present an overview of probability bounds analysis, as a computationally practical implementation of imprecise probabilities that combines ideas from both interval analysis and probability theory and sidesteps the limitations of each. It introduces probability boxes (p-boxes), briefly explains the numerous ways they can arise when empirical information is sparse, and illustrates their use in uncertainty modeling with a series of applications spanning environmental, structural and electrical engineering.

Biography

Scott Ferson is a senior scientist at Applied Biomathematics, a small-business research firm on Long Island in New York. He holds a Ph.D. from Stony Brook University. He has over 100 peer-reviewed papers and 5 books on risk analysis and related topics. His research, funded primarily by NIH, NASA and Sandia, has focused on developing methods and software to solve quantitative assessment problems when data are poor or lacking and structural knowledge about the model is severely limited.

Keynote Talk: CIHLI'14

Towards Human-Like Intelligence: A Self-Organizing Neural Network Approach

Ah-Hwee Tan
Nanyang Technological University, Singapore

Abstract

Human intelligence involves a complex interplay of cognitive functions, notably self-awareness, memory, reasoning, learning, and problem solving. This talk will present a family of self-organizing neural networks, collectively known as fusion Adaptive Resonance Theory (fusion ART) (Tan *et al*., 2007) for simulating intelligent systems with high level cognitive functions. By extending the original ART models consisting of a single pattern field into a multi-channel architecture, fusion ART unifies a number of important neural models developed over the past decades, including the original ART networks for clustering and unsupervised learning, Adaptive Resonance Associative Map (ARAM) for pattern classification and supervised learning (Tan, 1995), and Fusion Architecture for Learning and Cognition (FALCON) (Tan *et al*., 2008), for real-time decision making and reinforcement learning.

Following the notion of *embodied cognition* (Anderson, 2003), this talk will show how fusion ART, by encompassing a set of universal neural coding and adaptation principles, can be used as a building block of autonomous systems, integrating self-awareness, memory, learning, reasoning and decision making (Tan *et al*., 2010; Wang *et al*., 2012; Teng *et al.*, 2014). Several case studies will be presented, illustrating how such cognitive autonomous systems may be used in the domains of first-person shooting game (Wang *et al.*, 2009; Wang & Tan, 2014), adaptive Computer Generated Forces (CGF) (Teng *et al*., 2013), and modelling of human-like characters in virtual environment (Kang *et al*., 2012).

Biography

Dr. Ah-Hwee Tan received a Ph.D. in Cognitive and Neural Systems from Boston University, a Master of Science and a Bachelor of Science (First Class Honors) in Computer and Information Science from the National University of Singapore. He is currently an Associate Professor at the School of Computer Engineering (SCE), Nanyang Technological University His current research interests include cognitive and neural systems, brain-inspired intelligent agents, machine learning, knowledge discovery and text mining.

Dr. Tan has published more than 160 technical papers in major international journals and conferences of his fields, including 6 edited books. He holds two US patents, five Singapore patents, and has spearheaded several A*STAR projects in commercializing a suite of document analysis and text mining technologies.

Keynote Talk: CIMSIVP'14

Counting, Detecting and Tracking of People in Crowded Scenes

Mubarak Shah
University of Central Florida, USA

Abstract

In this talk, first I will present a new approach for counting people in extremely dense crowds. Our approach relies on multiple sources of information such as low confidence head detections, repetition of texture elements (using SIFT), and frequency-domain analysis to estimate counts, along with confidence associated with observing individuals, in an image region. In addition, we employ a global consistency constraint on counts using Markov Random Field. This caters for disparity in counts in local neighborhoods and across scales.

Next, I will discuss how we explore context for human detection in dense crowds in the form of locally-consistent scale prior which captures the similarity in scale in local neighborhoods and its smooth variation over the image. Using the scale and confidence of detections obtained from an underlying human detector, we infer scale and confidence priors using Markov Random Field. In an iterative mechanism, the confidences of detections are modified to reflect consistency with the inferred priors, and the priors are updated based on the new detections. The final set of detections obtained are then reasoned for occlusion using Binary Integer Programming where overlaps and relations between parts of individuals are encoded as linear constraints.

Finally, I will present a method for tracking in dense crowds using prominence and neighborhood motion concurrence. Our method begins with the automatic identification of prominent individuals from the crowd that are easy to track. Then, we use Neighborhood Motion Concurrence to model the behavior of individuals in a dense crowd, this predicts the position of an individual based on the motion of its neighbors.

Biography

Dr. Mubarak Shah, Agere Chair Professor of Computer Science, is the founding director of Center for Research in Computer Visions at University of Central Florida (UCF). He is a co-author of four books (Motion-Based Recognition (1997); Video Registration (2003); Automated Multi-Camera Surveillance: Algorithms and Practice (2008) and Modeling, Simulation and Visual Analysis of Crowds (2014)), all by Springer. He has published extensively on topics related to visual surveillance, tracking, human activity and action recognition, object detection and categorization, shape from shading, geo registration, visual crowd analysis, etc. Dr. Shah is a fellow of IEEE, IAPR, AAAS and SPIE. In 2006, he was awarded the Pegasus Professor award, the highest award at UCF, given to a faculty member who has made a significant impact on the university. He is ACM Distinguished Speaker. He was the program co-chair of IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2008.

Keynote Talk: CIPLS'14

Heuristic Algorithms in Scheduling

Fatih Tasgetiren
Yasar University, Turkey

Abstract

In this talk, modern heuristic algorithms will be presented to solve scheduling problems. The talk will cover some sophisticated constructive heuristics as well as evolutionary and swarm algorithms to solve variety of scheduling problems such as single machine scheduling, permutation flowshop, no-wait flowshop, no-idle flowshop, blocking flowshop, hybrid flowshop, parallel machine scheduling and so on. In addition, some sophisticated local search methods such as iterated local search (ILS), iterated greedy (IG) algorithm and variable neighborhood search (VNS) will be included in the talk so that evolutionary and swarm algorithms versus these sophisticated local search algorithms will be discussed. In general, speed-up methods for both insertion and swap neighborhood to solve these difficult scheduling problems will be summarized.

Biography

Dr. M. Fatih Tasgetiren received his BSc and MSc degrees in Industrial Engineering from Istanbul Technical University in 1982 and 1988, respectively. He was in the PhD program in Operations Management at Bosphorus University in Istanbul between 1988 and 1991. He received his PhD degree in Operations Management from Istanbul University in 1996. He worked as a faculty member in various universities such as Sakarya University (Turkey), Auburn University (USA), University of Alabama in Tuscaloosa (USA), University of Puerto Rico at Mayaguez (PR), Fatih University (Turkey), and Sultan Qaboos University (Oman). He is currently a full professor in the Industrial Engineering Department at Yasar University, Izmir, Turkey. He is the director of the Reserach and Development Center at Yasar University.

Dr. M. Fatih Tasgetiren's research interest is in heuristic optimization applied to both continuous and discrete/combinatorial optimization problems, especially to production scheduling problems. He has published about 30 journal papers, 70 conference papers and 15 book chapters. His citation is currently 1024 and h-index is 17 (ISI Web of Knowledge, July, 2014). His google scholar citation and h-index are 2759 and 29, respectively.

Keynote Talk: CIR2AT'14

Rehabilitation Robotics: From Evidence to Model-Based Interventions

Hermano Igo Krebs
Massachusetts Institute of Technology, USA

Abstract

The 2010 American Heart Association guidelines for stroke care endorsed robotic therapy for the upper extremity (UE), but not for the lower extremity (LE). In 2010, the US Veterans Administration similarly endorsed robotic therapy for UE but not for LE: "recommendation is made against routinely providing the [LE] intervention. At least fair evidence was found that the intervention is ineffective". This apparent immaturity of LE robotic therapy reflects the fact that, to date, knowledge of human motor control has not been applied to LE robotic therapy. Knowledge of human motor control, sensing, and cognition has matured to the point that a fundamental and unifying theory of movement for both UE arm movement and for LE walking is now within reach.

In this talk, I will discuss some of the evidence supporting our working model based on submovements, oscillations, and impedances for UE movement collected with the MIT-Manus robot and how we plan to develop a competent model that encompass both arm movement and walking based on these elementary actions and how to code it into adaptive controllers that will allow multiple robotic devices to target rehabilitation.

Biography

Dr. Hermano Igo Krebs joined MIT's Mechanical Engineering Department in 1997 where he is a Principal Research Scientist and Lecturer at the Newman Laboratory for Biomechanics and Human Rehabilitation. He also holds an affiliate position as an Adjunct Professor at University of Maryland School of Medicine, Department of Neurology and presently he is a Visiting Professor at Fujita Health University, Department of Physical Medicine and Rehabilitation and Visiting Professor at Newcastle University, Institute of Neuroscience. He is one of the founders and member of the Board of Directors of Interactive Motion Technologies, a Massachusetts-based company commercializing robot technology for rehabilitation. He is a Fellow of the IEEE (Institute of Electrical and Electronics Engineers). Dr. Krebs was nominated by two of IEEE societies: IEEE-EMBS (Engineering in Medicine & Biology Society) and IEEE-RAS (Robotics and Automation Society) to this distinguished engineering status "for contributions to rehabilitation robotics and the understanding of neuro-rehabilitation." Dr. Krebs has published and presented extensively on stroke rehabilitation related issues and is internationally recognized for his work in rehabilitation robotics (over 200 publications).

Keynote Talk: CIVTS'14

Multiagent Reinforcement Learning in Traffic and Transportation

Ana Bazzan
Universidade Federal do Rio Grande do Sul, Brasil

Abstract

The increasing demand for mobility in our society poses various challenges to traffic engineering, computer science in general, and computational intelligence in particular. This arises from the fact that, often, it is not possible to provide additional capacity to meet that increasing demand, so that a more efficient use of the available transportation infrastructure is necessary. This relates closely to optimization and multiagent systems as many problems in traffic management and control are inherently distributed.

However, there are some issues that make these problems hard to solve: the number of agents is high, typically agents are highly adaptive, and they react to changes in the environment at individual level but cause an unpredictable collective pattern, and act in a highly coupled environment. Therefore, this domain poses many challenges such as coordination and learning. In this talk, the following will be covered: the domain is introduced (transportation engineering in a nutshell); selected methods and approaches are explained (especially regarding traffic signal control); and open problems and challenges are listed in order to motivate future research by practitioners from the field of computational intelligence in general and reinforcement learning in particular.

Biography

Ana Bazzan received her Engineering Degree from the University of São Paulo (USP), and her PhD in 1997 from the University of Karlsruhe (now KIT), Germany. She is an associate professor at UFRGS (Computer Science Department) in Porto Alegre, Brazil. She is a fellow of the Alexander von Humboldt Foundation. Her professional activities include: associate editor of the journals Autonomous Agents and Multiagent Systems, Advances in Complex Systems, and Journal of Multiagent and Grid Systems; co-general chair of the AAMAS 2014 (the premier conference in the area of autonomous agents and multiagent systems); member of the board of the Int. Foundation for Autonomous Agents and Multiagent Systems (IFAAMAS). Her main research interests are: multiagent systems, multiagent learning, complex systems, machine learning, agent-based simulation, and applications of AI and multiagent techniques in traffic simulation and control.

Keynote Talk: Doctoral Consortium

Building a successful career in academic research- What can IEEE CIS do for you?

Pablo A. Estevez
Department of Electrical Engineering, University of Chile, and Millennium Institute of Astrophysics, Chile

Abstract

In this talk I will present my personal view on how to build a successful career in academic research. A key point is the exploration versus exploitation dilemma. As joining a professional society is essential in academic/research life, I will introduce also the opportunities offered by the IEEE Computational Intelligence Society regarding networking, publications, and leadership.

Biography

Pablo A. Estévez (M'98–SM'04) received the B.S. and the P.E. in electrical engineering (EE) from the Universidad de Chile, Santiago, in 1978 and 1981, respectively, and the M.Eng. and Dr.Eng. degrees from the University of Tokyo, Japan, in 1992 and 1995, respectively. He is a Full Professor with the Electrical Engineering Department, Universidad de Chile, and former Chairman of the EE Department in the period 2016-2010.

Prof. Estévez is one of the founders of the Millennium Institute of Astrophysics (MAS), Chile, which was launched in January 2014. He is currently leading the Astroinformatics/Astrostatistics group at MAS. He has been an Invited Researcher with the NTT Communication Science Laboratory, Kyoto, Japan; the Ecole Normale Supérieure, Lyon, France, and a Visiting Professor with the University of Tokyo.

Prof. Estévez is the Vice President for Members Activities of the IEEE Computational Intelligence Society (CIS) for the period 2011-2014, and the 2015 IEEE CIS President-elect. He has served as an IEEE CIS Distinguished Lecturer, Member-at-Large of the IEEE CIS ADCOM, and as an Associate Editor of the IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS.

Prof. Estévez was general chair of the Workshop on Self-organizing Maps 2012, and is serving as conference chair of the IJCNN 2016, to be held in Vancouver, Canada.

His current research interests include neural networks, self-organizing maps, information theoretic-learning, time series analysis, and advanced signal and image processing. One of his main topics of research is the application of computational intelligence techniques to astronomical datasets and biomedical signals.

Keynote Talk: EALS'14

Toward Association Rules in Data Streams: New Approaches with Potential Real-World Applications

Jorge Casillas
University of Granada, Spain

Abstract

Today, human activity is highly computerized; almost everything is recorded (or is likely to be) and sometimes stored and processed. Normally this information is stored for later reference exclusively; however, there is an increasing interest on dealing with them on-line for modeling and monitoring. This problem is being addressed by data streams, which are sequences of structured records that flow continuously. The key feature of these systems is that the data produced by these flows are not stored permanently but are handled on-the-fly, that is, each data is analyzed, processed and finally forgotten, thus being able to deal massive amounts of data in real time even with limited capacity of storage and computing.

In this talk, previous research on related topics is reviewed, new approaches based on evolutionary algorithms and fuzzy systems are introduced and some real-world applications are presented. Among them, special attention is made to some original results on finding relationships among different human biosignals.

Biography

Jorge Casillas received the MSc and PhD (with extraordinary prize) graduate degrees in Computer Science in 1998 and 2001, respectively, from the University of Granada, Spain. He is an Associate Professor with the Department of Computer Science and Artificial Intelligence, University of Granada, where he is a member of the Soft Computing and Intelligent Information Systems research group. He was Visiting Research Fellow at the University of the West of England (Bristol, UK) in 2004.

His main research interests focus on fuzzy modeling, evolutionary algorithms, data mining, intelligent mobile robotics, and intelligent systems for marketing and business intelligence.

He has authored a book and edited five international books. Two of these books, which exceed 250 citations (Google Scholar), were pioneers in the pursuit of interpretability-accuracy in fuzzy modeling balance when they were published in 2003. The remaining books cover the use of intelligent systems in marketing and business management. He is author of about 30 journal papers, 12 book chapters, and 60 conference papers. His h-index is 15 (Thomson Reuters) or 24 (Google Scholar).

Keynote Talk: FOCI'14

Interactive Memetic Algorithms: New Possibilities for Social Learning

Jim Smith
University of the West of England, UK

Abstract

Both Memetic and Interactive algorithms have both enjoyed success and popularity within the field of meta-heuristic problem-solving. However, despite the choice of name, and the oft-quoted links to memes as elements of cultural transmission, many aspects of human social learning have been largely ignored to date. In this talk I will examine some of the possibilities for transmission of adaptive behaviour between humans and machines, using examples from our research and suggesting that the rapid advances in interaction technologies offer huge potential for the field to explore.

Biography

Jim Smith is a Professor of Interactive Artificial Intelligence at the University of the West of England, where his research interests include meta-heuristic search, machine learning, and the use of interactive AI-based tools to aid human decision making. He sits on the editorial boards of several journals, is involved in organising major conferences, has published several books and over 100 peer reviewed papers

Keynote Talk: ICES'14

Robot Bodies and How to Evolve Them

Alan Winfield
University of the West England, UK

Abstract

While the theory and practice of evolutionary robotics is well established, most work to date has been concerned with evolving a robot's control system – it's software. In this talk I will address the much more difficult problem of how to evolve robot hardware – a robot's physical body shape (morphology) and the arrangement of sensors and actuators within that body. Of course bodies and brains must co-evolve, but co-evolving robot hardware and software remains deeply challenging for all but the simplest behaviours. I will conclude the talk by reflecting on the evolution of complexity in both evolutionary biology and robotics.

Biography

Alan Winfield is Professor of Electronic Engineering and Director of the Science Communication Unit at the University of the West of England (UWE), Bristol, and Visiting Professor at the University of York. He received his PhD in Digital Communications from the University of Hull in 1984, then co-founded and led APD Communications Ltd until taking-up appointment at UWE, Bristol in 1991. Winfield co-founded, with Chris Melhuish and Owen Holland, the Bristol Robotics Laboratory and his current research is focussed on the engineering and scientific applications of Swarm Intelligence. He is committed to the widest possible dissemination of research and ideas in science, engineering and technology. He led UK-wide EPSRC public engagement project Walking with Robots, awarded the 2010 Royal Academy of Engineering Rooke medal for public promotion of engineering. His latest book, Robotics: A Very Short Introduction, was published by Oxford University Press in September 2012.

Keynote Talk: IES'14

Intelligent Embedded Systems: Artificial Neural Networks for Industrial Applications

Eros G. Pasero
Politecnico of Turin, Italy

Abstract

Several industrial applications are based on human involvement. IT systems are typically used inside the electronic devices which must control these applications. Humans are requested to handle some specific operations but they are often the source of errors, imprecisions and bad performances. The lack of efficient algorithms is usually the reason for this necessity. Data can be used to train artificial neural networks which can replace humans in many applications. In this presentation some intelligent embedded systems applied to industrial applications are shown. We will first study a neural evaluator of car seat comfort where a group of human experts is replaced by a set of sensors and a probabilistic neural network. A second example will be an electronic reader able to read printed documents and give the information to a visually impaired person in the Braille format. An intelligent embedded system based on a sensor, a set of Artificial Neural Networks and a Braille transducer. The last example is an industrial coffee grinder where the man in charge of the grinding control is replaced by an artificial neural network. Today this intelligent Embedded System controls the coffee grinder of a big coffee company in Italy.

Biography

Eros G. Pasero is Professor of Electronics at the Politecnico of Turin since 1991 after a four year appointment as Professor at the University of Roma, Electronics Engineering. He was also Visiting Professor at ICSI, UC Berkeley, CA in 1991, Professor of digital electronics and electronic systems at Tongji University, Shanghai, China in 2011 and Professor of digital electronics and electronic systems at TTPU (Turin Tashkent Politechic University), Tashkent, Uzbekistan since 2012.

Prof. Pasero interests lie in Artificial Neural Networks and Electronic Sensors. He created in 1990 the Neuronica Lab where hardware neurons and synapses are studied for neuromorphic approaches; neural software applications are applied to real life proof of concepts. Innovative wired and wireless sensors are also developed for biomedical, environmental, automotive applications. Data coming from sensors are post processed by means of artificial neural networks.

Prof. Pasero is now the President of SIREN, the Italian Society for Neural Networks; he was v. General Chairman of IJCNN2000 in Como, General Chairman of SIRWEC2006 in Turin. He holds 5 international patents (two were the first silicon European neurons and synapse together Texas Instruments). He was supervisor of tenths of international Ph.D and hundredths of Master students and he is author of more than 100 international publications.

Keynote Talk: ISIC'14

Computational Intelligence and Independent Computing: A Biological Systems Perspective

Gary Fogel
Natural Selection, Inc, USA

Abstract

The rise of the Internet and inexpensive computing has come at the price of increased human dependency on such systems. While in the majority of cases computers have accelerated our own learning and ability to rapidly interact with others, it is also the case that the manner in which we interact and learn socially as humans has changed simply as a result of computing. In this talk I will explore the pros and cons of human-machine dependency through examples of symbiosis in natural systems. The possible conditions for different types of human-machine symbioses will be explored, along with possible paths between types of symbioses that could be realized, and the relevance of human-machine symbiosis to human welfare. I will explore the possibility of model alternative human-machine futures with computational intelligence in light of cost-benefits to determine which environments and interactions lead to competition, parasitism, commensalism, or mutualism. Such models could help researchers explore trajectories that increase or decrease our future dependency on computers.

Biography

Dr. Gary B. Fogel joined Natural Selection, Inc. in 1998 after completing the Ph.D. in biology from UCLA. His current research interests focus on the application of computational intelligence methods to problems in the biomedical sciences. These include biomarker discovery, sequence analysis, microRNA discovery, drug design, improved diagnosis, and biomedical pattern recognition. Dr. Fogel leads Natural Selection, Inc.'s efforts in biomedicine but also has led projects for industrial and defense related applications.

Dr. Fogel is a Fellow of the IEEE and member of Sigma Xi. He currently serves as editor-in-chief of *BioSystems* and has served as an associate editor on six other journals. He co-edited a volume on *Evolutionary Computation in Bioinformatics* published in 2003 (Morgan Kaufmann) and *Computational Intelligence in Bioinformatics*, published in 2008 (Wiley-IEEE Press). Dr. Fogel has assisted with many conferences and served as Conference Chair for the 2010 IEEE Congress on Evolutionary Computation, and Vice President for Conferences (2010-2013) for the IEEE Computational Intelligence Society. He serves as Finance Chair for the 2014 IEEE Symposium Series on Computational Intelligence. Dr. Fogel has received several honors and awards, including the 2012 Sigma Xi San Diego Section Distinguished Scientist Award.

Keynote Talk: MCDM'14

Combining Interactive and Evolutionary Approaches when Solving Multiobjective Optimization Problems

Kaisa Miettinen
University of Jyvaskyla, Finland

Abstract

In multiobjective optimization, the goal is to find the best possible solution in the presence of several, conflicting objectives. With mathematical tools we can define a set of nondominated or Pareto optimal solutions where none of the objective function values can be improved without impairing at least one of the others. To be able to find the most preferred Pareto optimal solution to be implemented, we need some preference information from an expert, a decision maker. Multiobjective optimization methods can be classified according to the role of the decision maker in the solution process. We review different types of methods and summarize their strengths and weaknesses. We pay most attention to interactive methods, where the decision maker takes actively part in the solution process and directs the search according to her/his desires and hopes. This enables the decision maker to gain insight about the interdependencies of the conflicting objectives and learn about one's own preferences. In this way, we support her/him in concentrating on such solutions that seem most promising and in finding the most preferred solution. An example of interactive methods is NIMBUS.

In this talk, some new interactive and hybrid multiobjective optimization methods are presented including E-NAUTILUS which enables decision making without trading-off and Pareto Navigator for computationally expensive problems. Finally, we study some complex real-life problems that have successively been solved and collect some experiences.

Biography

Kaisa Miettinen is Professor of Industrial Optimization at the Department of Mathematical Information Technology, University of Jyvaskyla in Finland. She is also vice-rector of the University of Jyvaskyla. Her research interests include theory, methods, applications and software of nonlinear multiobjective optimization including interactive and evolutionary approaches and she heads the Research Group on Industrial Optimization (http://www.mit.jyu.fi/optgroup). She has authored about 140 refereed journal, proceedings and collection papers and 80 reports, edited 12 proceedings, collections and special issues and written a monograph Nonlinear Multiobjective Optimization. She is the President of the International Society on Multiple Criteria Decision Making (http://www.mcdmsociety.org), a member of the Finnish Academy of Science and Letters, Section of Science and she was awarded as the Researcher of the Year at Helsinki School of Economics in 2007. For further information, see http://users.jyu.fi/~miettine/engl.html.

Keynote Talk: RiiSS'14

Informationally Structured Space for Cognitive Robotics

Naoyuki Kubota
Tokyo Metropolitan University, Japan

Abstract

Recently, various types of robot partners have been developed for the society of the next generation. The study on the cognition, intelligence, and self of robots has a long history. Cognition is defined as the mental process of knowing, including aspects such as awareness, perception, reasoning, and judgment according to American Heritage Dictionary. The study on cognitive robotics deals with cognitive phenomena such as perception, attention, reasoning, planning, memory, and learning based on constructivism. Fuzzy, neural, and evolutionary computation play important role to realize cognitive development of robots from the methodological point of view. Now, the synthesis of information technology, network technology, and robot technology may bring the brand-new emerging intelligence to robots from the technical point of view. The study on cognitive robotics leads to develop social robots.

In this talk, first, we explain the current state of art in cognitive robotics. Second, we discuss the informationally structured space for cognitive robotics from three theoretical points of view; (1) sharing property of information, (2) interpretability of information, and (3) reversibility of information. Furthermore, we discuss the informationally structured space from three methodological points of view; (1) multi-modal information processing, (2) multi-scale information processing, and (3) multi-phase information processing. Next, we show several examples of robot partners based on informationally structured space. We have been developing different types of robot partners called MOBiMac, iPhonoid, and iPadrone. These robot partners are interconnected through the informationally structured space. For example, human positions and behaviors as results of voice recognition and image processing can be shared among robot partners. Finally, we discuss the future direction of cognitive robotics from the viewpoint of informationally structured space.

Biography

Naoyuki Kubota received the B.Sc. degree from Osaka Kyoiku University, Kashiwara, Japan, in 1992, the M.Eng. degree from Hokkaido University, Hokkaido, Japan, in 1994, and the D.E. degree from Nagoya University, Nagoya, Japan, in 1997. He joined the Osaka Institute of Technology, Osaka, Japan, in 1997. In 2000, he joined the Department of Human and Artificial Intelligence Systems, Fukui University, as an Associate Professor. He joined the Department of Mechanical Engineering, Tokyo Metropolitan University, in 2004. He is a Professor with the Department of System Design, Tokyo Metropolitan University, Tokyo, Japan. His current interests are in the fields of coevolutionary computation, fuzzy control, spiking neural networks, cognitive robotics, and informationally structured space.

Keynote Talk: SDE'14

Single Objective, Large Scale, Constrained Optimization: A Survey and Recent Developments

Janez Brest
University of Maribor, Slovenia

Abstract

Differential evolution algorithm is a simple, yet powerful optimization algorithm. Differential Evolution (DE) is widely used in real-parameter optimization problems in many domains, such as single objective optimization, constrained optimization, multi-modal optimization, and multi-objective optimization. The DE algorithm was proposed by Storn and Price almost 20 years ago. The original DE algorithm has been modified in many directions, such as new mutation operators, adaptive and/or self-adaptive control parameters, ensembles, combined with local search heuristics, and many other. This talk will present some recent developments of the DE algorithm.

Biography

J. Brest received his Ph.D. degree in computer science from the University of Maribor, Maribor, Slovenia, in 2000. He has been with the Laboratory for Computer Architecture and Programming Languages, at the Faculty of Electrical Engineering and Computer Science of the University of Maribor, since 1993.

He is currently a Full Professor and Head of the Laboratory for Computer Architecture and Programming Languages at the Institute of Computer Science, at the University of Maribor, Slovenia. His research interests include evolutionary computing, artificial intelligence, and optimization. His fields of expertise embrace programming languages, and parallel and distributed computing research. He is currently the Chair of the Computational Intelligence Society (CIS) Task Force on Differential Evolution.

Keynote Talk: SIS'14

Putting People in the Swarm

Russell C. Eberhart
Phoenix Data Corporation, Indianapolis, Indiana, USA

Abstract

Particle swarm optimization has been applied to numerous applications in a variety of areas. Utilizing humans as part of a swarm system is a relatively recent area of investigation and application. The combined power of a human-swarm team has significant advantages in many environments, such as for dynamic decision making tasks. The combination of computer computational power with human intuitive knowledge can provide better solutions in less time than either computers or humans working by themselves. Humans can be incorporated into a computational swarm system in a variety of ways, including acting as one of the particles or being in the fitness feedback loop. This presentation explores options and examples of putting people into computational swarm systems. Finally, it describes new research areas that include dynamic optimization of the relative contributions of the human and computer contributions of a human-swarm system in rapidly changing scenarios.

Biography

Russell C. Eberhart earned a Ph.D. in electrical engineering from Kansas State University in 1972. He is best known as the co-developer of particle swarm optimization algorithm with Dr. James Kennedy. He is the Chief Technology Officer at Phoenix Data Corporation based in Indiana, USA, and was a professor of Electrical and Computer Engineering, and adjunct professor of Biomedical Engineering at the Purdue School of Engineering and Technology, Indiana University - Purdue University Indianapolis (IUPUI). He is a fellow of the IEEE and the American Institute for Medical and Biological Engineering. He was an Associate Editor of IEEE Transactions on Evolutionary Computation and past president of the IEEE Neural Networks Council (now the IEEE Computational Intelligence Society).

Tuesday, December 9th, 2014

Start Time	
12:00PM	Registration (Grand Sierra Registration SOUTH)
6:00PM	Reception (Grand Sierra A, B & C)
8:00PM	End of Day

Wednesday, December 10th, 2014

Start Time	Antigua 2	Antigua 3	Antigua 4	Bonaire 1	Bonaire 2	Bonaire 3	Bonaire 4	Bonaire 5	Bonaire 6	Bonaire 7	Bonaire 8	Curacao 1	Curacao 2	Curacao 3	Curacao 4	Curacao 7
8:00AM	Opening Remarks (Grand Sierra D)															
8:10AM	Wed-P: Plenary Talk (Grand Sierra D)															
9:10AM	Break															
9:20AM	Wed-K-C4: CIBD'14 Keynote Talk	Wed-K-A3: IES'14 Keynote Talk	Wed-K-A4: CIHLI'14 Keynote Talk	Wed-K-B1: CCMB'14 Keynote Talk	Wed-K-B2: CIPLS'14 Keynote Talk	Wed-K-B3: CIComms'14 Keynote Talk	Wed-K-B4: SDE'14 Keynote Talk	Wed-K-B5: CICS'14 Keynote Talk	Wed-K-B6: CIEL'14 Keynote Talk	Wed-K-B7: CIR2AT'14 Keynote Talk	Wed-K-B8: CIMSIVP'14 Keynote Talk	Wed-K-C1: ADPRL'14 Keynote Talk	Wed-K-C2: CIDM'14 Keynote Talk	Wed-K-C3: SIS'14 Keynote Talk	Wed-K-A2: CIASG'14 Keynote Talk	Wed-K-C7: DC'14 Keynote Talk
10:00AM	Break															
10:20AM	Wed-S1A1: CIBD'14 Session 1: Big Data Applications	Wed-S1A3: IES'14 Session 1	Wed-S1A4: CIHLI'14 Session 1: Various Aspects of Human-Level Intelligence	Wed-S1B1: CCMB'14 Session 1: Cognitive, Mind, and Brain	Wed-S1B2: CIPLS'14 Session 1: Computational Intelligence in Production Systems	Wed-S1B3: CIComms'14 Session 1: CI for Communications	Wed-S1B4: SDE'14 Session 1: Algorithms	Wed-S1B5: CICS'14 Session 1	Wed-S1B6: CIEL'14 Session 1	Wed-S1B7: CIR2AT'14 Session 1: Robotic Assistive Technology	Wed-S1B8: CIMSIVP'14 Session 1: Action Recognition	Wed-S1C1: ADPRL'14 Reinforcement Learning 1: Representation and Function Approximation	Wed-S1C2: CIDM'14 Session 1: Advances in clustering	Wed-S1C3: SIS'14 Session 1: Theory and Applications of Nature-Inspired Optimization Algorithms I	Wed-S1C4: CIASG'14 Session 1: Forecasting and Predictions in Smart Grids	Wed-S1C7: SSCI DC Session 1
12:00PM	Break															
1:30PM	Wed-S2A1: CIBD'14 Session 2: Big Data Analytic for Healthcare	Wed-S2A3: IES'14 Session 2	Wed-S2A4: CIHLI'14 Session 2: Grounded Cognition, Creativity and Motivated Learning	Wed-S2B1: CCMB'14 Session 2: Cognitive, Mind, and Brain	Wed-S2B2: CIPLS'14 Session 2: Computational Intelligence in Logistics Systems	Wed-S2B3: CIComms'14 Session 2: Advanced Nature-Inspired Optimization for New Generation Antenna Devices	Wed-S2B4: SDE'14 Session 2: Algorithms and applications	Wed-S2B5: CICS'14 Session 2	Wed-S2B6: CIEL'14 Session 2	Wed-S2B7: CIR2AT'14 Session 2: Robotic Rehabilitation	Wed-S2B8: CIMSIVP'14 Session 2: Applications	Wed-S2C1: ADPRL'14 Optimal Control 1: Fundamentals and Techniques	Wed-S2C2: CIDM'14 Session 2: Multitask and Metalearning	Wed-S2C3: SIS'14 Session 2: Particle Swarm Optimization - I	Wed-S2C4: CIASG'14 Session 2: Micro-grids & Electric Vehicles	Wed-S2C7: SSCI DC Session 2
3:10PM	Break															
3:30PM	Wed-S3A2: CIBD'14 Session 3: Big Data Analytics in Traditional Chinese Medicine	Wed-S3A3: IES'14 Session 3	Wed-S3A4: CIHLI'14 Session 3: Applications	Wed-S3B1: CCMB'14 Session 3: Cognitive, Mind, and Brain	Wed-S3B2: CIPLS'14 Session 3: Supply Chain Design, Optimization, and Management	Wed-S3B3: CIComms'14 Session 3: Intelligent Applications in Communication and Computation	Wed-S3B4: SDE'14 Session 3: Applications	Wed-S3B5: CICS'14 Session 3	Wed-S3B6: CIEL'14 Session 3	Wed-S3B7: CIR2AT'14 Session 3	Wed-S3B8: CIMSIVP'14 Session 3: Features and Detections	Wed-S3C1: ADPRL'14 Reinforcement Learning and Optimization in Stochastic Multi-objective Environments	Wed-S3C2: CIDM'14 Session 3: Computational Intelligence for Health and Wellbeing	Wed-S3C3: SIS'14 Session 3: Biologically-inspired Intelligence for Robotics	Wed-S3C4: CIASG'14 Session 3: Markets	Wed-S3C7: SSCI DC Session 3
5:10PM	End of Day															

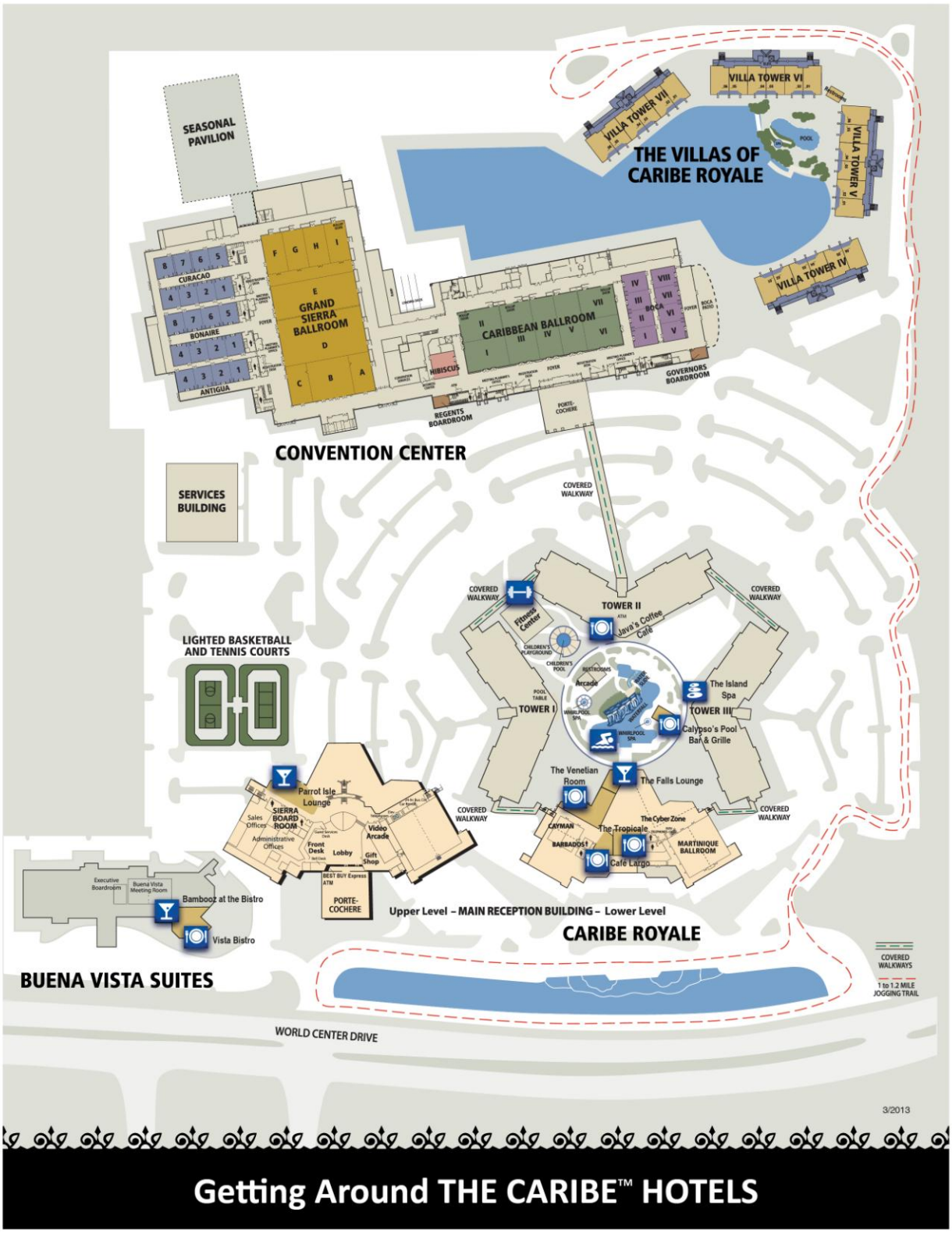
Thursday, December 11th, 2014

Start Time	Antigua 2	Antigua 3	Antigua 4	Bonaire 1	Bonaire 2	Bonaire 3	Bonaire 4	Bonaire 5	Bonaire 6	Bonaire 7	Bonaire 8	Curacao 1	Curacao 2	Curacao 3	Curacao 4	Curacao 7
8:00AM	**Thu-P: Plenary Talk (Grand Sierra D)**															
9:00AM	Break															
9:20AM	Thu-K-A2: CICA'14 Keynote Talk	Thu-K-A3: ICES'14 Keynote Talk	Thu-K-A4: CIBIM'14 Keynote Talk	Thu-K-B1: MCDM'14 Keynote Talk	Thu-K-B2: RiiSS'14 Keynote Talk	Thu-K-B3: CIVTS'14 Keynote Talk	Thu-K-B4: CIES'14 Keynote Talk	Thu-K-B5: ISIC'14 Keynote Talk	Thu-K-B6: FOCI'14 Keynote Talk	Thu-K-B7: EALS'14 Keynote Talk		Thu-T-C1: ADPRL'14 Talk	Thu-T-C2: Ghosts Competition Session	Thu-T-C3: SIS'14 Talk	Thu-SPC4: Computational Intelligence in Big Data Panel	
10:00AM	Break															
10:20AM	Thu-S1A2: CICA'14 Session 1: System Identification and Learning with Applications	Thu-S1A3: ICES'14 Session 1: Evolutionary Systems for Semiconductor Design, Simulation and Fabrication	Thu-S1A4: CIBIM'14 Session 1: Adaptive Biometric Systems - Recent Advances and Challenges	Thu-S1B1: MCDM'14 Session 1: Algorithms I	Thu-S1B2: RiiSS'14 Session 1: Computational Intelligence for Cognitive Robotics I	Thu-S1B3: CIVTS'14 Session 1	Thu-S1B4: CIES'14 Session 1: Theories and Designs	Thu-S1B5: ISIC'14 Session 1: Independent Computing I	Thu-S1B6: FOCI'14 Session 1: Fuzzy Logic	Thu-S1B7: EALS'14 Session 1: Theory and Principles	Thu-S1B8: CIMSIVP'14 Session 4: Algorithms I	Thu-S1C1: ADPRL'14 Approximate Dynamic Programming for Energy and Sustainability	Thu-S1C2: CIDM'14 Session 4: Mining Relational and Networked data	Thu-S1C3: SIS'14 Session 4: Applications of Swarm Intelligence for Industrial Processes	Thu-S1C4: CIASG'14 Session 4: Distribution Systems	Thu-S1C7: SSCI DC Session 4
12:00PM	Break															
1:30PM	Thu-S2A2: CICA'14 Session 2: Fuzzy Systems and Control with Applications	Thu-S2A3: ICES'14 Session 2: Bio-inspired Computation for the Engineering of Materials and Physical Devices	Thu-S2A4: CIBIM'14 Session 2: Adaptive Biometric Systems and Biometric Fusion	Thu-S2B1: MCDM'14 Session 2: Algorithms II	Thu-S2B2: RiiSS'14 Session 2: Intelligent Robots	Thu-S2B3: CIVTS'14 Session 2	Thu-S2B4: CIES'14 Session 2: Machines and Micro-machines	Thu-S2B5: ISIC'14 Session 2: Independent Computing II	Thu-S2B6: FOCI'14 Session 2: Evolutionary Algorithm and Memetic Computing	Thu-S2B7: EALS'14 Session 2: Applications	Thu-S2B8: CIMSIVP'14 Session 5: Algorithms II	Thu-S2C1: ADPRL'14 Learning Control and Optimization based on Adaptive Dynamic Programming	Thu-S2C2: CIDM'14 Session 5: High Dimensional Data Analysis	Thu-S2C3: SIS'14 Session 5: Particle Swarm Optimization - II	Thu-S2C4: CIASG'14 Session 5: Optimization and Scheduling	Thu-S2C7: SSCI DC Session 5
3:10PM	Break															
3:30PM	Thu-S3A2: CICA'14 Session 3: Neural Network Systems and Control with Applications I	Thu-S3A3: ICES'14 Session 3: Evolutionary Techniques Applied to FPGAs	Thu-S3A4: CIBIM'14 Session 3: Face Detection and Recognition	Thu-S3B1: MCDM'14 Session 3: Applications	Thu-S3B2: RiiSS'14 Session 3: Human-centric Robotics I	Thu-S3B3: CIVTS'14 Session 3: Intelligent Vehicle Systems	Thu-S3B4: CIES'14 Session 3: Applications I	Thu-S3B5: ISIC'14 Session 3: Independent Computing III	Thu-S3B6: FOCI'14 Session 3: Neural Networks	Thu-S3B7: EALS'14 Session 3: Techniques for Learning Systems	Thu-S3B8: CIMSIVP'14 Session 6: Algorithms III	Thu-S3C1: ADPRL'14 Online Learning Control Algorithms Based on ADP for Uncertain Dynamic Systems	Thu-S3C2: CIDM'14 Session 6: Rule based Modelling, Model Performance, and Interpretability	Thu-S3C3: SIS'14 Session 6: Swarm Algorithms & Applications - I	Thu-S3C4: CIASG'14 Session 6: Stability and Analysis	Thu-S3C7: SSCI DC Social
5:10PM	**Poster Session (Grand Sierra E)**															
6:45PM	Break															
7:00PM	**Banquet (Grand Sierra A, B, C & D)**															
9:30PM	End of Day															

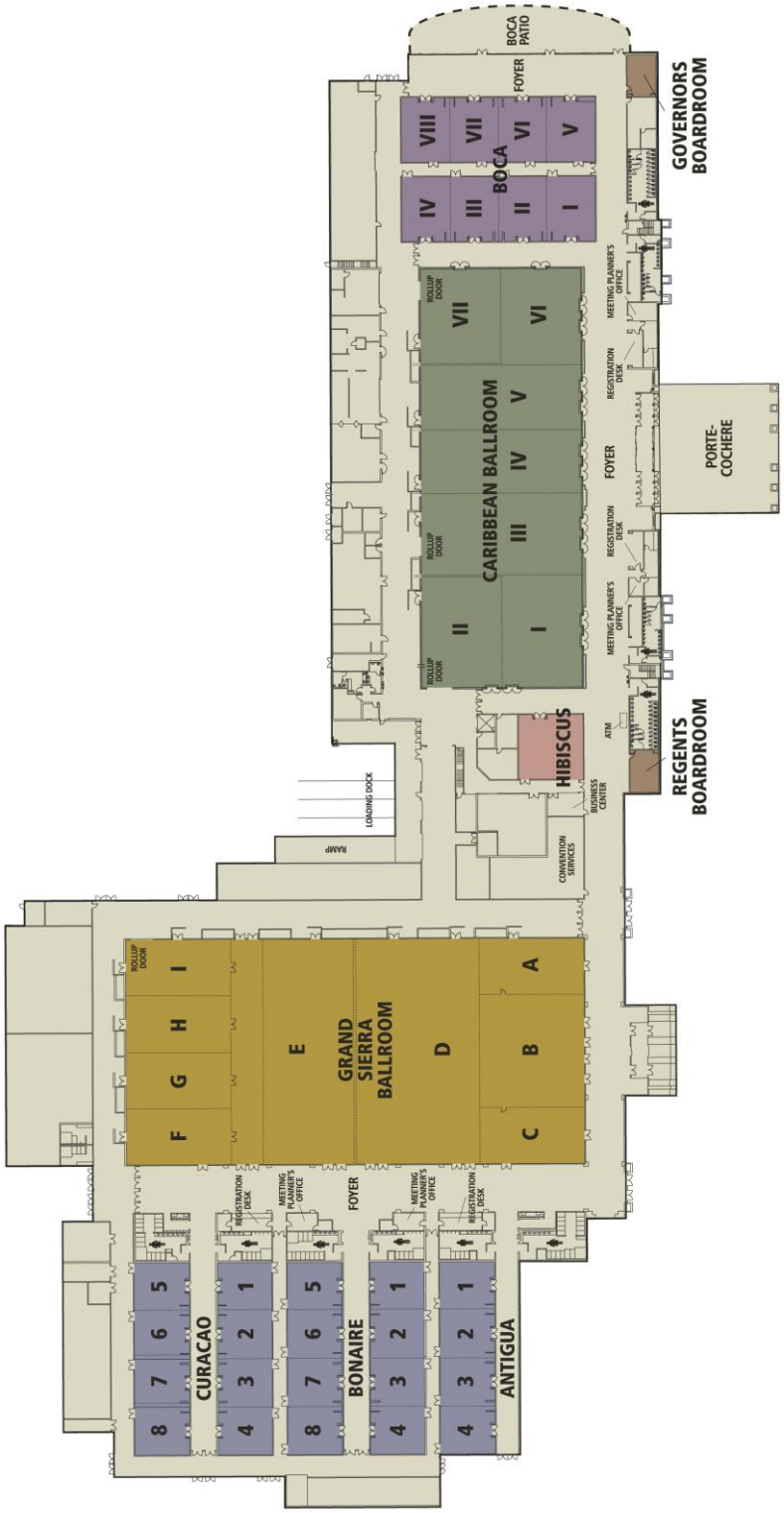
Friday, December 12th, 2014

Start Time	Antigua 2	Antigua 3	Antigua 4	Bonaire 1	Bonaire 2	Bonaire 3	Bonaire 4	Bonaire 5	Bonaire 6	Bonaire 7	Bonaire 8	Curacao 1	Curacao 2	Curacao 3	Curacao 4	Curacao 7
8:00AM	Fri-P: Plenary Talk (Grand Sierra D)															
9:00AM	Break															
9:30AM	Fri-S1A2: CICA'14 Session 4: Evolutionary Computation in Control and Automation	Fri-S1A3: ICES'14 Session 4: Evolvable Hardware I	Fri-S1A4: CIBIM'14 Session 4: Iris Recognition	Fri-S1B1: MCDM'14 Session 4: Optimization Methods in Bioinformatics and Bioengineering (OMBB) I	Fri-S1B2: RiiSS'14 Session 4: Computational Intelligence for Cognitive Robotics II	Fri-S1B3: CIVTS'14 Session 4	Fri-S1B4: CIES'14 Session 4: Applications II	Fri-S1B5: ISIC'14 Session 4: Independent Computing IV	Fri-S1B6: CIDUE'14 Session 1	Fri-S1B7: EALS'14 Session 4: Evolving Clustering and Classifiers	Fri-S1B8: CIBCI'14 Session 1	Fri-S1C1: ADPRL'14 Reinforcement Learning 2: Interdisciplinary Connections and Applications	Fri-S1C2: CIDM'14 Session 7: Business Process Mining, Market Analysis and Process Big Data	Fri-S1C3: SIS'14 Session 7: Theory and Applications of Nature-Inspired Optimization Algorithms II	Fri-S1C4: CICARE'14 Session 1: Applications of Computational Intelligence and Informatics in Brain Disorders	
10:30AM	Break															
11:00AM	Fri-S2A2: CICA'14 Session 5: Neural Network Systems and Control with Applications II	Fri-S2A3: ICES'14 Session 5: Evolvable Hardware II	Fri-S2A4: CIBIM'14 Session 5: Unconventional and New Biometrics	Fri-S2B1: MCDM'14 Session 5: Optimization Methods in Bioinformatics and Bioengineering (OMBB) II	Fri-S2B2: RiiSS'14 Session 5: Human-centric Robotics II	Fri-S2B3: CIVTS'14 Session 5	Fri-S2B4: CIES'14 Session 5: Applications III	Fri-S2B5: IA'14 Session 1: Multi-agent Systems	Fri-S2B6: CIDUE'14 Session 2	Fri-S2B7: EALS'14 Talk	Fri-S2B8: CIBCI'14 Session 2	Fri-S2C1: ADPRL'14 Optimal Control 2: Adaptive and Differential Dynamic Programming	Fri-S2C2: CIDM'14 Session 8: Educational Data Mining	Fri-S2C3: SIS'14 Session 8: Swarm Algorithms & Applications - II	Fri-S2C4: CICARE'14 Session 2: Applications of Computational Intelligence and eHealth in Disease Diagnosis and Therapy	
12:00PM	Break															
1:30PM	Fri-S3A2: CICA'14 Session 6: Applications of CI to Control and Automation	Fri-S3A3: ICES'14 Session 6: Evolutionary Robotics I	Fri-S3A4: CIBIM'14 Session 6: Biometric Security Solution	Fri-S3B1: MCDM'14 Session 6: Evolutionary Multi-Objective Optimization	Fri-S3B2: RiiSS'14 Session 6: Computational Intelligence for Cognitive Robotics III		Fri-S3B4: CIES'14 Session 6: Energy Systems	Fri-S3B5: IA'14 Session 2: Applications of Intelligent Agents	Fri-S3B6: CIDUE'14 Session 3		Fri-S3B8: CIBCI'14 Session 3		Fri-S3C2: CIDM'14 Session 9: Modelling and Mining Massive Data Sets	Fri-S3C3: SIS'14 Session 10: Combintorial Problems	Fri-S3C4: CICARE'14 Session 3: Prospects and Applications of Computational Intelligence in Health Assessment, Monitoring and eHealth	
3:10PM	Break															
3:30PM	Fri-S4A2: CICA'14 Session 7: Computational Intelligence in Robotics	Fri-S4A3: ICES'14 Session 7: Evolutionary Robotics II					Fri-S4B4: CIES'14 Session 7: Applications IV	Fri-S4B5: IA'14 Session 3: Ambient Computational Intelligence					Fri-S4C2: CIDM'14 Session 10: Advanced signal processing and data analysis	Fri-S4C3: SIS'14 Session 9: Cultural Algorithms and Their Applications	Fri-S4C4: CICARE'14 Session 4: Big Data Analytic Technology for Bioinformatics and Health Informatics	
5:10PM	End of Day															

IEEE SSCI 2014 Venue Map



IEEE SSCI 2014 Venue Map



Detailed Program Table of Contents

Wednesday, December 10, 10:20AM-12:00PM

11:20AM *WiFi Localization on the International Space Station*
Jongwoon Yoo, Taemin Kim, Christopher Provencher and Terrence Fong

CIHLI'14 Session 1: Various Aspects of Human-Level Intelligence
Chair: Jacek Mandziuk
Room: Antigua 4 105

10:20AM *Immersive Virtual Reality Environment of a Subway Evacuation on a Cloud for Disaster Preparedness and Response Training*
Sharad Sharma, Shanmukha Jerripothula, Stephon Mackey and Oumar Soumare

10:40AM *Autonomic Behaviors in an Ambient Intelligence System*
Alessandra De Paola, Pierluca Ferraro, Salvatore Gaglio and Giuseppe Lo Re

11:00AM *On efficiency-oriented support of consensus reaching in a group of agents in a fuzzy environment with a cost based preference updating approach*
Dominika Golunska, Janusz Kacprzyk and Slawomi Zadrozny

11:20AM *HICMA: A Human Imitating Cognitive Modeling Agent using Statistical Methods and Evolutionary Computation*
Magda Fayek and Osama Farag

11:40AM *A Cortex-inspired Episodic Memory Toward Interactive 3D Robotic Vision*
Abdul Rahman Abdul Ghani and Kazuyuki Murase

CCMB'14 Session 1: Cognitive, Mind, and Brain
Chair: Daniel S. Levine
Room: Bonaire 1 106

10:20AM *Learning Visual-Motor Cell Assemblies for the iCub Robot using a Neuroanatomically Grounded Neural Network*
Samantha Adams, Thomas Wennekers, Angelo Cangelosi, Max Garagnani and Friedemann Pulvermueller

10:40AM *Grounding Fingers, Words and Numbers in a Cognitive Developmental Robot*
Alessandro Di Nuovo, Vivian De La Cruz and Angelo Cangelosi

11:00AM *Neuromodulation Based Control of Autonomous Robots in ROS Environment*
Biswanath Samanta and Cameron Muhammad

11:20AM *Combined Linguistic and Sensor Models For Machine Learning*
Roman Ilin

11:40AM *Completion and Parsing Chinese Sentences Using Cogent Confabulation*
Zhe Li and Qinru Qiu

CIPLS'14 Session 1: Computational Intelligence in Production Systems
Chair: Fatih Tasgetiren and Raymond Chiong
Room: Bonaire 2 107

10:20AM *Hybrid Harmony Search Algorithm to minimize total weighted tardiness in permutation flow shop*
Mohammad Komaki, Shaya Sheikh and Ehsan Teymourian

10:40AM *A coordination mechanism for capacitated lot-sizing in non-hierarchical n-tier supply chains*
Frieder Reiss and Tobias Buer

11:00AM *An Iterated Greedy Algorithm for the Hybrid Flowshop Problem with Makespan Criterion*
Damla Kizilay, M. Fatih Tasgetiren, Quan-Ke Pan and Ling Wang

11:20AM *An agent-based approach to simulate production, degradation, repair, replacement and preventive maintenance of manufacturing systems*
Emanuel Federico Alsina, Giacomo Cabri and Alberto Regattieri

11:40AM *Common Due-Window Problem: Polynomial Algorithms for a Given Processing Sequence*
Abhishek Awasthi, Joerg Laessig, Oliver Kramer and Thomas Weise

CIComms'14 Session 1: CI for Communications
Chair: Maode Ma and Paolo Rocca
Room: Bonaire 3 108

10:20AM *Multiplexing Communication Routes with Proxy-Network to Avoid Intentional Barriers in Large Scale Network*
Hiroshi Fujikawa, Hirofumi Yamaki, Yukiko Yamamoto and Setsuo Tsuruta

10:40AM *Modeling and Reasoning in Context-Aware Systems based on Relational Concept Analysis and Description Logic*
Anne Marie Amja, Abdel Obaid and Petko Valtchev

11:00AM *Call Drop Minimization using Fuzzy Associated Memory*
Moses Ekpenyong, Inemesit Ekarika and Imeh Umoren

11:20AM *ANN Based Optimization of Resonating Frequency of Split Ring Resonator*
Kumaresh Sarmah, Kandarpa Kumar Sarma and Sunandan Baruah

11:40AM *Using Evolutionary Algorithms for Channel Assignment in 802.11 Networks*
Marlon Lima, Thales Rodrigues, Rafael Alexandre, Ricardo Takahashi and Eduardo Carrano

SDE'14 Session 1: Algorithms
Chair: Ferrante Neri
Room: Bonaire 4 109

10:20AM *Differential Evolution with Dither and Annealed Scale Factor*
Deepak Dawar and Simone Ludwig

10:40AM *A Competitive Coevolution Scheme Inspired by DE*
Gudmundur Einarsson, Thomas Runarsson and Gunnar Stefansson

11:00AM *Performance Comparison of Local Search Operators in Differential Evolution for Constrained Numerical Optimization Problems*
Saul Dominguez-Isidro, Efren Mezura-Montes and Guillermo Leguizamon

11:20AM *A Study on Self-configuration in the Differential Evolution Algorithm*
Rodrigo Silva, Rodolfo Lopes, Alan Freitas and Frederico Guimaraes

11:40AM *Comparative Analysis of a Modified Differential Evolution Algorithm Based on Bacterial Mutation Scheme*
Rawaa Al-Dabbagh, Janos Botzheim and Mohanad Al-Dabbagh

CICS'14 Session 1
Chair: El-Sayed El-Alfy and Dipankar Dasgupta
Room: Bonaire 5 110

10:20AM *Biobjective NSGA-II for Optimal Spread Spectrum Watermarking of Color Frames: Evaluation Study*
El-Sayed El-Alfy and Ghaleb Asem

10:40AM *G-NAS: A Grid-Based Approach for Negative Authentication*
Dipankar Dasgupta, Denise Ferebee, Sanjib Saha, Abhijit Kumar Nag, Alvaro Madero, Abel Sanchez, John Williams and Kul Prasad Subedi

11:00AM *User Identification Through Command History Analysis*
Foaad Khosmood, Phillip Nico and Jonathan Woolery

11:20AM *Quantifying the Impact of Unavailability in Cyber-Physical Environments*
Anis Ben Aissa, Robert Abercrombie, Frederick Sheldon and Ali Mili

CIEL'14 Session 1: Ensemble Classifiers
Chair: Alok Kanti Deb and Michal Wozniak
Room: Bonaire 6 110

10:20AM *Experiments on Simultaneous Combination Rule Training and Ensemble Pruning Algorithm*
Bartosz Krawczyk and Michal Wozniak

10:40AM *Fast Image Segmentation based on Boosted Random Forests, Integral Images, and Features On Demand*
Uwe Knauer and Udo Seiffert

11:00AM *Ensemble based Classification using Small Training sets : A Novel Approach*
Krishnaveni C Venkata and Sobha Rani Timmappareddy

CIR2AT'14 Session 1: Robotic Assistive Technology
Chair: Georgios Kouroupetroglou
Room: Bonaire 7 111

10:20AM *VirtuNav: A Virtual Reality Indoor Navigation Simulator with Haptic and Audio Feedback for the Visually Impaired*
Catherine Todd, Swati Mallya, Sara Majeed, Jude Rojas and Katy Naylor

10:40AM *A Guidance Robot for the Visually Impaired: System Description and Velocity Reference Generation*
Hironori Ogawa, Kazuteru Tobita, Katsuyuki Sagayama and Masayoshi Tomizuka

11:00AM *Assistive Mobile Manipulation for Self-Care Tasks Around the Head*
Kelsey P. Hawkins, Phillip M. Grice, Tiffany L. Chen, Chih-Hung King and Charles C. Kemp

11:20AM *A Novel Approach of Prosthetic Arm Control using Computer Vision, Biosignals, and Motion Capture*
Harold Martin, Jaime Donaw, Robert Kelly, Youngjin Jung and Jong-Hoon Kim

11:40AM *Tactile pitch feedback system for deafblind or hearing impaired persons -Singing accuracy of hearing persons under conditions of added noise-*
Masatsugu Sakajiri, Shigeki Miyoshi, Junji Onishi, Tsukasa Ono and Tohru Ifukube

CIMSIVP'14 Session 1: Action Recognition
Chair: Nizar Bouguila
Room: Bonaire 8 112

10:20AM *Stereoscopic Video Description for Human Action Recognition*
Ioannis Mademlis, Alexandros Iosifidis, Anastasios Tefas, Nikos Nikolaidis and Ioannis Pitas

10:40AM *Cascade Dictionary Learning for Action Recognition*
Jian Dong, Changyin Sun and Chaoxu Mu

11:00AM *Human Action Recognition using Normalized Cone Histogram Features*
Stephen Karungaru, Terada Kenji and Fukumi Minoru

11:20AM *Fuzzy Rules based Indoor Human Action Recognition using Multi Cameras*
Masayuki Daikoku, Stephen Karungaru and Kenji Terada

11:40AM *Improving Codebook generation for action recognition using a mixture of Asymmetric Gaussians*
Tarek Elguebaly and Nizar Bouguila

ADPRL'14 Reinforcement Learning 1: Representation and Function Approximation
Chair: Olivier Pietquin and Joschka Boedecker
Room: Curacao 1 113

10:20AM *Approximate Real-Time Optimal Control Based on Sparse Gaussian Process Models*
Joschka Boedecker, Jost Tobias Springenberg, Jan Wuelfing and Martin Riedmiller

10:40AM *Subspace Identification for Predictive State Representation by Nuclear Norm Minimization*
Hadrien Glaude, Olivier Pietquin and Cyrille Enderli

11:00AM *Active Learning for Classification: An Optimistic Approach*
Timothe Collet and Olivier Pietquin

11:20AM *Accelerated Gradient Temporal Difference Learning Algorithms*
Dominik Meyer, Remy Degenne, Ahmed Omrane and Hao Shen

11:40AM *Convergent Reinforcement Learning Control with Neural Networks and Continuous Action Search*
Minwoo Lee and Charles Anderson

CIDM'14 Session 1: Advances in clustering
Chair: Barbara Hammer
Room: Curacao 2 114

10:20AM *Clustering data over time using kernel spectral clustering with memory*
Rocco Langone, Raghvendra Mall and Johan A. K. Suykens

10:40AM *Agglomerative Hierarchical Kernel Spectral Data Clustering*
Raghvendra Mall, Rocco Langone and Johan Suykens

11:00AM *Quantum Clustering -- A Novel Method for Text Analysis*
Ding Liu, Minghu Jiang and Xiaofang Yang

11:20AM *Generalized Information Theoretic Cluster Validity Indices for Soft Clusterings*
Yang Lei, James C. Bezdek, Jeffrey Chan, Nguyen Xuan Vinh, Simone Romano and James Bailey

11:40AM *A Density-Based Clustering of the Self-Organizing Map Using Graph Cut*
Leonardo Enzo Brito da Silva and Jose Alfredo Ferreira Costa

Special Session: SIS'14 Session 1: Theory and Applications of Nature-Inspired Optimization Algorithms I
Chair: Xin-She Yang and Xingshi He
Room: Curacao 3 ..... **115**

10:20AM *Evolving Novel Algorithm Based on Intellectual Behavior of Wild Dog Group as Optimizer*
Avtar Buttar, Ashok Goel and Shakti Kumar

10:40AM *A Social-Spider Optimization Approach for Support Vector Machines Parameters Tuning*
Danillo Pereira, Mario Pazoti, Luis Pereira and Joao Papa

11:00AM *A Parametric Testing of the Firefly Algorithm in the Determination of the Optimal Osmotic Drying Parameters for Papaya*
Julian Yeomans and Raha Imanirad

11:20AM *Engineering Optimization using Interior Search Algorithm*
Amir H. Gandomi and David A. Roke

11:40AM *Non-dominated Sorting Cuckoo Search for Multiobjective Optimization*
Xing-shi He, Na Li and Xin-She Yang

CIASG'14 Session 1: Forecasting and Predictions in Smart Grids
Chair: Ganesh Kumar Venayagamoorthy
Room: Curacao 4 ..... **116**

10:20AM *A Time Series Ensemble Method to Predict Wind Power*
Sumaira Tasnim, Ashfaqur Rahman, Gm Shafiullah, Amanullah Oo and Alex Stojcevski

10:40AM *Neural Network Forecasting of Solar Power for NASA Ames Sustainability Base*
Chaitanya Poolla, Abe Ishihara, Steve Rosenberg, Rodney Martin, Chandrayee Basu, Alex Fong and Sreejita Ray

11:00AM *Comparison of Echo State Network and Extreme Learning Machine for PV Power Prediction*
Iroshani Jayawardene and Ganesh Kumar Venayagamoorthy

11:20AM *Accurate Localized Short Term Weather Prediction for Renewables Planning*
David Corne, Manjula Dissanayake, Andrew Peacock, Stuart Galloway and Edward Owens

11:40AM *Intelligent Analysis of Wind Turbine Power Curve Models*
Arman Goudarzi, Innocent Davidson, Afshin Ahmadi and Ganesh Kumar Venayagamoorthy

SSCI DC Session 1
Chair: Xiaorong Zhang
Room: Curacao 7 ..... **117**

10:20AM *Seismic Response Formulation of Self-Centering Concentrically Braced Frames Using Genetic Programming*
AmirHossein Gandomi

10:40AM *Coevolutionary Nonlinear System Identification Based on Correlation Functions and Neural Networks*
Helon Vicente Hultmann Ayala and Leandro dos Santos Coelho

11:00AM *Integrated Optimization and Prediction based on Adaptive Dynamic Programming (ADP) for Machine Intelligence*
Zhen Ni

11:20AM *Efficient Grouping and Cluster Validity Measures for NGS Data*
Markus Lux

11:40AM *Optimizing Non-traditional Designs for Order Picking Warehouses*
Sabahattin Gokhan Ozden, Alice Smith and Kevin Gue

Wednesday, December 10, 1:30PM-3:10PM

Special Session: CIBD'14 Session 2: Big Data Analytic for Healthcare
Chair: Norman Poh and David Windridge
Room: Antigua 2 118

1:30PM *A Human Geospatial Predictive Analytics Framework With Application to Finding Medically Underserved Areas*
James Keller, Andrew Buck, Mihail Popescu and Alina Zare

1:50PM *Challenges in Designing an Online Healthcare Platform for Personalised Patient Analytics*
Norman Poh, Santosh Tirunagari and Windridge David

2:10PM *Feature Selection/Visualisation of ADNI Data with Iterative Partial Least Squares*
Li Bai and Torbjorn Wasterlid

2:30PM *Application of Sparse Matrix Clustering with Convex-Adjusted Dissimilarity Matrix in an Ambulatory Hospital Specialist Service*
Xiaobin You, Bee Hoon Heng and Kiok Liang Teow

2:50PM *Microarray Big Data Integrated Analysis for the Prediction of Robust Diagnostics Signature for Triple-Negative Breast Cancer*
Masood Zaka, Yonghong Peng and Chris W Sutton

IES'14 Session 2
Chair: Manuel Roveri
Room: Antigua 3 119

1:30PM *Self-aware and Self-expressive Driven Fault Tolerance for Embedded Systems*
Tatiana Djaba Nya, Stephan C. Stilkerich and Christian Siemers

1:50PM *Learning Causal Dependencies to Detect and Diagnose Faults in Sensor Networks*
Cesare Alippi, Manuel Roveri and Francesco Trovo'

2:10PM *Salted Hashes for Message Authentication - Proof of concept on Tiny Embedded Systems*
Rene Romann and Ralf Salomon

2:30PM *Novelty Detection in Images by Sparse Representations*
Giacomo Boracchi, Diego Carrera and Brendt Wohlberg

Special Session: CIHLI'14 Session 2: Grounded Cognition, Creativity and Motivated Learning
Chair: Kathryn Merrick and Janusz Starzyk
Room: Antigua 4 119

1:30PM *Evolution of Intrinsic Motives in a Multi-Player Common Pool Resource Game*
Kathryn Merrick

1:50PM *Self-Motivated Learning of Achievement and Maintenance Tasks for Non-Player Characters in Computer Games*
Hafsa Ismail, Kathryn Merrick and Michael Barlow

2:10PM *Effective Motive Profiles and Swarm Compositions for Motivated Particle Swarm Optimisation Applied to Task Allocation*
Medria Hardhienata, Kathryn Merrick and Valery Ugrinovskii

2:30PM *Applying Behavior Models in a System Architecture*
Bruce Toy

2:50PM *Advancing Motivated Learningn with Goal Creation*
James Graham, Janusz Starzyk, Zhen Ni and Haibo He

CCMB'14 Session 2: Cognitive, Mind, and Brain
Chair: Angelo Cangelosi
Room: Bonaire 1 120

1:30PM *Assessing real-time cognitive load based on psycho-physiological measures for younger and older adults*
Eija Ferreira, Denzil Ferreira, SeungJun Kim, Pekka Siirtola, Juha Roning, Jodi F. Forlizzi and Anind K. Dey

1:50PM *Toward a Neural Network Model of Framing with Fuzzy Traces*
Daniel Levine

2:10PM *An Arousal-Based Neural Model of Infant Attachment*
David Cittern and Abbas Edalat

2:30PM *Solving a Cryptarithmetic Problem Using a Social Learning Heuristic*
Jose Fontanari

2:50PM *iflows: A Novel Simulation Model for Predicting the Effectiveness of a Research Community*
Alex Doboli and Simona Doboli

CIPLS'14 Session 2: Computational Intelligence in Logistics Systems
Chair: Sona Kande and Bülent Çatay
Room: Bonaire 2 121

1:30PM *Design of Multi-product / Multi-period Closed-Loop Reverse Logistics Network Using a Genetic Algorithm*
Helga Hernandez-Hernandez, Jairo R. Montoya-Torres and Fabricio Niebles-Atencio

1:50PM *Solving capacitated vehicle routing problem by artificial bee colony algorithm*
Alberto Gomez and Said Salhi

2:10PM *A genetic algorithm with an embedded Ikeda map applied to an order picking problem in a multi-aisle warehouse*
Michael Stauffer, Remo Ryter, Donald Davendra, Rolf Dornberger and Thomas Hanne

2:30PM *An Improved Optimization Method based on Intelligent Water Drops Algorithm for the Vehicle Routing Problem*
Zahra Booyavi, Ehsan Teymourian, Mohammad Komaki and Shaya Sheikh

2:50PM *Iterated Local Search with neighborhood space reduction for two-echelon distribution network for perishable products*
Sona Kande, Christian Prins, Lucile Belgacem and Redon Benjamin

Special Session: CIComms'14 Session 2: Advanced Nature-Inspired Optimization for New Generation Antenna Devices
Chair: Paolo Rocca and Andrea Massa
Room: Bonaire 3 122

1:30PM *An Overview of Several Recent Antenna Designs Utilizing Nature-Inspired Optimization Algorithms*
Douglas Werner, Micah Gregory, Zhi Hao Jiang, Donovan Brocker, Clinton Scarborough and Pingjuan Werner

1:50PM *A technique for the aperture partitioning*
Amedeo Capozzoli, Claudio Curcio, Giuseppe D'Elia, Angelo Liseno and Francesco Marano

2:10PM *Evolution of Nature-Inspired Optimization for New Generation Antenna Design*
Giacomo Oliveri, Paolo Rocca, Marco Salucci and Andrea Massa

2:30PM *Antenna Design by Using MOEA/D-Based Optimization Techniques*
Dawei Ding, Gang Wang, Chenwei Yang and Lu Wang

SDE'14 Session 2: Algorithms and Applications
Chair: Ferrante Neri
Room: Bonaire 4 123

1:30PM *MDE: Differential Evolution with Merit-based Mutation Strategy*
Ibrahim Ibrahim, Shahryar Rahnamayan and Miguel Vargas Martin

1:50PM *Multi-Objective Compact Differential Evolution*
Moises Osorio Velazquez, Carlos Coello Coello and Alfredo Arias-Montano

2:10PM *On the Efficient Design of a Prototype-Based Classifier Using Differential Evolution*
Luiz Soares Filho and Guilherme Barreto

2:30PM *Complex Network Analysis of Differential Evolution Algorithm applied to Flowshop with No-Wait Problem*
Donald Davendra, Ivan Zelinka, Magdalena Metlicka, Roman Senkerik and Michal Pluhacek

2:50PM *Some Improvements of the Self-Adaptive jDE Algorithm*
Janez Brest, Ales Zamuda, Iztok Fister and Borko Boskovic

CICS'14 Session 2
Chair: Nur Zincir-heywood and Dipankar Dasgupta
Room: Bonaire 5 123

1:30PM *Automated testing for cyber threats to ad-hoc wireless networks*
Karel Bergmann and Joerg Denzinger

1:50PM *Automatic Attack Surface Reduction in Next-Generation Industrial Control Systems*
Sebastian Obermeier, Michael Wahler, Thanikesavan Sivanthi, Roman Schlegel and Aurelien Monot

2:10PM *Supervised Learning to Detect DDoS Attacks*
Eray Balkanli, Jander Alves and A. Nur Zincir-heywood

2:30PM *Benchmarking Two Techniques for Tor Classification: Flow Level and Circuit Level Classification*
Khalid Shahbar and A. Nur Zincir-heywood

2:50PM *Spark-based Anomaly Detection Over Multi-source VMware Performance Data In Real-time*
Mohiuddin Solaimani, Mohammed Iftekhar, Latifur Khan, Bhavani Thuraisingham and Joey Burton Ingram

CIEL'14 Session 2: Ensemble Predictors
Chair: Robi Polikar and Alok Kanti Deb
Room: Bonaire 6 124

1:30PM *Ensemble Deep Learning for Regression and Time Series Forecasting*
Xueheng Qiu, Le Zhang, Ye Ren, Ponnuthurai Nagaratnam Suganthan and Gehan Amaratunga

1:50PM *Building Predictive Models in Two Stages with Meta-Learning Templates*
Pavel Kordik and Jan Cerny

2:10PM *Empirical Mode Decomposition based AdaBoost-Backpropagation Neural Network Method for Wind Speed Forecasting*
Ye Ren, Xueheng Qiu and Ponnuthurai Nagaratnam Suganthan

2:30PM *TS Fuzzy Model Identification by a Novel Objective Function Based Fuzzy Clustering Algorithm*
Tanmoy Dam and Alok Kanti Deb

CIR2AT'14 Session 2: Robotic Rehabilitation
Chair: Hermano Igo Krebs
Room: Bonaire 7 125

1:30PM *Spasticity Assessment System for Elbow Flexors/Extensors: Healthy Pilot Study*
Nitin Seth, Denise Johnson and Hussein Abdullah

1:50PM *Robotic Agents used to Help Teach Social Skills to Individuals with Autism: The Fourth Generation*
Matthew Tennyson, Deitra Kuester and Christos Nikolopoulos

2:10PM *Encouraging Specific Intervention Motions via a Robotic System for Rehabilitation of Hand Function*
Brittney English and Ayanna Howard

CIMSIVP'14 Session 2: Applications
Chair: Mohsen Dorodchi
Room: Bonaire 8 126

1:30PM *Endoscope Image Analysis Method for Evaluating the Extent of Early Gastric Cancer*
Tomoyuki Hiroyasu, Katsutoshi Hayashinuma, Hiroshi Ichikawa, Nobuyuki Yagi and Utako Yamamoto

1:50PM *Fuzzy C-Means Clustering with Spatially Weighted Information for Medical Image Segmentation*
Myeongsu Kang and Jong-Myon Kim

2:10PM *Improve Recognition Performance by Hybridizing Principal Component Analysis (PCA) and Elastic Bunch Graph Matching (EBGM)*
Xianming Chen, Zhang Chaoyang and Zhou Zhaoxian

2:30PM *Automatic Tumor Lesion Detection and Segmentation Using Histogram-Based Gravitational Optimization Algorithm*
Nooshin Nabizadeh and Mohsen Dorodchi

2:50PM *Identification of Mature Grape Bunches using Image Processing and Computational Intelligence Methods*
Ashfaqur Rahman and Andrew Hellicar

ADPRL'14 Optimal Control 1: Fundamentals and Techniques
Chair: Eugene Feinberg and Theodorou Evangelos
Room: Curacao 1 127

1:30PM *Convergence of Value Iterations for Total-Cost MDPs and POMDPs with General State and Action Sets*
Eugene Feinberg, Pavlo Kasyanov and Michael Zgurovsky

1:50PM *Theoretical Analysis of a Reinforcement Learning based Switching Scheme*
Ali Heydari

2:10PM *An analysis of optimistic, best-first search for minimax sequential decision making*
Lucian Busoniu, Remi Munos and Elod Pall

2:30PM *Nonparametric Infinite Horizon Kullback-Leibler Stochastic Control*
Yunpeng Pan and Evangelos Theodorou

2:50PM *Information-Theoretic Stochastic Optimal Control via Incremental Sampling-based Algorithms*
Oktay Arslan, Evangelos Theodorou and Panagiotis Tsiotras

CIDM'14 Session 2: Multitask and Metalearning
Chair: Rocco Langone
Room: Curacao 2 128

1:30PM *New Bilinear Formulation to Semi-Supervised Classification Based on Kernel Spectral Clustering*
Vilen Jumutc and Johan Suykens

1:50PM *Batch Linear Least Squares-based Learning Algorithm for MLMVN with Soft Margins*
Evgeni Aizenberg and Igor Aizenberg

2:10PM *Comparing Datasets by Attribute Alignment*
Jakub Smid and Roman Neruda

2:30PM *Convex Multi-task Relationship Learning using Hinge Loss*
Anveshi Charuvaka and Huzefa Rangwala

2:50PM *Precision-Recall-Optimization in Learning Vector Quantization Classifiers for Improved Medical Classification Systems*
Thomas Villmann, Marika Kaden, Mandy Lange, Paul Stuermer and Wieland Hermann

SIS'14 Session 2: Particle Swarm Optimization - I
Chair: Ivan Zelinka and Roman Senkerik
Room: Curacao 3 129

1:30PM *Weight Regularisation in Particle Swarm Optimisation Neural Network Training*
Anna Rakitianskaia and Andries Engelbrecht

1:50PM *Gathering algorithm: A new concept of PSO based metaheuristic with dimensional mutation*
Michal Pluhacek, Roman Senkerik, Donald Davendra and Ivan Zelinka

2:10PM *Comparison of Self-Adaptive Particle Swarm Optimizers*
Elre van Zyl and Andries Engelbrecht

2:30PM *Confident but Weakly Informed: Tackling PSO's Momentum Conundrum*
Christopher Monson and Kevin Seppi

2:50PM *Communication-Aware Distributed PSO for Dynamic Robotic Search*
Logan Perreault, Mike Wittie and John Sheppard

CIASG'14 Session 2: Micro-grids & Electric Vehicles
Chair: Edgar Sanchez
Room: Curacao 4 129

1:30PM *Performance of a Smart Microgrid with Battery Energy Storage System's Size and State of Charge*
Afshin Ahmadi, Ganesh Kumar Venayagamoorthy and Ratnesh Sharma

1:50PM *A Simple Recurrent Neural Network for Solution of Linear Programming: Application to a Microgrid*
Juan Diego Sanchez-Torres, Martin J. Loza-Lopez, Riemann Ruiz-Cruz, Edgar Sanchez and Alexander G. Loukianov

2:10PM *Parallel Tempering for Constrained Many Criteria Optimization in Dynamic Virtual Power Plants*
Joerg Bremer and Michael Sonnenschein

2:30PM *Non-convex Dynamic Economic/Environmental Dispatch with Plug-in Electric Vehicle Loads*
Zhile Yang, Kang Li, Qun Niu, Cheng Zhang and Aoife Foley

2:50PM *Coordinated Electric Vehicle Charging Solutions Using Renewable Energy Sources*
Kumarsinh Jhala, Balasubramaniam Natarajan, Anil Pahwa and Larry Erickson

SSCI DC Session 2
Chair: Xiaorong Zhang
Room: Curacao 7 131

1:30PM *An Evolutionary Neural Network Model for Dynamic Channel Allocation in Mobile Communication Network*
Peter Ugege

1:50PM *Computational Intelligence in Smart Grid Security Analysis Against Smart Attacks*
Jun Yan

2:10PM *Doctoral Consortium*
Anne Marie Amja

2:30PM *Predicting the Terminal Ballistics of Kinetic Energy Projectiles Using Artificial Neural Networks*
John Auten

2:50PM *Pruning Algorithm for Multi-objective Optimization using Specific Bias Intensity Parameter*
Sufian Sudeng and Naruemon Wattanapongsakorn

Wednesday, December 10, 3:30PM-5:10PM

Special Session: CIBD'14 Session 3: Big Data Analytics in Traditional Chinese Medicine
Chair: Josiah Poon, Xuezhong Zhou and Runshun Zhang
Room: Antigua 2 132

3:30PM *Mining the Prescription-Symptom Regularity of TCM for HIV/AIDS Based on Complex Network*
Zhang Xiaoping, Wang Jian, Liang Biyan, Qi Haixun and Zhao Yufeng

3:50PM *Regularity of Herbal Formulae for HIV/AIDS Patients with Syndromes Based on Complex Networks*
Jian Wang, Xiaoping Zhang, Biyan Liang, Xuezhong Zhou, Jiaming Lu, Liran Xu, Xin Deng, Xiuhui Li, Li Wang, Xinghua Tan, Yuxiang Mao, Guoliang Zhang, Junwen Wang, Xiaodong Li and Yuguang Wang

4:10PM *Development of large-scale TCM corpus using hybrid named entity recognition methods for clinical phenotype detection: an initial study*
Lizhi Feng, Xuezhong Zhou, Haixun Qi, Runshun Zhang, Yinghui Wang and Baoyan Liu

4:30PM *Methods and technologies of traditional Chinese medicine clinical information datamation in real world*
Guanli Song, Guanbo Song, Baoyan Liu, Yinghui Wang, Runshun Zhang, Xuezhong Zhou, Liang Xie and Xinghuan Huang

4:50PM *TCM Syndrome Classification of AIDS based on Manifold Ranking*
Yufeng Zhao, Lin Luo, Liyun He, Baoyan Liu, Qi Xie, Xiaoping Zhang, Jian Wang, Guanli Song and Xianghong Jing

IES'14 Session 3
Chair: Manuel Roveri
Room: Antigua 3 133

3:30PM *High precision FPGA implementation of neural network activation functions*
Francisco Ortega, Jose Jerez, Gustavo Juarez, Jorge Perez and Leonardo Franco

3:50PM *An Intelligent Embedded System for Real-Time Adaptive Extreme Learning Machine*
Raul Finker, Ines del Campo, Javier Echanobe and Victoria Martinez

4:10PM *A differential flatness theory approach to adaptive fuzzy control of chaotic dynamical systems*
Gerasimos Rigatos

CIHLI'14 Session 3: Applications
Chair: Jacek Mandziuk and Janusz Starzyk
Room: Antigua 4 133

3:30PM *The Leaning Intelligent Distribution Agent (LIDA) and Medical Agent X (MAX): Computational Intelligence for Medical Diagnosis*
Steve Strain, Sean Kugele and Stan Franklin

3:50PM *Two-Phase Multi-Swarm PSO and the Dynamic Vehicle Routing Problem*
Michal Okulewicz and Jacek Mandziuk

4:10PM *Proactive and Reactive Risk-Aware Project Scheduling*
Karol Waledzik, Jacek Mandziuk and Slawomir Zadrozny

4:30PM *Towards Intelligent Caring Agents for Aging-In-Place: Issues and Challenges*
Di Wang, Budhitama Subagdja, Yilin Kang, Ah-Hwee Tan and Daqing Zhang

4:50PM *A Rapid Learning and Problem Solving Method: Application to the Starcraft Game Environment*
Seng-Beng Ho and Fiona Liausvia

CCMB'14 Session 3: Cognitive, Mind, and Brain
Chair: Robert Kozma
Room: Bonaire 1 134

3:30PM *Limit Cycle Representation of Spatial Locations Using Self-Organizing Maps*
Di-Wei Huang, Rodolphe Gentili and James Reggia

3:50PM *Self Organizing Neuro-Glial Network, SONG-NET*
Hajer Landolsi and Kirmene Marzouki

4:10PM *Joint decision-making on two visual perception systems*
Henrique Valim, Molly Clemens and D. Frank Hsu

4:30PM *Statistical Analysis and Classification of EEG-based Attention Network Task Using Optimized Feature Selection*
Hua-Chin Lee, Li-Wei Ko, Hui-Ling Huang, Jui-Yun Wu, Ya-Ting Chuang and Shinn-Ying Ho

4:50PM *The Effect of tDCS on ERD Potentials: A Randomized, Double-Blind Placebo Controlled Study*
Ahmed Izzidien, Sriharsha Ramaraju, Mohammed Ali Roula, Jenny Ogeh and Peter McCarthy

Special Session: CIPLS'14 Session 3: Supply Chain Design, Optimization, and Management
Chair: Hernan Chavez and Krystel Castillo
Room: Bonaire 2 135

3:30PM *Managing Inventories in Multi-echelon On-line Retail Fulfillment System with Different Response Lead Time Demands*
Juan Li and John Muckstadt

3:50PM *A bi-objective model for local and Global Green Supply Chain*
Neale Smith, Mario Manzano, Krystel K. Castillo-Villar and Luis Rivera-Morales

4:10PM *A bi-objective inventory routing problem by considering customer satisfaction level in context of perishable product*
Mohammad Rahimi, Armand Baboli and Yacine Rekik

4:30PM *A Preliminary Simulated Annealing for Resilience Supply Chains*
Krystel Castillo-Villar and Hernan Chavez

Special Session: CIComms'14 Session 3: Intelligent Applications in Communication and Computation
Chair: Paolo Rocca and Maode Ma
Room: Bonaire 3 136

3:30PM *Interference Suppression using CPP Adaptive Notch Filters for UWB Synchronization in Stochastic Non-Linear Channels*
Farhana Begum, Manash Pratim Sarma, Kandarpa Kumar Sarma, Nikos Mastorakis and Aida Bulucea

3:50PM *Computation of transfer function of unknown networks for indoor power line communication*
Banty Tiru

4:10PM *Efficient Synthesis of Complex Antenna Devices Through System-by-Design*
Giacomo Oliveri, Marco Salucci, Paolo Rocca and Andrea Massa

4:30PM *Optimal Observations Transmission for Distributed Estimation under Energy Constraint*
Marwan Alkhweldi

SDE'14 Session 3: Applications
Chair: Janez Brest
Room: Bonaire 4 137

3:30PM *Differential Evolution Schemes for Speech Segmentation: A Comparative Study*
Sunday Iliya, Ferrante Neri, Dylan Menzies, Pip Cornelius and Lorenzo Picinali

3:50PM *The Usage of Differential Evolution in a Statistical Machine Translation*
Jani Dugonik, Borko Boskovic, Mirjam Sepesy Maucec and Janez Brest

4:10PM *An Improved Differential Evolution Algorithm with Novel Mutation Strategy*
Yujiao Shi, Hao Gao and Dongmei Wu

CICS'14 Session 3
Chair: Robert Abercrombie and Dipankar Dasgupta
Room: Bonaire 5 137

3:30PM *A Theoretical Q-Learning Temporary Security Repair*
Arisoa S. Randrianasolo and Larry D. Pyeatt

3:50PM *The Analysis of Feature Selection Methods and Classification Algorithms in Permission Based Android Malware Detection*
Ugur Pehlivan, Nuray Baltaci; Cengiz Acarturk and Nazife Baykal

4:10PM *A Novel Bio-Inspired Predictive Model for Spam Filtering Based on Dendritic Cell Algorithm*
El-Sayed El-Alfy and Ali Al-Hasan

4:30PM *A Genetic Programming Approach for Fraud Detection in Electronic Transactions*
Carlos Assis, Adriano Pereira, Marconi Arruda and Eduardo Carrano

CIEL'14 Session 3: Ensemble Optimization
Chair: Andries P. Engelbrecht and Nikhil R Pal
Room: Bonaire 6 138

3:30PM *Hyper-heuristic approach for solving Nurse Rostering Problem*
Khairul Anwar, Mohammed A. Awadallah, Ahamad Tajudin Khader and Mohammed Azmi Al-Betar

3:50PM *The Entity-to-Algorithm Allocation Problem: Extending the Analysis*
Jacomine Grobler, Andries P. Engelbrecht, Graham Kendall and V.S.S. Yadavalli

4:10PM *Genetic Algorithm-Based Neural Error Correcting Output Classifier*
Mahdi Amina, Francesco Masulli and Stefano Rovetta

CIMSIVP'14 Session 3: Features and Detections
Chair: Khan M. Iftekharuddin and Bonny Banerjee
Room: Bonaire 8 139

3:30PM *Change Detection using Dual Ratio and False Color*
Patrick Hytla, Eric Balster, Juan Vasquez and Robert Neuroth

3:50PM *Real-time Shape Classification Using Biologically Inspired Invariant Features*
Bharath Ramesh, Cheng Xiang and Tong Heng Lee

4:10PM *An Improved Evolution-COnstructed (iECO) Features Framework*
Stanton Price, Derek Anderson and Robert Luke

4:30PM *Unsupervised Learning of Spatial Transformations in the Absence of Temporal Continuity*
Bonny Banerjee and Kamran Ghasedi Dizaji

4:50PM *Multiresolution superpixels for visual saliency detection*
Henry Chu, Anurag Singh and Michael Pratt

Special Session: ADPRL'14 Reinforcement Learning and Optimization in Stochastic Multi-objective Environments
Chair: Madalina Drugan and Yann-Michael De Hauwere
Room: Curacao 1 140

3:30PM *Policy Gradient Approaches for Multi-Objective Sequential Decision Making: A Comparison*
Simone Parisi, Matteo Pirotta, Nicola Smacchia, Luca Bascetta and Marcello Restelli

3:50PM *Annealing-Pareto Multi-Objective Multi-Armed Bandit Algorithm*
Saba Yahyaa, Madalina Drugan and Bernard Manderick

4:10PM *Pareto Upper Confidence Bounds algorithms: an empirical study*
Madalina Drugan, Ann Nowe and Bernard Manderick

4:30PM *Multi-Objective Reinforcement Learning for AUV Thruster Failure Recovery*
Seyed Reza Ahmadzadeh, Petar Kormushev and Darwin G. Caldwell

4:50PM *Model-Based Multi-Objective Reinforcement Learning*
Marco Wiering, Maikel Withagen and Madalina Drugan

Special Session: CIDM'14 Session 3: Computational Intelligence for Health and Wellbeing
Chair: Paulo Lisboa
Room: Curacao 2 ..... **141**

3:30PM *BioHCDP: A Hybrid Constituency-Dependency Parser for Biological NLP Information Extraction*
Kamal Taha and Mohammed Al Zaabi

3:50PM *Classification of iPSC Colony Images Using Hierarchical Strategies with Support Vector Machines*
Henry Joutsijoki, Jyrki Rasku, Markus Haponen, Ivan Baldin, Yulia Gizatdinova, Michelangelo Paci, Jyri Saarikoski, Kirsi Varpa, Harri Siirtola, Jorge Avalos-Salguero, Kati Iltanen, Jorma Laurikkala, Kirsi Penttinen, Jari Hyttinen, Katriina Aalto-Setala and Martti Juhola

4:10PM *Semi-supervised source extraction methodology for the nosological imaging of glioblastoma response to therapy*
Sandra Ortega-Martorell, Ivan Olier, Teresa Delgado-Goni, Magdalena Ciezka, Margarida Julia-Sape, Paulo Lisboa and Carles Arus

4:30PM *Automatic relevance source determination in human brain tumors using Bayesian NMF*
Sandra Ortega-Martorell, Ivan Olier, Margarida Julia-Sape, Carles Arus and Paulo Lisboa

4:50PM *Alzheimer's disease patients classification through EEG signals processing*
Giulia Fiscon, Emanuel Weitschek, Giovanni Felici, Paola Bertolazzi, Simona De Salvo, Placido Bramanti and Maria Cristina De Cola

Special Session: SIS'14 Session 3: Biologically-inspired Intelligence for Robotics
Chair: Chaomin Luo and Simon X. Yang
Room: Curacao 3 ..... **142**

3:30PM *A Bio-inspired Approach to Task Assignment of Multi-robots*
Yi Xin, Anmin Zhu and Zhong Ming

3:50PM *Naturally Inspired Optimization Algorithms as Applied to Mobile Robotic Path Planning*
Steven Muldoon, Chaomin Luo, Furao Shen and Hongwei Mo

4:10PM *A fuzzy system for parameter adaptation in Ant Colony Optimization*
Frumen Olivas, Fevrier Valdez and Oscar Castillo

4:30PM *OCbotics: An Organic Computing Approach to Collaborative Robotic Swarms*
Sebastian von Mammen, Sven Tomforde, Joerg Haehner, Patrick Lehner, Lukas Foerschner, Andreas Hiemer, Mirela Nicola and Patrick Blickling

4:50PM *Sensor-based Autonomous Robot Navigation Under Unknown Environments with Grid Map Representation*
Chaomin Luo, Jiyong Gao, Xinde Li, Hongwei Mo and Qimi Jiang

CIASG'14 Session 3: Markets
Chair: Hiroyuki Mori
Room: Curacao 4 ..... **143**

3:30PM *A Kalman Filtering approach to the detection of option mispricing in electric power markets*
Gerasimos Rigatos

3:50PM *LMP Forecasting with Prefiltered Gaussian Process*
Hiroyuki Mori and Kaoru Nakano

4:10PM *An Efficient Iterative Double Auction for Energy Trading in Microgrids*
Bodhisattwa Majumder, Mohammad Faqiry, Sanjoy Das and Anil Pahwa

4:30PM *Smart Grid Energy Fraud Detection Using Artificial Neural Networks*
Vitaly Ford, Ambareen Siraj and William Eberle

SSCI DC Session 3
Chair: Xiaorong Zhang
Room: Curacao 7 143

3:30PM *Universal Task Model for Simulating Human System Integration Processes*
Anastasia Angelopoulou and Waldemar Karwowski

3:50PM *Transfer learning in a sequence of Reinforcement Learning tasks with continuous state spaces*
Edwin Torres

4:10PM *Scaling Up Subset Selection and the Microbiome*
Gregory Ditzler

4:30PM *Application for Doctoral Consortium in SSCI2014*
Naoki Masuyama

4:50PM *A Study on Adaptive Dynamic Programming*
Xiangnan Zhong

Thursday, December 11, 8:00AM-9:00AM

Thursday, December 11, 9:20AM-10:00AM

Thursday, December 11, 10:20AM-12:00PM

11:40AM *Adaptive ECG Biometric Recognition: a Study on Re-Enrollment Methods for QRS Signals*
Ruggero Donida Labati, Vincenzo Piuri, Roberto Sassi, Fabio Scotti and Gianluca Sforza

MCDM'14 Session 1: Algorithms I
Chair: Piero Bonissone and Yaochu Jin
Room: Bonaire 1 149

10:20AM *Robustness Threshold Methodology for Multicriteria based Ranking using Imprecise Data*
Bastien Rizzon, Sylvie Galichet and Vincent Cliville

10:40AM *Generating Diverse and Accurate Classifier Ensembles Using Multi-Objective Optimization*
Shenkai Gu and Yaochu Jin

11:00AM *Selection of Solutions in Multi-Objective Optimization: Decision Making and Robustness*
Antonio Gaspar-Cunha, Jose Ferreira, Jose Covas and Gustavo Reccio

11:20AM *A Multiobjective Genetic Algorithm based on NSGA II for Deriving Final Ranking from a Medium-Sized Fuzzy Outranking Relation*
Juan Carlos Leyva Lopez, Diego Alonso Gastelum Chavira and Jesus Jaime Solano Noriega

11:40AM *A Hybrid Multi-objective GRASP+SA Algorithm with Incorporation of Preferences*
Eunice Oliveira, Carlos Henggeler Antunes and Alvaro Gomes

Special Session: RiiSS'14 Session 1: Computational Intelligence for Cognitive Robotics I
Chair: Naoyuki Kubota
Room: Bonaire 2 150

10:20AM *Average Edit Distance Bacterial Mutation Algorithm for Effective Optimisation*
Tiong Yew Tang, Simon Egerton, Janos Botzheim and Naoyuki Kubota

10:40AM *Robust face recognition via transfer learning for robot partner*
Noel Nuo wi Tay, Janos Botzheim, Chu Kiong Loo and Naoyuki Kubota

11:00AM *Combining Pose Control and Angular Velocity Control for Motion Balance of Humanoid Robot Soccer EROS*
Azhar Aulia Saputra, Indra Adji Sulistijono, Achmad Subhan Khalilullah, Takahiro Takeda and Naoyuki Kubota

11:20AM *Spiking Neural Network based Emotional Model for Robot Partner*
Janos Botzheim and Naoyuki Kubota

11:40AM *GNG Based Conversation Selection Model for Robot Partner and Human Communication System*
Shogo Yoshida and Naoyuki Kubota

CIVTS'14 Session 1
Chair: Justin Dauwels, Dipti Srinivasan and Ana Bazzan
Room: Bonaire 3 151

10:20AM *A GPU-Based Real-Time Traffic Sign Detection and Recognition System*
Zhilu Chen, Xinming Huang, Ni Zhen and Haibo He

10:40AM *Traffic Information Extraction from a Blogging Platform using Knowledge-based Approaches and Bootstrapping*
Jorge Aching, Thiago de Oliveira and Ana Bazzan

11:00AM *Multiobjective Selection of Input Sensors for Travel Times Forecasting Using Support Vector Regression*
Jiri Petrlik, Otto Fucik and Lukas Sekanina

11:20AM *Predicting Bikeshare System Usage Up to One Day Ahead*
Romain Giot and Raphael Cherrier

11:40AM *Battery-supercapacitor electric vehicles energy management using DP based predictive control algorithm*
Xiaofeng Lin, Meipin Hu, Shaojian Song and Yimin Yang

CIES'14 Session 1: Theories and Designs
Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse
Room: Bonaire 4 152

10:20AM *If We Take Into Account that Constraints Are Soft, Then Processing Constraints Becomes Algorithmically Solvable*
Quentin Brefort, Luc Jaulin, Martine Ceberio and Vladik Kreinovich

10:40AM *Why Ricker Wavelets Are Successful in Processing Seismic Data: Towards a Theoretical Explanation*
Afshin Gholamy and Vladik Kreinovich

11:00AM *Fuzzy Local Linear Approximation-based Sequential Design*
Joachim van der Herten, Dirk Deschrijver and Tom Dhaene

11:20AM *Incorporating Decision Maker Preference in Multi-objective Evolutionary Algorithm*
Sufian Sudeng and Naruemon Wattanapongsakorn

11:40AM *Visualizing Uncertainty with Fuzzy Rose Diagrams*
Andrew Buck and James Keller

ISIC'14 Session 1: Independent Computing I
Chair: Neil Y. Yen
Room: Bonaire 5 152

10:20AM *Meta-Framework for Semantic TRIZ*
K.R.C. Koswatte, Incheon Paik and B.T.G.S. Kumara

10:40AM *A Model for Estimating SCM Audit Effort with Key Characteristic Sensitivity Analysis*
John Medellin

11:00AM *Signboard Design System through Social Voting Technique*
Hiroshi Takenouchi, Hiroyuki Inoue and Masataka Tokumaru

11:20AM *Social Network based Smart Grids Analysis*
Joseph C. Tsai, Neil Y. Yen and Takafumi Hayashi

11:40AM *Design Support System with Votes from Multiple People using Digital Signage*
Masayuki Sakai, Hiroshi Takenouchi and Masataka Tokumaru

FOCI'14 Session 1: Fuzzy Logic
Chair: Leonardo Franco
Room: Bonaire 6 153

10:20AM *Information Fusion with Uncertainty Modeled on Topological Event Spaces*
Roman Ilin and Jun Zhang

10:40AM *Ranking scientists from the field of quantum game theory using p-index*
Upul Senanayake, Mahendra Piraveenan and Albert Zomaya

11:00AM *Quantum-inspired Genetic Algorithm with Two Search Supportive Schemes and Artificial Entanglement*
Chee Ken Choy, Kien Quang Nguyen and Ruck Thawonmas

11:20AM *The Performance of Page Rank Algorithm under Degree Preserving Perturbations*
Upul Senanayake, Peter Szot, Mahendra Piraveenan and Dharshana Kasthurirathna

11:40AM *Fuzzy Networks: What Happens When Fuzzy People Are Connected through Social Networks*
Li-Xin Wang and Jerry M. Mendel

EALS'14 Session 1: Theory and Principles
Chair: Fernando Gomide
Room: Bonaire 7 154

10:20AM *Anomaly Detection based on Eccentricity Analysis*
Plamen Angelov

10:40AM *Recursive Possibilistic Fuzzy Modeling*
Leandro Maciel, Fernando Gomide and Rosangela Ballini

11:00AM *On Merging and Dividing of Barabasi-Albert-Graphs*
Pascal Held, Alexander Dockhorn and Rudolf Kruse

11:20AM *Embodied Artificial Life at an Impasse: Can Evolutionary Robotics Methods Be Scaled?*
Andrew Nelson

11:40AM *Topological stability of evolutionarily unstable strategies*
Dharshana Kasthurirathna and Mahendra Piraveenan

CIMSIVP'14 Session 4: Algorithms I
Chair: Khan M. Iftekharuddin and Salim Bouzerdoum
Room: Bonaire 8 155

10:20AM *A Comparison of Genetic Programming Feature Extraction Languages for Image Classification*
Mehran Maghoumi and Brian Ross

10:40AM *Finding Optimal Transformation Function for Image Thresholding Using Genetic Programming*
Shaho Shahbazpanahi and Shahryar Rahnamayan

11:00AM *PFBIK-Tracking: Particle Filter with Bio-Inspired Keypoints Tracking*
Silvio Filipe and Luis Alexandre

11:20AM *Unsupervised Multiobjective Design for Weighted Median Filters Using Genetic Algorithm*
Yoshiko Hanada and Yukiko Orito

11:40AM *Analysis of Gray Scale Watermark in RGB Host using SVD and PSO*
Irshad Ahmad Ansari, Millie Pant and Ferrante Neri

Special Session: ADPRL'14 Approximate Dynamic Programming for Energy and Sustainability
Chair: Boris Defourny
Room: Curacao 1 156

10:20AM *Using Approximate Dynamic Programming for Estimating the Revenues of a Hydrogen-based High-Capacity Storage Device*
Vincent Francois-Lavet, Raphael Fonteneau and Damien Ernst

10:40AM *Adaptive Aggregated Predictions for Renewable Energy Systems*
Balazs Csaji, Andras Kovacs and Jozsef Vancza

11:00AM *A Comparison of Approximate Dynamic Programming Techniques on Benchmark Energy Storage Problems: Does Anything Work?*
Daniel Jiang, Thuy Pham, Warren Powell, Daniel Salas and Warren Scott

11:20AM *Near-Optimality Bounds for Greedy Periodic Policies with Application to Grid-Level Storage*
Yuhai Hu and Boris Defourny

CIDM'14 Session 4: Mining Relational and Networked data
Chair: John Lee
Room: Curacao 2 157

10:20AM *Relational Data Partitioning using Evolutionary Game Theory*
Lawrence O. Hall and Alireza Chakeri

10:40AM *Aggregating Predictions vs. Aggregating Features for Relational Classification*
Oliver Schulte and Kurt Routley

11:00AM *Ontology Learning with Complex Data Type for Web Service Clustering*
B. T. G. S. Kumara, Incheon Paik, K. R. C. Koswatte and Wuhui Chen

11:20AM *Semantic clustering-based cross-domain recommendation*
Anil Kumar, Nitesh Kumar, Muzammil Hussain, Santanu Chaudhury and Sumeet Agarwal

11:40AM *Distributed Evolutionary Approach To Data Clustering and Modeling*
Mustafa Hajeer, Dasgupta Dipankar, Alexander Semenov and Jari Veijalainen

Special Session: SIS'14 Session 4: Applications of Swarm Intelligence for Industrial Processes
Chair: Wei-Chang Yeh
Room: Curacao 3 158

10:20AM *MAX-SAT Problem using Evolutionary Algorithms*
Hafiz Munsub Ali, David Mitchell and Daniel C. Lee

10:40AM *A Generic Archive Technique for Enhancing the Niching Performance of Evolutionary Computation*
Zhang Yu-Hui, Gong Yue-Jiao, Chen Wei-Neng, Zhan Zhi-Hui and Zhang Jun

11:00AM *Solving the S-system Model-based Genetic Network Using The Novel Hybrid Swarm Intelligence*
Wei-Chang Yeh and Chia-Ling Huang

11:20AM *Changing Factor based Food Sources in ABC*
Tarun Kumar Sharma, Millie Pant and Ferrante Neri

11:40AM *A New K-Harmonic Means based Simplified Swarm Optimization for Data Mining*
Chia-Ling Huang and Wei-Chang Yeh

CIASG'14 Session 4: Distribution Systems
Chair: Zita Vale
Room: Curacao 4 159

10:20AM *Pulsed Power Network Based on Decentralized Intelligence for Reliable and Low Loss Electrical Power Distribution*
Hisayoshi Sugiyama

10:40AM *Distributed Volt/Var Control in Unbalanced Distribution Systems with Distributed Generation*
Ahmad Reza Malekpour, Anil Pahwa and Balasubramaniam Natarajan

11:00AM *A Uniform Implementation Scheme for Evolutionary Optimization Algorithms and the Experimental Implementation of an ACO Based MPPT for PV Systems under Partial Shading*
Lian lian Jiang and Douglas L. Maskell

SSCI DC Session 4
Chair: Xiaorong Zhang
Room: Curacao 7 160

10:20AM *Safe and Secure Networked Control Systems*
Arman Sargolzaei

10:40AM *Neuroscience-Inspired Dynamic Architectures*
Catherine Schuman

11:00AM *Active Fault Detection in Dynamic Systems*
Jan Skach

11:20AM *Hybrid Approach of Clustered-SVM for Rational Clinical Features in Early Diagnosis of Heart Disease*
Noreen Kausar and Sellapan Palaniappan

11:40AM *Adaptive Critic Designs Based Intelligent Controller for Power Systems*
Yufei Tang

Thursday, December 11, 1:30PM-3:10PM

CICA'14 Session 2: Fuzzy Systems and Control with Applications
Chair: Li-Xin Wang and Tadanari Taniguchi
Room: Antigua 2 160

1:30PM *Speculative Dynamical Systems: How Technical Trading Rules Determine Price Dynamics*
Li-Xin Wang

1:50PM *Adaptive Dynamic Output Feedback Control of Takagi-Sugeno Fuzzy Systems with Immeasurable Premise Variables and Disturbance*
Balaje Thumati and Al Salour

2:10PM *Optimal Robust Control for Generalized Fuzzy Dynamical Systems: A Novel Use on Fuzzy Uncertainties*
Jin Huang, Jiaguang Sun, Xibin Zhao and Ming Gu

2:30PM *SOFC for TS fuzzy systems: Less Conservative and Local Stabilization Conditions*
Leonardo Mozelli, Fernando Souza and Eduardo Mendes

2:50PM *Quadrotor Control Using Dynamic Feedback Linearization Based on Piecewise Bilinear Models*
Tadanari Taniguchi, Luka Eciolaza and Michio Sugeno

Special Session: ICES'14 Session 2: Bio-inspired Computation for the Engineering of Materials and Physical Devices
Chair: Lukas Sekanina
Room: Antigua 3 161

1:30PM *Evolution-In-Materio: Solving Bin Packing Problems Using Materials*
Maktuba Mohid, Julian Miller, Simon Harding, Gunnar Tufte, Odd Rune, Kieran Massey and Mike Petty

1:50PM *Evolution-In-Materio: A Frequency Classifier Using Materials*
Maktuba Mohid, Julian Miller, Simon Harding, Gunnar Tufte, Odd Rune, Kieran Massey and Mike Petty

2:10PM *Comparison and Evaluation of Signal Representations for a Carbon Nanotube Computational Device*
Odd Rune Lykkebo and Gunnar Tufte

2:30PM *Practical issues for configuring carbon nanotube composite materials for computation*
Kester Clegg, Julian Miller, Kieran Massey and Mike Petty

2:50PM *In-Situ Evolution of an Antenna Array with Hardware Fault Recovery*
Jonathan Becker, Jason Lohn and Derek Linden

CIBIM'14 Session 2: Adaptive Biometric Systems and Biometric Fusion
Chair: Eric Granger
Room: Antigua 4 162

1:30PM *Differential Evolution Based Score Level Fusion For Multi-modal Biometric Systems*
Satrajit Mukherjee, Kunal Pal, Bodhisattwa Prasad Majumder, Chiranjib Saha, B. K. Panigrahi and Sanjoy Das

1:50PM *Offline Signature-Based Fuzzy Vault: A Review and New Results*
George Eskander, Robert Sabourin and Eric Granger

2:10PM *TARC: A Novel Score Fusion Scheme for Multimodal Biometric Systems*
Kamlesh Tiwari, Aditya Nigam and Phalguni Gupta

2:30PM *Efficient Adaptive Face Recognition Systems Based on Capture Conditions*
Christophe Pagano, Eric Granger, Robert Sabourin, Ajita Rattani, Gian Luca Marcialis and Fabio Roli

2:50PM *A New Wrist Vein Biometric System*
Abhijit Das, Umapada Pal, Miguel Ferrer Ballaster and Michael Blumenstein

MCDM'14 Session 2: Algorithms II
Chair: Juergen Branke and Piero Bonissone
Room: Bonaire 1 163

1:30PM *Clustering Decision Makers with respect to similarity of views*
Edward Abel, Ludmil Mikhailov and John Keane

1:50PM *Multi-Genomic Algorithms*
Mathias Ngo and Raphael Labayrade

2:10PM *A Perceptual Fuzzy Neural Model*
John Rickard and Janet Aisbett

2:30PM *Multicriteria Approaches for Predictive Model Generation: A Comparative Experimental Study*
Bassma Al-Jubouri and Bogdan Gabrys

2:50PM *PICEA-g Using An Enhanced Fitness Assignment Method*
ZhiChao Shi, Rui Wang and Tao Zhang

RiiSS'14 Session 2: Intelligent Robots
Chair: Janos Botzheim
Room: Bonaire 2 164

1:30PM *An Adaptive Force Reflective Teleoperation Control using Online Environment Impedance Estimation*
Faezeh Heydari Khabbaz, Andrew Goldenberg and James Drake

1:50PM *Development and Performance Comparison of Extended Kalman Filter and Particle Filter for Self-Reconfigurable Mobile Robots*
Peter Won, Mohammad Biglarbegian and William Melek

2:10PM *Autonomous Motion Primitive Segmentation of Actions for Incremental Imitative Learning of Humanoid*
Farhan Dawood and Chu Kiong Loo

2:30PM *A Computational Approach to Parameter Identification of Spatially Distributed Nonlinear Systems with Unknown Initial Conditions*
Josip Kasac, Vladimir Milic, Josip Stepanic and Gyula Mester

2:50PM *Multi-Robots Coverage Approach*
Ryad Chellali and Khelifa Baizid

CIVTS'14 Session 2
Chair: Justin Dauwels, Dipti Srinivasan and Ana Bazzan
Room: Bonaire 3 165

1:30PM *Dynamic Ridesharing with Intermediate Locations*
Kamel Aissat and Ammar Oulamara

1:50PM *An Evolutionary Approach to Traffic Assignment*
Ana Bazzan, Daniel Cagara and Bjoern Scheuermann

2:10PM *Car relocation for carsharing service: Comparison of CPLEX and Greedy Search*
Rabih Zakaria, Mohammad Dib, Laurent Moalic and Alexandre Caminada

2:30PM *Evolving the Topology of Subway Networks using Genetic Algorithms*
Ana L. C. Bazzan and Silvio R. Dahmen

2:50PM *Driver Distraction Detection By In-Vehicle Signal Processing*
Seongsu Im, Cheolha Lee, Seokyoul Yang, Jinhak Kim and Byungyong You

CIES'14 Session 2: Machines and Micro-machines
Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse
Room: Bonaire 4 166

1:30PM *Reliable Condition Monitoring of an Induction Motor using a Genetic Algorithm based Method*
Jang Won-Chul, Hung Nguyen, Myeongsu Kang, JaeYoung Kim and Jong-Myon Kim

1:50PM *Performance Comparison of classifiers in the detection of Short Circuit Incipient Fault in a Three-Phase Induction Motor*
David Coelho, Jose Alencar, Claudio Medeiros and Guilherme Barreto

2:10PM *Artificial intelligence-based modelling and optimization of microdrilling processes*
Gerardo Beruvides, Ramon Quiza, Marcelino Rivas, Fernando Castano and Rodolfo Haber

2:30PM *Application of hybrid incremental modeling strategy for surface roughness estimation in micromachining processes*
Castano Fernando, Haber Rodolfo E., del Toro Raul M. and Beruvides Gerardo

2:50PM *A Tabu-search Algorithm for Two-machine Flow-shop with Controllable Processing Times*
Kailiang Xu, Gang Zheng and Sha Liu

ISIC'14 Session 2: Independent Computing II
Chair: Cheng-Hsiung Hsieh
Room: Bonaire 5 167

1:30PM *Improving Performance of Decision Boundary Making with Support Vector Machine Based Outlier Detection*
Yuya Kaneda, Yan Pei, Qiangfu Zhao and Yong Liu

1:50PM *Verification of an Image Morphing Based Technology for Improving the Security in Cloud Storage Services*
Ryota Hanyu, Kazuki Murakami and Qiangfu Zhao

2:10PM *Simulation of Human Awareness Control in Spatiotemporal Language Understanding as Mental Image Processing*
Rojanee Khummongkol and Masao Yokota

2:30PM *A New Steganography Protocol for Improving Security of Cloud Storage Services*
Kazuki Murakam, Qiangfu Zhao and Ryota Hanyu

FOCI'14 Session 2: Evolutionary Algorithm and Memetic Computing
Chair: Leonardo Franco and Ferrante Neri
Room: Bonaire 6 167

1:30PM *Test Problems and Representations for Graph Evolution*
Daniel Ashlock, Justin Schonfeld, Lee-Ann Barlow and Colin Lee

1:50PM *Comparing Generic Parameter Controllers for EAs*
Giorgos Karafotias, Mark Hoogendoorn and Berend Weel

2:10PM *A Discrete Representation for Real Optimization with Unique Search Properties*
Daniel Ashlock and Jeremy Gilbert

2:30PM *Two Local Search Components that Move Along the Axes for Memetic Computing Frameworks*
Neri Ferrante and Khan Noel

2:50PM *A Separability Prototype for Automatic Memes with Adaptive Operator Selection*
Michael G. Epitropakis, Fabio Caraffini, Ferrante Neri and Edmund Burke

EALS'14 Session 2: Applications
Chair: Jose Antonio Iglesias
Room: Bonaire 7 168

1:30PM *A Real-time Approach for Autonomous Detection and Tracking of Moving Objects from UAV*
Pouria Sadeghi-Tehran, Clarke Christopher and Angelov Plamen

1:50PM *Real Time Road Traffic Monitoring Alert based on Incremental Learning from Tweets*
Di Wang, Ahmad Al-Rubaie, John Davies and Sandra Stincic-Clarke

2:10PM *Influence of the data codification when applying evolving classifiers to develop spoken dialog systems*
Jose Antonio Iglesias, David Griol, Agapito Ledezma and Araceli Sanchis

2:30PM *An Apprenticeship Learning Hyper-Heuristic for Vehicle Routing in HyFlex*
Shahriar Asta and Ender Ozcan

2:50PM *Classification and Segmentation of fMRI spatio-temporal brain data with a NeuCube evolving spiking neural network model*
Maryam Gholami Doborjeh, Elisa Capecci and Kasabov Nikola

CIMSIVP'14 Session 5: Algorithms II
Chair: Aini Hussain
Room: Bonaire 8 169

1:30PM *A Ridge Extraction Algorithm Based on Partial Differential Equations of the Wavelet Transform*
Pan Jiasong and Yue Lin

1:50PM *cobICA: A Concentration-Based, Immune-Inspired Algorithm for ICA Over Galois Fields*
Daniel Silva, Jugurta Montalvao and Romis Attux

2:10PM *Multivariate PDF Matching via Kernel Density Estimation*
Denis Fantinato, Levy Boccato, Aline Neves and Romis Attux

2:30PM *Unsupervised Learning Algorithm for Signal Separation*
Theju Jacob and Wesley Snyder

2:50PM *Human Gait State Classification using Neural Network*
Win Kong, Mohamad Hanif Md Saad, Ma Hannan and Aini Hussain

Special Session: ADPRL'14 Learning Control and Optimization based on Adaptive Dynamic Programming
Chair: Dongbin Zhao and Derong Liu
Room: Curacao 1 170

1:30PM *Data-Driven Partially Observable Dynamic Processes Using Adaptive Dynamic Programming*
Xiangnan Zhong, Zhen Ni, Yufei Tang and Haibo He

1:50PM *Model-free Q-learning over Finite Horizon for Uncertain Linear Continuous-time Systems*
Hao Xu and Sarangapani Jagannathan

2:10PM *Optimal Self-Learning Battery Control in Smart Residential Grids by Iterative Q-Learning Algorithm*
Qinglai Wei, Derong Liu, Guang Shi, Yu Liu and Qiang Guan

2:30PM *A Data-based Online Reinforcement Learning Algorithm with High-efficient Exploration*
Zhu Yuanheng and Zhao Dongbin

2:50PM *Reinforcement Learning-based Optimal Control Considering L Computation Time Delay of Linear Discrete-time Systems*
Taishi Fujita and Toshimitsu Ushio

Special Session: CIDM'14 Session 5: High Dimensional Data Analysis
Chair: Thomas Villmann
Room: Curacao 2 171

1:30PM *Valid Interpretation of Feature Relevance for Linear Data Mappings*
Benoit Frenay, Daniela Hofmann, Alexander Schulz, Michael Biehl and Barbara Hammer

1:50PM *High Dimensional Exploration: A Comparison of PCA, Distance Concentration, and Classification Performance in two fMRI Datasets*
Joset Etzel and Todd Braver

2:10PM *Two key properties of dimensionality reduction methods*
John A. Lee and Michel Verleysen

2:30PM *Generalized kernel framework for unsupervised spectral methods of dimensionality reduction*
Diego Hernan Peluffo-Ordonez, John Aldo Lee and Michel Verleysen

2:50PM *Evaluating Topic Quality using Model Clustering*
Vineet Mehta, Rajmonda Caceres, Kevin Carter and Vineet Mehta

SIS'14 Session 5: Particle Swarm Optimization - II
Chair: Andries Engelbrecht and Katherine Malan
Room: Curacao 3 ..... **172**

1:30PM *Asynchronous Particle Swarm Optimization with Discrete Crossover*
Andries Engelbrecht

1:50PM *Particle Swarm Optimisation Failure Prediction Based on Fitness Landscape Characteristics*
Katherine Malan and Andries Engelbrecht

2:10PM *Evolutionary Design of Self-Organizing Particle Systems for Collective Problem Solving*
Benjamin Bengfort, Philip Y. Kim, Kevin Harrison and James A. Reggia

2:30PM *Towards a Network-based Approach to Analyze Particle Swarm Optimizers*
Marcos Oliveira, Carmelo Bastos-Filho and Ronaldo Menezes

2:50PM *Particle Swarm Optimization based Distributed Agreement in Multi-Agent Dynamic Systems*
Veysel Gazi and Raul Ordonez

CIASG'14 Session 5: Optimization and Scheduling
Chair: Zita Vale
Room: Curacao 4 ..... **173**

1:30PM *An Evolutionary Approach for the Demand Side Management Optimization in Smart Grid*
Andre Vidal, Leonardo Jacobs and Lucas Batista

1:50PM *Quantum-based Particle Swarm Optimization Application to Studies of Aggregated Consumption Shifting and Generation Scheduling in Smart Grids*
Pedro Faria, Joao Soares and Zita Vale

2:10PM *A New Heuristic Providing an Effective Initial Solution for a Simulated Annealing approach to Energy Resource Scheduling in Smart Grids*
Tiago Sousa, Hugo Morais, Rui Castro and Zita Vale

2:30PM *A Learning Algorithm and System Approach to Address Exceptional Events in the Domestic Consumption Management*
Luis Gomes, Filipe Fernandes, Zita Vale, Pedro Faria and Carlos Ramos

SSCI DC Session 5
Chair: Xiaorong Zhang
Room: Curacao 7 ..... **174**

1:30PM *Analysis of Tor Anonymity*
Khalid Shahbar

1:50PM *A Generic Framework for Multi-Method Modeling and Simulation in Complex Systems*
Konstantinos Mykoniatis and Waldemar Karwowski

2:10PM *Developing a Business Case for Probabilistic Risk Assessment of Complex Socio-Technical Systems*
Marzieh Abolhelm

Thursday, December 11, 3:30PM-5:10PM

CICA'14 Session 3: Neural Network Systems and Control with Applications I
Chair: Ming Zhang Edgar N. Sanchez
Room: Antigua 2 174

3:30PM *Ultra High Frequency Polynomial and Sine Artificial Higher Order Neural Networks for Control Signal Generator*
Ming Zhang

3:50PM *Robust Pinning Control of Complex Dynamical Networks using Recurrent Neural Networks*
Edgar N. Sanchez and David I. Rodriguez

4:10PM *Dissolved Oxygen Control of Activated Sludge Biorectors using Neural-Adaptive Control*
Seyedhossein Mirghasemi, Chris J.B. Macnab and Angus Chu

4:30PM *Estimation of States of a Nonlinear Plant using Dynamic Neural Network*
Alok Kanti Deb and Dibyendu Guha

4:50PM *Cascaded Free Search Differential Evolution Applied to Nonlinear System Identification Based on Correlation Functions and Neural Networks*
Helon Vicente Hultmann Ayala, Luciano Cruz, Roberto Zanetti Freire and Leandro dos Santos Coelho

ICES'14 Session 3: Evolutionary Techniques Applied to FPGAs
Chair: Jason Lohn
Room: Antigua 3 175

3:30PM *Evolving Hierarchical Low Disruption Fault Tolerance Strategies for a Novel Programmable Device*
David Lawson, James Walker, Martin Trefzer, Simon Bale and Andy Tyrrell

3:50PM *Evolutionary Digital Circuit Design with Fast Candidate Solution Establishment in Field Programmable Gate Arrays*
Roland Dobai, Kyrre Glette, Jim Torresen and Lukas Sekanina

4:10PM *Optimising Ring Oscillator Frequency on a Novel FPGA Device via Partial Reconfiguration*
Pedro Campos, Martin A. Trefzer, James Alfred Walker, Simon J. Bale and Andy M. Tyrrell

4:30PM *Temperature Management for Heterogeneous Multi-core FPGAs Using Adaptive Evolutionary Multi-Objective Approaches*
Renzhi Chen, Peter R. Lewis and Xin Yao

4:50PM *Multiobjective Genetic Algorithm for Routability-Driven Circuit Clustering on FPGAs*
Yuan Wang, Simon J. Bale, James Alfred Walker, Martin A. Trefzer and Andy M. Tyrrell

CIBIM'14 Session 3: Face Detection and Recognition
Chair: Gelson da Cruz Junior and Marina Gavrilova
Room: Antigua 4 176

3:30PM *Robust Face Detection from Still Images*
Patrick Laytner, Chrisford Ling and Qinghan Xiao

3:50PM *Handling Session Mismatch by Fusion-based Co-training: An Empirical Study using Face and Speech Multimodal Biometrics*
Norman Poh, Ajita Rattani and Josef Kittler

4:10PM *Disguised face detection and recognition under the complex background*
Jing Li, Bin Li, Yong Xu, Kaixuan Lu, Lunke Fei and Ke Yan

4:30PM *Adaptive Multi-Stream Score Fusion for Illumination Invariant Face Recognition*
Madeena Sultana, Marina Gavrilova, Reda Alhajj and Svetlana Yanushkevich

4:50PM *Multi-Spectral Facial Biometrics in Access Control*
Kenneth Lai, Steven Samoil and Svetlana Yanushkevich

MCDM'14 Session 3: Applications
Chair: Yaochu Jin, Juergen Branke and Mitsukuni Matayoshi
Room: Bonaire 1 177

3:30PM *Sustainability Status of Indian States: Application and Assessment of MCDM frameworks*
Nandita Sen, Akash Ghosh, Arnab Saha and Bhaskar Roy Karmaker

3:50PM *Evaluation of E-commerce System Trustworthiness Using Multi-criteria Analysis*
Lifeng Wang and Zhengping Wu

4:10PM *Nonlinear Programming Models and Method for Interval-Valued Multiobjective Cooperative Games*
Fei-Mei Wu and Deng-Feng Li

4:30PM *An Extended Bilevel Programming Model and Its Kth-Best Algorithm for Dynamic Decision Making in Emergency Situations*
Hong Zhou, Jie Lu and Guangquan Zhang

4:50PM *Partially Optimized Cyclic Shift Crossover for Multi-Objective Genetic Algorithms for the Multi-Objective Vehicle Routing Problem with Time-Windows*
Djamalladine Mahamat Pierre and Nordin Zakaria

Special Session: RiiSS'14 Session 3: Human-centric Robotics I
Chair: Takenori Obo
Room: Bonaire 2 178

3:30PM *Medical Interview Training Using Depressed Patient Robot in Psychiatric Education*
Takuya Hashimoto, Ryo Kurimoto, Hideyuki Nakane and Hiroshi Kobayashi

3:50PM *A Route Planning for Disaster Waste Disposal Based on Robot Technology*
Takahiro Takeda, Yuki Mori, Naoyuki Kubota and Yasuhiro Arai

4:10PM *Fuzzy Neural Network based Activity Estimation for Recording Human Daily Activity*
Manabu Nii, Kazunobu Takahama, Takuya Iwamoto, Takafumi Matsuda, Yuki Matsumoto and Kazusuke Maenaka

4:30PM *Behavior Pattern Learning for Robot Partner based on Growing Neural Networks in Informationally Structured Space*
Takenori Obo and Naoyuki Kubota

Special Session: CIVTS'14 Session 3: Intelligent Vehicle Systems
Chair: Yi Lu Murphey, Mahmoud Abou-Nasr, Ishwar K Sethi, Robert Karlsen, and Chaomin Luo
Room: Bonaire 3 179

3:30PM *Trust-Based Controller for Convoy String Stability*
Dariusz Mikulski

3:50PM *Cloud Aided Semi-Active Suspension Control*
Zhaojian Li, Ilya Kolmanovsky, Ella Atkins, John Michelini, Jianbo Lu and Dimitar Filev

4:10PM *Exploring the Mahalanobis-Taguchi Approach to Extract Vehicle Prognostics and Diagnostics*
Michael Gosnell and Robert Woodley

4:30PM *Robust Obstacle Segmentation based on Topological Persistence in Outdoor Traffic Scenes*
Chunpeng Wei, Qian Ge, Somrita Chattopadhyay and Edgar Lobaton

4:50PM *An Effective Search and Navigation Model to an Auto-Recharging Station of Driverless Vehicles*
Chaomin Luo, Yu-Ting Wu, Mohan Krishnan, Mark Paulik, Gene Eu Jan and Jiyong Gao

CIES'14 Session 3: Applications I
Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse
Room: Bonaire 4 180

3:30PM *From Offline to Onboard System Solution for a Control Sequence Optimization Problem*
Jin Huang, Xibin Zhao, Xinjie Chen, Qinwen Yang and Jiaguang Sun

3:50PM *GA optimized time delayed feedback control of chaos in a memristor based chaotic circuit*
Sanju Saini and Jasbir Singh Saini

4:10PM *A graph-based signal processing approach for low-rate energy disaggregation*
Vladimir Stankovic, Jing Liao and Lina Stankovic

4:30PM *Neural Networks for Prediction of Stream Flow based on Snow Accumulation*
Sansiri Tarnpradab, Kishan Mehrotra, Chilukuri Mohan and David Chandler

4:50PM *A Survey on the Application of Neural Networks in the Safety Assessment of Oil and Gas Pipelines*
Mohamed Layouni, Sofiene Tahar and Mohamed Salah Hamdi

ISIC'14 Session 3: Independent Computing III
Chair: Junbo Wang
Room: Bonaire 5 181

3:30PM *A Concept Model of 'Two-Ties-Aware' and Design of a Discovery Engine based on User Experienced Bigdata*
Junbo Wang, Yilang Wu and Zixue Cheng

3:50PM *The Development of a Multi-Piecewise-Based Thinning Description Method*
Wen-Chang Cheng

4:10PM *Development of A Control System for Home Appliances Based on BLE Technique*
Junbo Wang, Lei Jing, Zixue Cheng, Yinghui Zhou and Yilang Wu

4:30PM *Topological Approaches to Locative Prepositions*
Ikumi Imani and Itaru Takarajima

4:50PM *Word Sense Disambiguation using Author Topic Model*
Shougo Kaneishi and Takuya Tajima

FOCI'14 Session 3: Neural Networks
Chair: Leonardo Franco
Room: Bonaire 6 182

3:30PM *Explicit Knowledge Extraction in Information-Theoretic Supervised Multi-Layered SOM*
Ryotaro Kamimura

3:50PM *Adaptive Particle Swarm Optimization Learning in a Time Delayed Recurrent Neural Network for Multi-Step Prediction*
Kostas Hatalis, Basel Alnajjab, Shalinee Kishore and Alberto Lamadrid

4:10PM *Attractor Flow Analysis for Recurrent Neural Network with Back-to-Back Memristors*
Gang Bao and Zhigang Zeng

4:30PM *Fingerprint multilateration for automatically classifying evolved Prisoner's Dilemma agents*
Jeffrey Tsang

4:50PM *Visual Analytics for Neuroscience-Inspired Dynamic Architectures*
Margaret Drouhard, Catherine Schuman, J. Douglas Birdwell and Mark Dean

EALS'14 Session 3: Techniques for Learning Systems
Chair: Plamen Angelov
Room: Bonaire 7 182

3:30PM *RTSDE: Recursive Total-Sum-Distances-based Density Estimation Approach and its Application for Autonomous Real-Time Video Analytics*
Plamen Angelov and Ashley Wilding

3:50PM *Self-learning Data Processing Framework Based on Computational Intelligence: Enhancing Autonomous Control by Machine Intelligence*
Prapa Rattadilok and Andrei Petrovski

4:10PM *Distributed GAs with Case-Based Initial Populations for Real-Time Solution of Combinatorial Problems*
Kawabe Takashi, Masaki Suzuki, Matsumaru Taro, Yamamoto Yukiko, Setsuo Tsuruta, Yoshitaka Sakurai and Rainer Knauf

4:30PM *Heuristic Generation via Parameter Tuning for Online Bin Packing*
Ahmet Yarimcam, Shahriar Asta, Ender Ozcan and Andrew J. Parkes

4:50PM *Evolving Maximum Likelihood Clustering Algorithm*
Orlando Donato Rocha Filho and Ginalber Serra

CIMSIVP'14 Session 6: Algorithms III
Chair: Biovanna Castellano
Room: Bonaire 8 183

3:30PM *Manifold Learning Approach to Curve Identification with Applications to Footprint Segmentation*
Namita Lokare, Qian Ge, Wesley Snyder, Zoe Jewell, Sky Allibhai and Edgar Lobaton

3:50PM *Self-Localization Method for Three-dimensional Handy Scanner Using Multi Spot Laser*
Kumiko Yoshida and Kikuhito Kawasue

4:10PM *Clustering and Visualization of Geodetic Array Data Streams using Self-Organizing Maps*
Razvan Popovici, Razvan Andonie, Walter Szeliga, Tim Melbourne and Craig Scrivner

4:30PM *Incremental Semi-Supervised Fuzzy Clustering for Shape Annotation*
Giovanna Castellano, Anna Maria Fanelli and Maria Alessandra Torsello

Special Session: ADPRL'14 Online Learning Control Algorithms Based on ADP for Uncertain Dynamic Systems
Chair: Xin Xu and Yanhong Luo
Room: Curacao 1 184

3:30PM *Pseudo-MDPs and Factored Linear Action Models*
Hengshuai Yao, Csaba Szepesvari, Bernardo Avila Pires and Xinhua Zhang

3:50PM *Event-based Optimal Regulator Design for Nonlinear Networked Control Systems*
Avimanyu Sahoo, Hao Xu and Sarangapani Jagannathan

4:10PM *Adaptive Fault Identification for a Class of Nonlinear Dynamic Systems*
Li-Bing Wu, Dan Ye and Xin-Gang Zhao

4:30PM *Adaptive Dynamic Programming for Discrete-time LQR Optimal Tracking Control Problems with Unknown Dynamics*
Yang Liu, Yanhong Luo and Huaguang Zhang

4:50PM *Neural-Network-Based Adaptive Dynamic Surface Control for MIMO Systems with Unknown Hysteresis*
Lei Liu, Zhanshan Wang and Zhengwei Shen

CIDM'14 Session 6: Rule based Modelling, Model Performance, and Interpretability
Chair: Oliver Schulte
Room: Curacao 2 185

3:30PM *Optimization of the Type-1 and Interval Type-2 Fuzzy Integrators in Ensembles of ANFIS models for Prediction of the Dow Jones Time Series*
Jesus Soto, Patricia Melin and Oscar Castillo

3:50PM *Accurate and Interpretable Regression Trees using Oracle Coaching*
Ulf Johansson, Cecilia Sonstrod and Rikard Konig

4:10PM *Product Aspect Identification: Analyzing Role of Different Classifiers*
Xing Yu, Sukanya Manna and Brian N Truong

4:30PM *Rule Extraction using Genetic Programming for Accurate Sales Forecasting*
Rikard Konig and Ulf Johansson

4:50PM *Facial Image Clustering in Stereo Videos Using Local Binary Patterns and Double Spectral Analysis*
Georgios Orfanidis, Anastasios Tefas, Nikos Nikolaidis and Ioannis Pitas

SIS'14 Session 6: Swarm Algorithms & Applications - I
Chair: Simone Ludwig and Alok Singh
Room: Curacao 3 186

3:30PM *Fitness Function Evaluations: A Fair Stopping Condition?*
Andries Engelbrecht

3:50PM *Parallel Glowworm Swarm Optimization Clustering Algorithm based on MapReduce*
Nailah Almadi, Ibrahim Aljarah and Simone Ludwig

4:10PM *Analysis of Stagnation Behaviour of Competitive Coevolutionary Trained Neuro-Controllers*
Christiaan Scheepers and Andries Engelbrecht

4:30PM *Learning Bayesian Classifiers using Overlapping Swarm Intelligence*
Nathan Fortier, John Sheppard and Shane Strasser

4:50PM *Human-Swarm Hybrids Outperform Both Humans and Swarms Solving Digital Jigsaw Puzzles*
Daniel Palmer, Marc Kirschenbaum, Eric Mustee and Jason Dengler

CIASG'14 Session 6: Stability and Analysis
Chair: Ganesh Kumar Venayagamoorthy
Room: Curacao 4 187

3:30PM *Remote Power System Stabilizer Tuning Using Synchrophasor Data*
Paranietharan Arunagirinathan, Hany Abdelsalam and Ganesh Kumar Venayagamoorthy

3:50PM *Multi-Machine Power System Control based on Dual Heuristic Dynamic Programming*
Zhen Ni, Yufei Tang, Haibo He and Jinyu Wen

4:10PM *Impact of Signal Transmission Delays on Power System Damping Control Using Heuristic Dynamic Programming*
Yufei Tang, Xiangnan Zhong, Zhen Ni, Jun Yan and Haibo He

4:30PM *Time-Delay Analysis on Grid-Connected Three-Phase Current Source Inverter based on SVPWM Switching Pattern*
Arman Sargolzaei, Amirhasan Moghadasi, Kang Yen and Arif Sarwat

4:50PM *A low-complexity energy disaggregation method: Performance and robustness*
Hana Altrabalsi, Jing Liao, Lina Stankovic and Vladimir Stankovic

SSCI DC Social
Chair: Xiaorong Zhang
Room: Curacao 7 **.....187**

Thursday, December 11, 5:10PM-6:45PM

Poster Session: SSCI'14 Poster Session
Chair: Dongbin Zhao and Haibo He
Room: Grand Sierra E **.....188**

P101 *Adaptive dynamic programming-based optimal tracking control for nonlinear systems using general value iteration*
Xiaofeng Lin, Qiang Ding, Weikai Kong, Chunning Song and Qingbao Huang

P102 *ADP-based Optimal Control for a Class of Nonlinear Discrete-time Systems with Inequality Constraints*
Yanhong Luo and Geyang Xiao

P103 *Using supervised training signals of observable state dynamics to speed-up and improve reinforcement learning*
Daniel Elliott and Charles Anderson

P104 *A Two Stage Learning Technique for Dual Learning in the Pursuit-Evasion Differential Game*
Ahmad Al-Talabi and Howard Schwartz

P105 *Heuristics for Multiagent Reinforcement Learning in Decentralized Decision Problems*
Martin Allen, David Hahn and Douglas MacFarland

P106 *An Adaptive Dynamic Programming Algorithm to Solve Optimal Control of Uncertain Nonlinear Systems*
Xiaohong Cui, Yanhong Luo and Huaguang Zhang

P107 *Effect Of tDCS Application On P300 Potentials: A Randomized, Double Blind Placebo Controlled Study*
Sriharsha Ramaraju, Ahmed Izzidien, Mohammed Ali Roula and Peter McCarthy

P108 *EEG dynamics in Inhibition of Left-hand and Right-hand Responses during Auditory Stop Signal Task*
Rupesh Kumar Chikara, Ramesh Perumal, Li-Wei Ko and Hsin Chen

P109 *An Adaptive EEG Filtering Approach to Maximize the Classification Accuracy in Motor Imagery*
Kais Belwafi, Ridha Djemal, Fakhreddine Ghaffari and Olivier Romain

P110 *Modulation of Brain Connectivity by Memory Load in a Working Memory Network*
Pouya Bashivan, Gavin Bidelman and Mohammed Yeasin

P111 *Distributed Robust Training of Multilayer Neural Netwroks Using Normalized Risk-Averting Error*
Hiroshi Ninomiya

P112 *Multi-Layer Cortical Learning Algorithms*
Pulin Agrawal and Stan Franklin

P113 *RSS based Loop-free Compass Routing Protocol for Data Communication in Advanced Metering Infrastructure (AMI) of Smart Grid*
Imtiaz Parvez, Mahdi Jamei, Aditya Sundararajan and Arif I Sarwat

P114 *Frequency Band for HAN and NAN Communication in Smart Grid*
Imtiaz Parvez, Aditya Sundararajan and Arif I Sarwat

P115 *Integrated Analytics of Microarray Big Data for Revealing Robust Gene Signature*
Wanting Liu, Yonghong Peng and Desmond J Tobin

P116 *Large Graph Clustering Using DCT-Based Graph Clustering*
Nikolaos Tsapanos, Anastasios Tefas, Nikolaos Nikolaidis and Ioannis Pitas

P117 *A Scalable Machine Learning Online Service for Big Data Real-Time Analysis*
Alejandro Baldominos, Esperanza Albacete, Yago Saez and Pedro Isasi

P118 *Target-based evaluation of face recognition technology for video surveillance applications*
Dmitry Gorodnichy and Eric Granger

P119 *Automated Border Control: Problem Formalization*
Dmitry Gorodnichy, Vlad Shmerko and Svetlana Yanushkevich

P120 *Computationally Efficient Statistical Face Model in the Feature Space*
Mohammad Haghighat, Mohamed Abdel-Mottaleb and Wadee Alhalabi

P121 *A Feasibility Study of Using a Single Kinect Sensor for Rehabilitation Exercises Monitoring: A Rule Based Approach*
Wenbing Zhao, Deborah Espy, Ann Reinthal and Hai Feng

P122 *Automating Assessment in Video Game Teletherapy: Data Cutting*
William Blewitt, Martin Scott, Gray Ushaw, Jian Shi, Graham Morgan and Janet Eyre

P123 *An efficient Computer Aided Decision Support System for breast cancer diagnosis using Echo State Network Classifier*
Summrina Kanwal Wajid, Prof. Amir Hussain and Prof. Bin Luo

P124 *Intelligent Image Processing Techniques for Cancer Progression, Detection, Recognition and Prediction in the Human Liver*
Liaqat Ali, Amir Hussain, Usman Zakir, Xiu Yan, Sudhakar Unnam, M.Abdur Rajak, Amir Shah and Mufti Mahmud

P125 *An approximate inverse recipe method with application to automatic food analysis*
Jieun Kim and Mireille Boutin

P126 *The design, implementation and evaluation of a relaxation service with facial emotion detection*
Somchanok Tivatansakul and Michiko Ohkura

P127 *Intelligent emotions stabilization system using standardized images, breath sensor and biofeedback - new concept*
Oleksandr Sokolov, Krzysztof Dobosz, Joanna Dreszer, Bibianna Balaj, Wlodzislaw Duch, Slawomir Grzelak, Tomasz Komendzinski, Dariusz Mikolajewski, Tomasz Piotrowski, Malgorzata Swierkocka and Piotr Weber

P128 *Cognitively Inspired Speech Processing For Multimodal Hearing Technology*
Andrew Abel, Amir Hussain and Bin Luo

P129 *Analysis of Three-Dimensional Vasculature Using the Multifractal Theory*
Li Bai, Ward Wil and Ding Yuchun

P130 *New frequent pattern mining algorithm tested for activities models creation*
Mohamed Tarik Moutacalli, Abdenour Bouzouane and Bruno Bouchard

P131 *Developing an Affective Point-of-Care Technology*
Pedro Bacchini, Erlan Lopes, Marco Aurelio Barbosa, Jose Ferreira, Olegario Silva Neto, Adson da Rocha and Talles Barbosa

P132 *Weighted Feature-based Classification of Time series Data*
Ravikumar Penugonda and V. Susheela Devi

P133 *Gender classification of subjects from cerebral blood flow changes using Deep Learning*
Tomoyuki Hiroyasu, Kenya Hanawa and Utako Yamamoto

P134 *A feature transformation method using genetic programming for two-class classification*
Tomoyuki Hiroyasu, Toshihide Shiraishi, Tomoya Yoshida and Utako Yamamoto

P135 *Dependency Network Methods for Hierarchical Multi-label Classification of Gene Functions*
Fabio Fabris and Alex A. Freitas

P136 *A Novel Criterion for Overlapping Communities Detection and Clustering Improvement*
Alessandro Berti, Alessandro Sperduti and Andrea Burattin

P137 *Incremental Transfer RULES with Incomplete Data*
Hebah ElGibreen and Mehmet Sabih Aksoy

P138 *Novelty Detection Applied to the Classification Problem Using Probabilistic Neural Network*
Balvant Yadav and V. Susheela Devi

P139 *A Framework for Initialising a Dynamic Clustering Algorithm: ART2-A*
Simon Chambers, Ian Jarman and Paulo Lisboa

P140 *Recommendation for Web Services with Domain Specific Context Awareness*
B. T. G. S. Kumara, Incheon Paik, K. R. C. Koswatte and Wuhui Chen

P141 *Tibetan-Chinese Cross Language Named Entity Extraction Based on Comparable Corpus and Naturally Annotated Resources*
Yuan Sun, Wenbin Guo and Xiaobing Zhao

P142 *Detecting and profiling sedentary young men using machine learning algorithms*
Pekka Siirtola, Riitta Pyky, Riikka Ahola, Heli Koskimaki, Timo Jamsa, Raija Korpelainen and Juha Roning

P143 *Patient Level Analytics Using Self-Organising Maps: A Case Study on Type-1 Diabetes Self-care Survey Responses*
Santosh Tirunagari, Norman Poh, Kouros Aliabadi, David Windridge and Deborah Cooke

P144 *Interpolation and Extrapolation: Comparison of Definitions and Survey of Algorithms for Convex and Concave Hulls*
Tobias Ebert, Julian Belz and Oliver Nelles

P145 *Takagi-Sugeno-Kang Type Collaborative Fuzzy Rule Based System*
Kuang-pen Chou, Mukesh Prasad, Yang-Yin Lin, Sudhanshu Joshi, Chin-Teng Lin and Jyh-Yeong Chang

P146 *Recognizing Gym Exercises Using Acceleration Data from Wearable Sensors*
Heli Koskimaki and Pekka Siirtola

P147 *What can Spatial Collectives tell us about their environment?*
Zena Wood

P148 *Weighted One-Class Classification for Different Types of Minority Class Examples in Imbalanced Data*
Bartosz Krawczyk, Michal Wozniak and Francisco Herrera

P149 *A Sparsity-Based Training Algorithm for Least Squares SVM*
Jie Yang and Jun Ma

P150 *Wolf Search Algorithm for Attribute Reduction in classification*
Waleed Yamany, Eid Emary and Aboul Ella Hassanien

P151 *Alarm prediction in industrial machines using autoregressive LS-SVM models*
Rocco Langone, Carlos Alzate, Abdellatif Bey-Temsamani and Johan A. K. Suykens

P152 *Sensor dynamics in high dimensional phase spaces via nonlinear transformations: Application to helicopter loads monitoring*
Julio Valdes, Catherine Cheung and Matthew Li

P153 *Automatic Text Categorization Using a System of High-Precision and High-Recall Models*
Dai Li, Yi Murphey and Huang Yinghao

P154 *Simplified firefly algorithm for 2D image key-points search*
Christian Napoli, Giuseppe Pappalardo, Emiliano Tramontana, Zbigniew Marszalek, Dawid Polap and Marcin Wozniak

P155 *Human-Mobile Agents Partnerships in Complex Environment*
Oleksandr Sokolov, Sebastian Meszynski, Gernot Groemer, Birgit Sattler, Franco Carbognani, Jean-Marc Salotti and Mateusz Jozefowicz

P156 *K-means based Double-bit Quantization For Hashing*
Zhu Hao

P157 *Fast Overcomplete Topographical Independent Component Analysis (FOTICA) and its Implementation using GPUs*
Chao-Hui Huang

P158 *Toward an under specified queries enhancement using retrieval and classification platforms*
Mustapha Aouache, Aini Hussain, Abdul Samad Salina and Zulkifley Mohd Asyraf

P159 *A Multi-modal Moving Object Detection Method Based on GrowCut Segmentation*
Xiuwei Zhang, Yanning Zhang, Stephen Maybank and Jun Liang

P160 *Inertial-Visual Pose Tracking Using Optical Flow-aided Particle Filtering*
Armaghan Moemeni and Eric Tatham

P161 *A Distance Based Variable Neighborhood Search for Parallel Machine Scheduling*
Andre Batista and Lucas Batista

P162 *GPU Accelerated NEH Algorithm*
Magdalena Metlicka, Donald Davendra, Frank Hermann, Markus Meier and Matthias Amann

P163 *A Two-Layer Optimization Framework for UAV Path Planning with Interval Uncertainties*
Bai Li, Raymond Chiong and Mu Lin

P164 *Realtime Dynamic Clustering for Interference and Traffic Adaptation in Wireless TDD System*
Mingliang Tao, Qimei Cui, Xiaofeng Tao and Haihong Xiao

P165 *Optimization of Material Supply Model in an Emergent Disaster Using Differential Evolution*
Qi Cao and K. M. Leung

P166 *Determining the Cost Impact of SCM System Errors*
John Medellin

P167 *Comparing a Hybrid Branch and Bound Algorithm with Evolutionary Computation Methods, Local Search and their Hybrids on the TSP*
Yan Jiang, Thomas Weise, Joerg Laessig, Raymond Chiong and Rukshan Athauda

P168 *Multivariate Gaussian Copula in Estimation of Distribution Algorithm with Model Migration*
Martin Hyrs and Josef Schwarz

P169 *The Impact of Agent Size and Number of Rounds on Cooperation in the Iterated Prisoner's Dilemma*
Lee-Ann Barlow

P170 *Optimization of Feedforward Neural Network by Multiple Particle Collision Algorithm*
Juliana Anochi and Haroldo Campos Velho

P171 *The Evolution of Exploitation*
Wendy Ashlock, Jeffrey Tsang and Daniel Ashlock

P172 *A Privacy and Authentication Protocol for Mobile RFID System*
Huang* Hui-Feng*, Yu Po-Kai and Liu Kuo-Ching

P173 *Adaptive Fast Image Dehazing Algorithm*
Cheng-Hsiung Hsieh, Chih-Tsung Chen and Yu-Sheng Lin

P174 *A TAIEX Forecasting Model based on Changes of Keyword Search Volume on Google Trends*
Min-Hsuan Fan, Mu-Yen Chen and En-Chih Liao

P175 *Using Data Mining Technology to Explore Internet Addiction Behavioral Patterns*
Mu-Jung Huang, Mu-Yen Chen and Chin-Chun Cheng

P176 *A CMA-ES-based 2-Stage Memetic Framework for Solving Constrained Optimization Problems*
Vinicius Veloso de Melo and Giovanni Iacca

P177 *Cluster Restarted Differential Migration*
Marek Dlapa

P178 *Bipolar Choquet integral of fuzzy events*
Jabbar Ghafil

P179 *Interval Linear Optimization Problems with Fuzzy Inequality Constraints*
Ibraheem Alolyan

P180 *Evolutionary Fixed-Structure Mu-Synthesis*
Philippe Feyel, Gilles Duc and Guillaume Sandou

P181 *An Algorithm of Polygonal Approximation Constrained by The Offset Direction*
Fangmin Dong, Xiaojing Xuan, Shuifa Sun and Bangjun Lei

Thursday, December 11, 7:00PM-9:30PM

Banquet
Room: Grand Sierra A, B, C & D 201

Friday, December 12, 8:00AM-9:00AM

Plenary Talk: Blast from the Past - Revisiting Evolutionary Strategies for the Design of Engineered Systems
Speaker: Alice E. Smith
Chair: Robert G. Reynolds
Room: Grand Sierra D 201

Friday, December 12, 9:30AM-10:30AM

CICA'14 Session 4: Evolutionary Computation in Control and Automation
Chair: Alok Kanti Deb and Chixin Xiao
Room: Antigua 2 202

9:30AM *Constrained Multi-objective Evolutionary Algorithm Based on Decomposition for Environmental/Economic Dispatch*
Yin Jianping, Xiao Chixin and Zhou Xun

9:50AM *Grasping Novel Objects with a Dexterous Robotic Hand through Neuroevolution*
Pei-Chi Huang, Joel Lehman, Aloysius K. Mok, Risto Miikkulainen and Luis Sentis

10:10AM *New Multiagent Coordination Optimization Algorithms for Mixed-Binary Nonlinear Programming with Control Applications*
Haopeng Zhang and Qing Hui

ICES'14 Session 4: Evolvable Hardware I
Chair: Kyrre Glette
Room: Antigua 3 202

9:30AM *Supervised Learning of DPLL Based Winner-Take-All Neural Network*
Masaki Azuma and Hiroomi Hikawa

9:50AM *How Evolvable is Novelty Search?*
David Shorten and Geoff Nitschke

10:10AM *How to Evolve Complex Combinational Circuits From Scratch?*
Zdenek Vasicek and Lukas Sekanina

CIBIM'14 Session 4: Iris Recognition
Chair: Gelson da Cruz Junior and Norman Poh
Room: Antigua 4 203

9:30AM *Gaze Angle Estimate and Correction in Iris Recognition*
Tao Yang, Joachim Stahl, Stephanie Schuckers, Fang Hua, Chris Boehnen and Mahmut Karakaya

9:50AM *Subregion Mosaicking Applied to Nonideal Iris Recognition*
Tao Yang, Joachim Stahl, Stephanie Schuckers and Fang Hua

10:10AM *Gender Inference within Turkish Population by Using Only Fingerprint Feature Vectors*
Eyup Burak Ceyhan and Seref Sagiroglu

Special Session: MCDM'14 Session 4: Optimization Methods in Bioinformatics and Bioengineering (OMBB) I
Chair: Anna Lavygina, Richard Allmendinger and Sanaz Mostaghim
Room: Bonaire 1 204

9:30AM *Visualization and Classification of Protein Secondary Structures using Self-Organizing Maps*
Christian Grevisse, Ian Muller, Juan Luis Jimenez Laredo, Marek Ostaszewski, Gregoire Danoy and Pascal Bouvry

9:50AM *The Coxlogit model : feature selection from survival and classification data*
Samuel Branders, Roberto D'Ambrosio and Pierre Dupont

10:10AM *Gene interaction networks boost genetic algorithm performance in biomarker discovery*
Charalampos Moschopoulos, Dusan Popovic, Rocco Langone, Johan Suykens, Bart De Moor and Yves Moreau

Special Session: RiiSS'14 Session 4: Computational Intelligence for Cognitive Robotics II
Chair: Chu Kiong Loo
Room: Bonaire 2 204

9:30AM *Self-generation of reward in reinforcement learning by universal rules of interaction with the external environment*
Kentarou Kurashige and Kaoru Nikaido

9:50AM *Facial Pose Estimation via Dense and Sparse Respresentation*
Hui Yu and Honghai Liu

10:10AM *Affective Communication Robot Partners using Associative Memory with Mood Congruency Effects*
Naoki Masuyama, MD. Nazrul Islam and Chu Loo

CIVTS'14 Session 4
Chair: Justin Dauwels, Dipti Srinivasan and Ana Bazzan
Room: Bonaire 3 205

9:30AM *Fitness function for evolutionary computation applied in dynamic object simulation and positioning*
Marcin Wozniak

9:50AM *Autonomous Running Control System of an AGV by a Tablet PC based on the Wall-floor Boundary Line*
Anar Zorig, Haginiwa Atsushi and Sato Hiroyuki

10:10AM *Fuzzy Logic Based Localization for Vehicular Ad Hoc Networks*
Lina Altoaimy and Imad Mahgoub

CIES'14 Session 4: Applications II
Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse
Room: Bonaire 4 205

9:30AM *Finding longest paths in hypercubes, snakes and coils*
Seth Meyerson, Whiteside William, Thomas Drapela and Walter Potter

9:50AM *Solar Irradiance Forecasting by Using Wavelet Based Denoising*
Lingyu Lyu, Kantardzic Mehmed and Arabmakki Elaheh

10:10AM *Compressive sensing based power spectrum estimation from incomplete records by utilizing an adaptive basis*
Liam Comerford, Ioannis Kougioumtzoglou and Michael Beer

ISIC'14 Session 4: Independent Computing IV
Chair: Lei Jing
Room: Bonaire 5 206

9:30AM *3D Topographic Map Generation of Fukushima Daiichi Power Plant*
Akio Doi, Kenji Oshida, Sachio Kurose, Kaichi Matsui, Tomoya Ito and Sachio Kurose

9:50AM *A System for Controlling Personal Computers by Hand Gestures using a Wireless Sensor Device*
Kaoru Yamagishi, Lei Jing and Zixue Cheng

10:10AM *Exercise Prescription Formulating Scheme Based on a Two-Layer K-means Classifier*
Shyr-Shen Yu, Chan Yung-Kuan, Chiu Ching-Hua, Liu Chia-Chi and Tsai Meng-Hsiun

CIDUE'14 Session 1
Chair: Yaochu Jin and Shengxiang Yang
Room: Bonaire 6 207

9:30AM *Analysis of Hyper-heuristic Performance in Different Dynamic Environments*
Stefan van der Stockt and Andries Engelbrecht

9:50AM *Multi-Colony Ant Algorithms for the Dynamic Travelling Salesman Problem*
Michalis Mavrovouniotis, Shengxiang Yang and Xin Yao

10:10AM *Real-World Dynamic Optimization Using An Adaptive-mutation Compact Genetic Algorithm*
Chigozirim Uzor, Mario Gongora, Simon Coupland and Benjamin Passow

EALS'14 Session 4: Evolving Clustering and Classifiers
Chair: Orlando Filho
Room: Bonaire 7 207

9:30AM *A Fully Autonomous Data Density Based Clustering Technique*
Richard Hyde and Plamen Angelov

9:50AM *An Ensemble Method Based on Evolving Classifiers: eStacking*
Jose Iglesias, Agapito Ledezma and Araceli Sanchis

10:10AM *A Recurrent Meta-Cognitive-Based Scaffolding Classifier from Data Streams*
Mahardhika Pratama, Jie Lu, Sreenatha Anavatti and Jose Antonio Iglesias

CIBCI'14 Session 1
Chair: Damien Coyle and Robert Kozma
Room: Bonaire 8 208

9:30AM *Development of an Autonomous BCI Wheelchair*
Danny Wee-Kiat Ng, Ying-Wei Soh and Sing-Yau Goh

9:50AM *Across-subject estimation of 3-back task performance using EEG signals*
Jinsoo Kim, Min-Ki Kim, Christian Wallraven and Sung-Phil Kim

10:10AM *Abnormal Event Detection in EEG Imaging - Comparing Predictive and Model-based Approaches*
Jayanta Dutta, Banerjee Bonny, Ilin Roman and Kozma Robert

ADPRL'14 Reinforcement Learning 2: Interdisciplinary Connections and Applications
Chair: Abjhijit Gosavi
Room: Curacao 1 208

9:30AM *Closed-Loop Control of Anesthesia and Mean Arterial Pressure Using Reinforcement Learning*
Regina Padmanabhan, Nader Meskin and Wassim Haddad

9:50AM *Beyond Exponential Utility Functions: A Variance-Adjusted Approach for Risk-Averse Reinforcement Learning*
Abhijit Gosavi, Sajal Das and Susan Murray

10:10AM *Tunable and Generic Problem Instance Generation for Multi-objective Reinforcement Learning*
Deon Garrett, Jordi Bieger and Kristinn Thorisson

Special Session: CIDM'14 Session 7: Business Process Mining, Market Analysis and Process Big Data
Chair: Andrea Burattin
Room: Curacao 2 209

9:30AM *The Use of Process Mining in a Business Process Simulation Context: Overview and Challenges*
Niels Martin, Benoit Depaire and An Caris

9:50AM *Discovering Cross-Organizational Business Rules from the Cloud*
Mario Luca Bernardi, Marta Cimitile and Fabrizio Maggi

10:10AM *GoldMiner: A Genetic Programming based algorithm applied to Brazilian Stock Market*
Alexandre Pimenta, Eduardo Carrano, Ciniro Nametala, Frederico Guimaraes and Ricardo Takahashi

Special Session: SIS'14 Session 7: Theory and Applications of Nature-Inspired Optimization Algorithms II
Chair: Xin-She Yang and Xingshi He
Room: Curacao 3 209

9:30AM *A Discontinuous Recurrent Neural Network with Predefined Time Convergence for Solution of Linear Programming*
Juan Diego Sanchez-Torres, Edgar Sanchez and Alexander G. Loukianov

9:50AM *A Biogeography-based Optimization Algorithm for Energy Efficient Virtual Machine Placement*
Hafiz Munsub Ali and Daniel Lee

10:10AM *Improved Particle Swarm Optimization based on Greedy and Adaptive Features*
Aderemi Oluyinka Adewumi and Martins Akugbe Arasomwan

CICARE'14 Session 1: Applications of Computational Intelligence and Informatics in Brain Disorders
Chair: Mufti Mahmud and Amir Hussain
Room: Curacao 4 210

9:30AM *An Intelligent System for Assisting Family Caregivers of Dementia People*
Vasily Moshnyaga, Osamu Tanaka, Toshin Ryu and Akira Hayashida

9:50AM *Towards a Personal Health Records System for Patients with Autism Spectrum Disorders*
Giovanni Paragliola and Antonio Coronato

10:10AM *A Comparison of Syntax, Semantics, and Pragmatics in Spoken Language among Residents with Alzheimer's Disease in Managed-Care Facilities*
Curry Guinn, Ben Singer and Anthony Habash

Friday, December 12, 11:00AM-12:00PM

CICA'14 Session 5: Neural Network Systems and Control with Applications II
Chair: Jose Mario Araujo Daniel Yuh Chao
Room: Antigua 2 211

11:00AM *Enumeration of Reachable, Forbidden, Live States of Gen-Left K-net System (with a non-sharing resource place) of Petri Nets*
Daniel Yuh Chao and Tsung Hsien Yu

11:20AM *Glucose Level Regulation for Diabetes Mellitus Type 1 Patients using FPGA Neural Inverse Optimal Control*
Jorge C. Romero-Aragon, Edgar N. Sanchez and Alma Y. Alanis

11:40AM *Neural Network Fitting for Input-Output Manifolds of Online Control Laws in Constrained Linear Systems*
Samarone Nascimento do Carmo, Marconi Oliveira de Almeida, Rafael Campos, Flavio Castro, Jose Mario Araujo and Carlos Eduardo Trabuco Dorea

ICES'14 Session 5: Evolvable Hardware II
Chair: Julian F Miller
Room: Antigua 3 211

11:00AM *Evolutionary Growth of Genomes for the Development and Replication of Multicellular Organisms with Indirect Encoding*
Stefano Nichele and Gunnar Tufte

11:20AM *An Artificial Ecosystem Algorithm Applied to Static and Dynamic Travelling Salesman Problems*
Manal Adham and Peter Bentley

11:40AM *Towards Compositional Coevolution in Evolutionary Circuit Design*
Michaela Sikulova, Gergely Komjathy and Lukas Sekanina

CIBIM'14 Session 5: Unconventional and New Biometrics
Chair: Sanjoy Das and Nhat Quang Huynh
Room: Antigua 212

11:00AM *A Study of Similarity between Genetically Identical Body Vein Patterns*
Hengyi Zhang, Chaoying Tang, Xiaojie Li and Adams Wai Kin Kong

11:20AM *Human Body Part Detection Using Likelihood Score Computations*
Manoj Ramanathan, Yau Wei-Yun and Teoh Eam Khwang

11:40AM *A Preliminary Report on a Full-Body Imaging System for Effectively Collecting and Processing Biometric Traits of Prisoners*
Nhat Quang Huynh, Xingpeng Xu, Adams Wai Kin Kong and Sathyan Subbiah

Special Session: MCDM'14 Session 5: Optimization Methods in Bioinformatics and Bioengineering (OMBB) II
Chair: Anna Lavygina, Richard Allmendinger and Sanaz Mostaghim
Room: Bonaire 1 213

11:00AM *SARNA-Predict: Using Adaptive Annealing Schedule and Inversion Mutation Operator for RNA Secondary Structure Prediction*
Peter Grypma and Herbert H. Tsang

11:40AM *Short-term Wind Speed Forecasting using Support Vector Machines*
Tiago Pinto, Sergio Ramos, Tiago M. Sousa and Zita Vale

Special Lecture: EALS'14 Talk: On-line Fault Detection and Diagnosis Using Autonomous Learning Classifiers
Speaker: Bruno Costa
Room: Bonaire 7 216

CIBCI'14 Session 2
Chair: Robert Kozma and Kai Keng Ang
Room: Bonaire 8 216

11:00AM *Sensitivity Analysis of Hilbert Transform with Band-Pass FIR Filters for Robust Brain Computer Interface*
Jeffery Davis and Kozma Robert

11:20AM *Electroencephalographic Method Using Fast Fourier Transform Overlap Processing for Recognition of Right- or Left-handed Elbow Flexion Motor Imagery*
Tomoyuki Hiroyasu, Yuuki Ohkubo and Utako Yamamoto

11:40AM *Development of SSVEP-based BCI using Common Frequency Pattern to Enhance System Performance*
Li-Wei Ko, Shih-Chuan Lin, Wei-Gang Liang, Oleksii Komarov and Meng-Shue Song

ADPRL'14 Optimal Control 2: Adaptive and Differential Dynamic Programming
Chair: Shubhendu Bhasin and Hao Xu
Room: Curacao 1 217

11:00AM *Continuous-Time Differential Dynamic Programming with Terminal Constraints*
Wei Sun, Evangelos Theodorou and Panagiotis Tsiotras

11:20AM *Neural Network-based Adaptive Optimal Consensus Control of Leaderless networked Mobile Robots*
Haci Mehmet Guzey, Hao Xu and Jagannatan Sarangapani

11:40AM *On-policy Q-learning for Adaptive Optimal Control*
Sumit Kumar Jha and Shubhendu Bhasin

CIDM'14 Session 8: Educational Data Mining
Chair: Alexander Schulz
Room: Curacao 2 217

11:00AM *FATHOM: A Neural Network-based Non-verbal Human Comprehension Detection System for Learning Environments.*
Fiona Buckingham, Keeley Crockett, Zuhair Bandar and James O'Shea

11:20AM *Predicting Student Success Based on Prior Performance*
Ahmad Slim, Gregory Heileman, Jarred Kozlick and Chaouki Abdallah

11:40AM *To What Extend Can We Predict Students' Performance? A Case Study in Colleges in South Africa*
Norman Poh and Ian Smythe

SIS'14 Session 8: Swarm Algorithms & Applications - II
Chair: Mohammed El-Abd and Oscar Castillo
Room: Curacao 3 218

11:00AM *Repellent Pheromones for Effective Swarm Robot Search in Unknown Environments*
Filip Fossum, Jean-Marc Montanier and Pauline C. Haddow

11:20AM *A MOPSO based on hyper-heuristic to optimize many-objective problems*
Olacir Castro Jr. and Aurora Pozo

11:40AM *Using Heterogeneous Knowledge Sharing Strategies with Dynamic Vector-evaluated Particle Swarm Optimisation*
Marde Helbig and Andries P. Engelbrecht

CICARE'14 Session 2: Applications of Computational Intelligence and eHealth in Disease Diagnosis and Therapy
Chair: Newton Howard and Kamran Farooq
Room: Curacao 4 219

11:00AM *Adaptive Splitting and Selection Ensemble for Breast Cancer Malignancy Grading*
Bartosz Krawczyk, Lukasz Jelen and Michal Wozniak

11:20AM *Patient Stratification based on Activity of Daily Living Score using Relational Self-Organizing Maps*
Mohammed Khalilia, Mihail Popescu and James Keller

11:40AM *A Novel Cardiovascular Decision Support Framework for Effective Clinical Risk Assessment*
Kamran Farooq, Jan Karasek, Hicham Atassi, Amir Hussain, Peipei Yang, Calum MacRae, Chris Eckl, Warner Slack, Bin Luo and Mufti Mahmud

Friday, December 12, 1:30PM-3:10PM

CICA'14 Session 6: Applications of CI to Control and Automation
Chair: Alexander Kochegurov Li-Xin Wang
Room: Antigua 2 219

1:30PM *What Happens When Trend-Followers and Contrarians Interplay in Stock Market*
Li-Xin Wang

1:50PM *An efficient Method to Evaluate the Performance of Edge Detection Techniques by a two-dimensional Semi-Markov Model*
Dmitry Dubinin, Viktor Geringer, Alexander Kochegurov and Konrad Reif

2:10PM *Design and Implementation of a Robust Fuzzy Controller for a Rotary Inverted Pendulum using the Takagi-Sugeno Descriptor Representation*
Quoc Viet Dang, Benyamine Allouche, Laurent Vermeiren, Antoine Dequidt and Michel Dambrine

2:30PM *Ensuring safe prevention and reaction in smarthome systems dedicated to people becoming disabled*
Sebastien Guillet, Bruno Bouchard and Abdenour Bouzouane

2:50PM *How to Detect Big Buyers in Hong Kong Stock Market and Follow Them Up to Make Money*
Li-Xin Wang

Special Session: ICES'14 Session 6: Evolutionary Robotics I
Chair: Jim Torrensen
Room: Antigua 3 220

1:30PM *A Robotic Ecosystem with Evolvable Minds and Bodies*
Berend Weel, Emanuele Crosato, Jacqueline Heinerman, Evert Haasdijk and A.E. Eiben

1:50PM *On Using Gene Expression Programming to Evolve Multiple Output Robot Controllers*
Jonathan Mwaura and Edward Keedwell

2:10PM *Filling the Reality Gap: Using Obstacles to Promote Robust Gaits in Evolutionary Robotics*
Kyrre Glette, Andreas Johnsen and Eivind Samuelsen

2:30PM *Adaptive Self-assembly in Swarm robotics through Environmental Bias*
Jean-Marc Montanier and Pauline C. Haddow

2:50PM *Evolving a Lookup Table Based Controller for Robotic Navigation*
Mark Beckerleg and Justin Matulich

CIBIM'14 Session 6: Biometric Security Solution
Chair: Sanjoy Das and Xiaojie Li
Room: Antigua 4 221

1:30PM *Toward an Attack-sensitive Tamper-resistant Biometric Recognition with a Symmetric Matcher: A Fingerprint Case Study*
Norman Poh, Rita Wong and Gian-Luca Marcialis

1:50PM *Authentication System using Behavioral Biometrics through Keystroke Dynamics*
Diego Alves, Gelson Cruz and Cassio Vinhal

2:10PM *Speeding up the Knowledge-based Deblocking Method for Efficient Forensic Analysis*
Yanzhu Liu, Xiaojie Li and Adams Wai Kin Kong

2:30PM *Ontology Development and Evaluation for Urinal Tract Infection*
Bureera Sabir, Dr Usman Qamar and Abdul Wahab Muzaffar

2:50PM *Fingerprint Indexing through Sparse Decomposition of Ridge Flow Patches*
Antoine Deblonde

Special Session: MCDM'14 Session 6: Evolutionary Multi-Objective Optimization
Chair: Mardé Helbig, Sanaz Mostaghim and Rui Wang
Room: Bonaire 1 222

1:30PM *Difficulties in Specifying Reference Points to Calculate the Inverted Generational Distance for Many-Objective Optimization Problems*
Hisao Ishibuchi, Hiroyuki Masuda, Yuki Tanigaki and Yusuke Nojima

1:50PM *Review of Coevolutionary Developments of Evolutionary Multi-Objective and Many-Objective Algorithms and Test Problems*
Hisao Ishibuchi, Hiroyuki Masuda, Yuki Tanigaki and Yusuke Nojima

2:10PM *Cascaded Evolutionary Multiobjective Identification Based on Correlation Function Statistical Tests for Improving Velocity Analyzes in Swimming*
Helon Vicente Hultmann Ayala, Luciano Cruz, Roberto Zanetti Freire and Leandro dos Santos Coelho

2:30PM *Optimization Algorithms for Multi-objective Problems with Fuzzy Data*
Oumayma Bahri, Nahla Ben Amor and Talbi El-Ghazali

2:50PM *Multi-Objective Evolutionary Approach for the Satellite Payload Power Optimization Problem*
Emmanuel Kieffer, Apostolos Stathakis, Gregoire Danoy, Pascal Bouvry, El-Ghazali Talbi and Gianluigi Morelli

Special Session: RiiSS'14 Session 6: Computational Intelligence for Cognitive Robotics III
Chair: Janos Botzheim
Room: Bonaire 2 223

1:30PM *Evolutionary Swarm Robotics Approach to a Pursuit Problem*
Toshiyuki Yasuda, Kazuhiro Ohkura, Tosei Nomura and Yoshiyuki Matsumura

1:50PM *Unknown Object Extraction based on Plane Detection in 3D Space*
HIroyuki Masuta, Makino Shinichiro, Lim Hun-ok, Motoyoshi Tatsuo, Koyanagi Ken'ichi and Oshima Toru

2:10PM *Robot Team Learning Enhancement Using Human Advice*
Justin Girard and M. Reza Emami

2:30PM *Slip Based Pick-and-Place by Universal Robot Hand with Force/Torque Sensors*
Futoshi Kobayashi, Hayato Kanno, Hiroyuki Nakamoto and Fumio Kojima

CIES'14 Session 6: Energy Systems
Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse
Room: Bonaire 4 224

1:30PM *Investigating the Use of Echo State Networks for Prediction of Wind Power Generation*
Aida Ferreira, Ronaldo Aquino, Teresa Ludermir, Otoni Nobrega Neto, Jonata Albuquerque, Milde Lira and Manoel Carvalho Jr.

1:50PM *A Multi-Population Genetic Algorithm to Solve Multi-Objective Remote Switches Allocation Problem in Distribution Networks*
Helton Alves and Railson Sousa

2:10PM *An Evolutionary Approach to Improve Efficiency for Solving the Electric Dispatch Problem*
Carolina G. Marcelino, Elizabeth F. Wanner and Paulo E. M. Almeida

2:30PM *Energy Price Forecasting in the North Brazilian Market using NN - ARIMA model and Explanatory Variables*
Jose Carlos Filho, Carolina Affonso and Roberto Celio Oliviera

2:50PM *Participatory Learning in the Neurofuzzy Short-Term Load Forecasting*
Michel Hell, Pyramo Costa Jr. and Fernando Gomide

IA'14 Session 2: Applications of Intelligent Agents
Chair: Hani Hagras and Vincenzo Loia
Room: Bonaire 5 225

1:30PM *Human Activity Recognition in Smart Homes: Combining Passive RFID and Load Signatures of Electrical Devices*
Dany Fortin-Simard, Jean-Sebastien Bilodeau, Sebastien Gaboury, Bruno Bouchard and Abdenour Bouzouane

1:50PM *Naive Creature Learns to Cross a Highway in a Simulated CA-Like Environment*
Anna Lawniczak, Bruno Di Stefano and Jason Ernst

2:10PM *An Agent-based Trading Infrastructure for Combinatorial Reverse Auctions*
Hakan Bayindir, Hurevren Kilic and Mohammed Rehan

2:30PM *Human Perceptions of Altruism in Artificial Agents*
Curry Guinn and Daniel Palmer

2:50PM *Developing Game-Playing Agents That Adapt to User Strategies: A Case Study*
Rececca Brown and Curry Guinn

CIDUE'14 Session 3
Chair: Robi Polikar and Shengxiang Yang
Room: Bonaire 6 226

1:30PM *Ant Colony Optimization with Self-Adaptive Evaporation Rate in Dynamic Environments*
Michalis Mavrovouniotis and Shengxiang Yang

1:50PM *Learning Features and their Transformations from Natural Videos*
Jayanta Dutta and Bonny Banerjee

2:10PM *Neuron Clustering for Mitigating Catastrophic Forgetting in Feedforward Neural Networks*
Ben Goodrich and Itamar Arel

2:30PM *Evolutionary Algorithms for Bid-Based Dynamic Economic Load Dispatch: A Large-Scale Test Case*
Sunny Orike and David Corne

2:50PM *Statistical Hypothesis Testing for Chemical Detection in Changing Environments*
Anna Ladi, Jon Timmis, Andrew M Tyrrell and Peter J Hickey

CIBCI'14 Session 3
Chair: Kai Keng Ang and Damien Coyle
Room: Bonaire 8 227

1:30PM *EEG-based Golf Putt Outcome Prediction Using Support Vector Machine*
Qing Guo, Jingxian Wu and Baohua Li

1:50PM *Non-supervised Technique to Adapt Spatial Filters for ECoG Data Analysis*
Emmanuel Morales-Flores, Gerwin Schalk and J.Manuel Ramirez-Cortes

2:10PM *Identification of Three Mental States Using a Motor Imagery Based Brain Machine Interface*
Trongmun Jiralerspong, Chao Liu and Jun Ishikawa

2:30PM *EEG Subspace Analysis and Classification Using Principal Angles for Brain-Computer Interfaces*
Rehab Ashari and Charles Anderson

CIDM'14 Session 9: Modelling and Mining Massive Data Sets
Chair: Jean-Marc Andreoli
Room: Curacao 2 228

1:30PM *Matching Social Network Biometrics Using Geo-Analytical Behavioral Modeling*
Mark Rahmes, Kevin Fox, John Delay and Gran Roe

1:50PM *Massively Parallelized Support Vector Machines based on GPU-Accelerated Multiplicative Updates*
Connie (Khor Li) Kou and Chao-Hui Huang

2:10PM *Scaling a Neyman-Pearson Subset Selection Approach Via Heuristics for Mining Massive Data*
Gregory Ditzler, Matthew Austen, Gail Rosen and Robi Polikar

2:30PM *MapReduce Guided Approximate Inference Over Graphical Models*
Ahsanul Haque, Swarup Chandra, Latifur Khan and Michael Baron

2:50PM *Optimization of Relational Database Usage Involving Big Data (A Model Architecture for Big Data applications)*
Erin-Elizabeth Durham, Andrew Rosen and Robert Harrison

SIS'14 Session 10: Combintorial Problems
Chair: Donald Wunsch and Eunjin Kim
Room: Curacao 3 229

1:30PM *A Distributed and Decentralized Approach for Ant Colony Optimization with Fuzzy Parameter Adaptation in Traveling Salesman Problem*
Jacob Collings and Eunjin Kim

1:50PM *An Extended EigenAnt Colony System Applied to the Sequential Ordering Problem*
Ahmed Ezzat, Ashraf Abdelbar and Donald Wunsch

2:10PM *A Planner for Autonomuos Risk-Sensitive Coverage (PARCov) by a Team of Unmanned Aerial Vehicles*
Alex Wallar, Erion Plaku and Donald Sofge

2:30PM *Path Planning for Swarms in Dynamic Environments by Combining Probabilistic Roadmaps and Potential Fields*
Alex Wallar and Erion Plaku

2:50PM *Feature Selection for Problem Decomposition on High Dimensional Optimization*
Pedro Reta and Ricardo Landa

Special Session: CICARE'14 Session 3: Prospects and Applications of Computational Intelligence in Health Assessment, Monitoring and eHealth
Chair: Haider Ali Al-Lawati and Mufti Mahmud
Room: Curacao 4 230

1:30PM *Exploring sustained phonation recorded with acoustic and contact microphones to screen for laryngeal disorders*
Adas Gelzinis, Antanas Verikas, Evaldas Vaiciukynas, Marija Bacauskiene, Jonas Minelga, Magnus Hallander, Virgilijus Uloza and Evaldas Padervinskis

1:50PM *Rule Based Realtime Motion Assessment for Rehabilitation Exercises*
Wenbing Zhao, Roanna Lun, Deborah Espy and Ann Reinthal

2:10PM *Exploring Emotion in an E-learning System using Eye Tracking*
Saromporn Charoenpit and Michiko Ohkura

2:30PM *Privacy Preservation, Sharing and Collection of Patient Records using Cryptographic Techniques for Cross-Clinical Secondary Analytics*
Hajara Abdulrahman, Norman Poh and Jack Burnett

2:50PM *How to find your appropriate doctor: An integrated recommendation framework in big data context*
Hongxun Jiang and Wei Xu

Friday, December 12, 3:30PM-5:10PM

CICA'14 Session 7: Computational Intelligence in Robotics
Chairs: Yongping Pan, Andrei Petrovski
Room: Antigua 2 231

3:30PM *Calibration between a Laser Range Scanner and an Industrial Robot Manipulator*
Thomas Timm Andersen, Nils Axel Andersen and Ole Ravn

3:50PM *Context-based Adaptive Robot Behavior Learning Model (CARB-LM)*
Joohee Suh and Dean Hougen

4:10PM *Biomimetic Hybrid Feedback Feedforword Adaptive Neural Control of Robotic Arms*
Yongping Pan and Haoyong Yu

4:30PM *Improved Multiobjective Particle Swarm Optimization for Designing PID Controllers Applied to Robotic Manipulator*
Juliano Pierezan, Helon V. H. Ayala, Luciano F. Cruz, Leandro dos S. Coelho and Roberto Z. Freire

4:50PM *Automated Inferential Measurement System for Traffic Surveillance: Enhancing Situation Awareness of UAVs by Computational Intelligence*
Prapa Rattadilok and Andrei Petrovski

Special Session: ICES'14 Session 7: Evolutionary Robotics II
Chair: Martin A. Trefzer
Room: Antigua 3 232

3:30PM *Improvements to Evolutionary Model Consistency Checking for a Flapping-Wing Micro Air Vehicle*
John Gallagher, Eric Matson, Garrison Greenwood and Sanjay Boddhu

3:50PM *Evolutionary Strategy Approach for Improved In-Flight Control Learning in a Simulated Insect-Scale Flapping-Wing Micro Air Vehicle*
Monica Sam, Sanjay Boddhu, Kayleigh Duncan and John Gallagher

4:10PM *Islands of Fitness Compact Genetic Algorithm for Rapid In-Flight Control Learning in a Flapping-Wing Micro Air Vehicle: A Search Space Reduction Approach*
Kayleigh Duncan, Sanjay Boddhu, Monica Sam and John Gallagher

4:30PM *Balancing Performance and Efficiency in a Robotic Fish with Evolutionary Multiobjective Optimization*
Anthony Clark, Jianxun Wang, Xiaobo Tan and Philip McKinley

CIES'14 Session 7: Applications IV
Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse
Room: Bonaire 4 233

3:30PM *Video Summarization based on Subclass Support Vector Data Description*
Vasileios Mygdalis, Alexandros Iosifidis, Anastasios Tefas and Ioannis Pitas

3:50PM *Determination of sugar content in whole Port Wine grape berries combining hyperspectral imaging with neural networks methodologies*
Veronique Gomes, Armando Fernandes, Arlete Faia and Pedro Melo-Pinto

Special Session: IA'14 Session 3: Ambient Computational Intelligence
Chair: Ahmad Lotfi and Giovanni Acampora
Room: Bonaire 5 233

3:30PM *Distributed Team Formation in Urban Disaster Environments*
Abel Correa

3:50PM *Prediction of Mobility Entropy in an Ambient Intelligent Environment*
Saisakul Chernbumroong, Ahmad Lotfi and Caroline Langensiepen

4:10PM *A Hybrid Computational Intelligence Approach for Efficiently Evaluating Customer Sentiments in E-Commerce Reviews*
Giovanni Acampora and Georgina Cosma

4:30PM *Interoperable Services based on Activity Monitoring in Ambient Assisted Living Environments*
Giovanni Acampora, Kofi Appiah, Autilia Vitiello and Andrew Hunter

4:50PM *Semantic-Based Decision Support for Remote Care of Dementia Patients*
Taha Osman, Ahmad Lotfi, Ccaroline Langensiepen, Mahmoud Saeed and Saisakul Chernbumroong

CIDM'14 Session 10: Advanced signal processing and data analysis
Chair: Barbara Hammer
Room: Curacao 2 234

3:30PM *Learning Energy Consumption Profiles from Data*
Jean-Marc Andreoli

3:50PM *kNN estimation of the unilateral dependency measure between random variables*
Angel Cataron, Razvan Andonie and Yvonne Chueh

4:10PM *Using Data Mining to Investigate Interaction between Channel Characteristics and Hydraulic Geometry Channel Types*
Leong Lee and Gregory S. Ridenour

4:30PM *Experimental Studies on Indoor Sign Recognition and Classification*
Zhen Ni, Siyao Fu, Bo Tang, Haibo He and Xinming Huang

4:50PM *High-SNR Model Order Selection Using Exponentially Embedded Family and Its Applications to Curve Fitting and Clustering*
Quan Ding, Steven Kay and Xiaorong Zhang

Special Session: SIS'14 Session 9: Cultural Algorithms and Their Applications
Chair: Robert G. Reynolds
Room: Curacao 3 235

3:30PM *Improving Artifact Selection via Agent Migration in Multi-Population Cultural Algorithms*
Felicitas Mokom and Ziad Kobti

3:50PM *An Artificial Bee Colony Algorithm for Minimum Weight Dominating Set*
C.G. Nitash and Alok Singh

4:10PM *A New Strategy to Detect Variable Interactions in Large Scale Global Optimization*
Mohammad R. Raeesi N. and Ziad Kobti

4:30PM *A Computational Basis for the Presence of Sub-Cultures in Cultural Algorithms*
Yousof Gawasmeh and Robert Reynolds

4:50PM *Balancing Search Direction in Cultural Algorithm for Enhanced Global Numerical Optimization*
Mostafa Ali, Noor Awad and Robert Reynolds

5:10PM *Hybrid Cooperative Co-evolution for Large Scale Optimization*
Mohammed El-Abd

5:30PM *Prediction of University Enrollment Using Computational Intelligence*
Biswanath Samanta and Ryan Stallings

Special Session: CICARE'14 Session 4: Big Data Analytic Technology for Bioinformatics and Health Informatics
Chair: Giovanni Paragliola and Mufti Mahmud
Room: Curacao 4 237

3:30PM *A Novel Mixed Values k-Prototypes Algorithm with Application to Health Care Databases Mining*
Ahmed Najjar, Christian Gagne and Daniel Reinharz

3:50PM *Label the many with a few: Semi-automatic medical image modality discovery in a large image collection*
Szilard Vajda, Daekeun You, Antani Sameer and George Thoma

4:10PM *Identifying Risk Factors Associate with Hypoglycemic Events*
Ran Duan, Haoda Fu and Chenchen Yu

4:30PM *Towards a Prototype Medical System for Devices Vigilance and Patient Safety*
Antonios Deligiannakis, Nikos Giatrakos and Nicolas Pallikarakis

4:50PM *FDT 2.0: Improving scalability of the fuzzy decision tree induction tool - integrating database storage*
Erin-Elizabeth Durham, Xiaxia Yu and Robert Harrison

DETAILED PROGRAM

Tuesday, December 9, 12:00PM-6:00PM

Registration
Tuesday, December 9, 12:00PM-6:00PM, Room: Grand Sierra Registration SOUTH

Tuesday, December 9, 6:00PM-8:00PM

Reception
Tuesday, December 9, 6:00PM-8:00PM, Room: Grand Sierra A, B & C

Wednesday, December 10, 8:00AM-8:10AM

Opening Remarks
Wednesday, December 10, 8:00AM-8:10AM, Room: Grand Sierra D

Wednesday, December 10, 8:10AM-9:10AM

Plenary Talk: Sensor Fault Diagnosis in Cyber-Physical Systems
Wednesday, December 10, 8:10AM-9:10AM, Room: Grand Sierra D, Speaker: Marios M. Polycarpou, Chair: Derong Liu

Wednesday, December 10, 9:20AM-10:00AM

CIBD'14 Keynote Talk: Big Data and Analytics at Verizon
Wednesday, December 10, 9:20AM-10:00AM, Room: Antigua 2, Speaker: Ashok Srivastava

IES'14 Keynote Talk: Intelligent Embedded Systems: Artificial Neural Networks for Industrial Applications
Wednesday, December 10, 9:20AM-10:00AM, Room: Antigua 3, Speaker: Eros Pasero

CIHLI'14 Keynote Talk: Towards Human-Like Intelligence: A Self-Organizing Neural Network Approach
Wednesday, December 10, 9:20AM-10:00AM, Room: Antigua 4, Speaker: Ah-Hwee Tan

CCMB'14 Keynote Talk: Toward Physics of the Mind
Wednesday, December 10, 9:20AM-10:00AM, Room: Bonaire 1, Speaker: Leonid Perlovsky

Wednesday, December 10, 9:20AM-10:00AM

CIPLS'14 Keynote Talk: Heuristic Algorithms in Scheduling
Wednesday, December 10, 9:20AM-10:00AM, Room: Bonaire 2, Speaker: Fatih Tasgetiren

ClComms'14 Keynote Talk: Dealing with Complexity in Optimization Design
Wednesday, December 10, 9:20AM-10:00AM, Room: Bonaire 3, Speaker: Andrea Massa

SDE'14 Keynote Talk: Single Objective, Large Scale, Constrained Optimization: A Survey and Recent Developments
Wednesday, December 10, 9:20AM-10:00AM, Room: Bonaire 4, Speaker: Janez Brest

ClCS'14 Keynote Talk: Post-Breach Cyber Defense
Wednesday, December 10, 9:20AM-10:00AM, Room: Bonaire 5, Speaker: Vipin Swarup

CIEL'14 Keynote Talk: What Can Ensemble of Classifiers Do for You?
Wednesday, December 10, 9:20AM-10:00AM, Room: Bonaire 6, Speaker: Robi Polikar

CIR2AT'14 Keynote Talk: Rehabilitation Robotics: From Evidence to Model-Based Interventions
Wednesday, December 10, 9:20AM-10:00AM, Room: Bonaire 7, Speaker: Hermano Igo Krebs

CIMSIVP'14 Keynote Talk: Counting, Detecting and Tracking of People in Crowded Scenes
Wednesday, December 10, 9:20AM-10:00AM, Room: Bonaire 8, Speaker: Mubarak Shah

ADPRL'14 Keynote Talk: Approximate Dynamic Programming Methods: A Unified Framework
Wednesday, December 10, 9:20AM-10:00AM, Room: Curacao 1, Speaker: Dimitri P. Bertsekas

CIDM'14 Keynote Talk: What Might be Predicted from Medical Image Mining
Wednesday, December 10, 9:20AM-10:00AM, Room: Curacao 2, Speaker: Lawrence Hall

SIS'14 Keynote Talk: Putting People in the Swarm
Wednesday, December 10, 9:20AM-10:00AM, Room: Curacao 3, Speaker: Russ Eberhart

CIASG'14 Keynote Talk: Computational Systems Thinking for Transformation of Smart Grid Operations
Wednesday, December 10, 9:20AM-10:00AM, Room: Curacao 4, Speaker: Ganesh Kumar Venayagamoorthy

Wednesday, December 10, 9:20AM-10:00AM

DC'14 Keynote Talk

Wednesday, December 10, 9:20AM-10:00AM, Room: Curacao 7, Speaker: Pablo Estévez

CIBD'14 Session 1: Big Data Applications

Wednesday, December 10, 10:20AM-12:00PM, Room: Antigua 2, Chair: Yaochu Jin and Yonghong Peng

10:20AM Endmember Representation of Human Geography Layers [#14635]

Andrew Buck, Alina Zare, James Keller and Mihail Popescu, University of Missouri, United States

This paper presents an endmember estimation and representation approach for human geography data cubes. Human-related factors that can be mapped for a geographic region include factors relating to population, age, religion, education, medical access and others. Given these hundreds (or even thousands) of factors mapped over a region, it is extremely difficult for an analyst to summarize and understand the interactions between all of these factors. In this paper, a method to provide a compact representation and visualization of hundreds of human geography layers is presented. These are large data cubes containing a range of human geographic information including some represented using fuzzy values. Results on a human geography data cube compiled for the state of Missouri, USA is presented.

10:40AM Sparse Bayesian Approach for Feature Selection [#15049]

Chang Li and Huanhuan Chen, University of Science and Technology of China, China

This paper employs sparse Bayesian approach to enable the Probabilistic Classification Vector Machine (PCVM) to select a relevant subset of features. Because of probabilistic outputs and the ability to automatically optimize the regularization items, the sparse Bayesian framework has shown great advantages in real-world applications. However, the Gaussian priors that introduce the same prior to different classes may lead to instability in the classifications. An improved Gaussian prior, whose sign is determined by the class label, is adopt in PCVM. In this paper, we present a joint classifier and feature learning algorithm: Feature Selection Probabilistic Classification Vector Machine (FPCVM). The improved Gaussian priors, named as truncated Gaussian prior, are introduced into the feature space for feature selection, and into the sample space to generate sparsity to the weight parameters, respectively. The expectation-maximization (EM) algorithm is employed to obtain a maximum a posteriori (MAP) estimation of these parameters. In experiments, both the accuracy of classification and performance of feature selection are evaluated on synthetic datasets, benchmark datasets and high-dimensional gene expression datasets.

11:00AM High Level High Performance Computing for Multitask Learning of Time-varying Models [#15090]

Marco Signoretto, Emanuele Frandi, Zahra Karevan and Johan Suykens, STADIUS, KU Leuven, Belgium

We propose an approach suitable to learn multiple time-varying models jointly and discuss an application in data- driven weather forecasting. The methodology relies on spectral regularization and encodes the typical multi-task learning assumption that models lie near a common low dimensional subspace. The arising optimization problem amounts to estimating a matrix from noisy linear measurements within a trace norm ball. Depending on the problem, the matrix dimensions as well as the number of measurements can be large. We discuss an algorithm that can handle large-scale problems and is amenable to parallelization. We then compare high level high performance implementation strategies that rely on Just- in-Time (JIT) decorators. The approach enables, in particular, to offload computations to a GPU without hard-coding computationally intensive operations via a low-level language. As such, it allows for fast prototyping and therefore it is of general interest for developing and testing novel computational models.

11:20AM Sentiment Analysis for Various SNS Media Using Naive Bayes Classifier and Its Application to Flaming Detection [#15065]

Shun Yoshida, Jun Kitazono, Seiichi Ozawa, Takahiro Sugawara, Tatsuya Haga and Shogo Nakamura, Graduate School of Engineering, Kobe University, Japan; Eltes Co.,Ltd., Japan

SNS is one of the most effective communication tools and it has brought about drastic changes in our lives. Recently, however, a phenomenon called flaming or backlash becomes an imminent problem to private companies. A flaming incident is usually triggered by thoughtless comments/actions on SNS, and it sometimes ends up damaging to the company's reputation seriously. In this paper, in order to prevent such unexpected damage to the company's reputation, we propose a new approach to sentiment analysis using a naive Bayes classifier, in which the features of tweets/comments are selected based on entropy-based criteria and an empirical rule to capture negative expressions. In addition, we propose a semi-supervised learning approach to handling training data with unreliable class information, which come from various SNS media such as Twitter, Facebook, blogs and a Japanese textboard called '2-channel'. In the experiments, we use four datasets of users' comments, which were posted to different SNS media of private companies. The experimental results show that the proposed naive Bayes classifier model has good performance for different SNS media, and a semi-supervised learning effectively works for the dataset with unreliable class information. In addition, the proposed method is applied to detect flaming incidents, and we show that it is successfully detected.

11:40AM Increasing Big Data Front End Processing Efficiency via Locality Sensitive Bloom Filter for Elderly Healthcare [#14354]

Yongqiang Cheng, Ping Jiang and Yonghong Peng, University of Hull, United Kingdom; University of Bradford, United Kingdom

In support of the increasing number of elderly population, wearable sensors and portable mobile devices capable of monitoring, recording, reporting and alerting are envisaged to enable them an independent lifestyle without relying on intrusive care programmes. However, the big data readings generated from the sensors are characterized as multidimensional, dynamic and non-linear with weak correlation with observable human behaviors and health conditions which challenges the information transmission, storing and processing. This paper proposes to use Locality Sensitive Bloom Filter to increase the Instance Based Learning efficiency for the front end sensor data pre-processing so that only relevant and meaningful information will be sent out for further processing aiming to relieve the burden of the above big data challenges. The

approach is proven to optimize and enhance a popular instance-based learning method benefits from its faster speed, less space requirements and is adequate for the application.

IES'14 Session 1

Wednesday, December 10, 10:20AM-12:00PM, Room: Antigua 3, Chair: Manuel Roveri

10:20AM Fuzzy Algorithm for Intelligent Wireless Sensors with Solar Harvesting [#14530]

Michal Prauzek, Petr Musilek and Asher G. Watts, VSB - Technical University of Ostrava, Czech Republic; University of Alberta, Canada

Wireless sensors are sophisticated embedded systems designed for collecting data on systems or processes of interest. In many cases, they are expected to operate in inaccessible locations, without user supervision. As a result, such monitoring systems need to operate autonomously and independently of external sources of energy. To achieve long-lived sustainability, monitoring systems often rely on energy extracted from the environment, e.g. through solar harvesting. Their design is a challenging problem with several conflicting goals and a number of design and implementation possibilities. For obvious reasons, these devices must be designed in an energy efficient way. As a result, they usually have low computational performance and cannot implement complicated control algorithms. At the same time, due to the requirements for autonomy and dependability, they must be endowed with certain degree of adaptability and fault tolerance - properties typically found in intelligent systems. In this contribution, we describe the design flow of an intelligent embedded control system for management of energy use in wireless monitoring systems. The paper also provides a simulation-based analysis of the control system performance.

10:40AM Location-specific Optimization of Energy Harvesting Environmental Monitoring Systems [#14531]

Petr Musilek, Pavel Kromer and Michal Prauzek, University of Alberta, Canada; VSB - Technical University of Ostrava, Czech Republic

Environmental sensing is necessary for air quality monitoring, assessment of ecosystem health, or climate change tracking. Environmental monitoring systems can take a form of standalone monitoring stations or networks of individual sensor nodes with wireless connectivity. The latter approach allows high resolution mapping of spatiotemporal characteristics of the environment. To allow their autonomous operation and to minimize their maintenance costs, such systems are often powered using energy harvested from the environment itself. Due to the scarcity and intermittency of the environmental energy, operation of energy harvesting monitoring systems is not a trivial task. Their sensing, transmitting and housekeeping activities must be carefully managed to extend their lifetime while providing desired quality of service. As the environmental conditions change with the region of deployment, the strategies for energy management must change accordingly to match the energy availability. In this work, we examine how geographic location affects the operations and quality of data collected by a solarpowered monitoring system. In particular, we use node/network simulation tools to follow the performance of energy-harvesting environmental monitoring sensor nodes at different latitudes, from equator to the pole. Static parameters of the simulated sensor nodes are determined for each latitude using an intelligent optimization method. The results show a clear dependence of the monitoring system performance on its deployment location. This encourages location-specific

11:00AM Directional Enhancements for Emergency Navigation [#14487]

Andras Kokuti and Erol Gelenbe, Budapest University of Technology and Economics, Hungary; Imperial College London, England

We present a novel direction based shortest path search algorithm to guide evacuees during an emergency. It uses opportunistic communications (oppcomms) with low-cost wearable mobile nodes that can exchange packets at close range of a few to some tens of meters without help of an infrastructure. The algorithm seeks the shortest path to exits which are safest with regard to a hazard, and is integrated into an autonomous Emergency Support System (ESS) to guide evacuees in a built environment. The ESS that we propose, that includes the directional algorithm and the Oppcomms, are evaluated using simulation experiments with the DBES (Distributed Building Evacuation Simulator) tool by simulating a shopping centre where fire is spreading. The results show that the directional path finding algorithm can offer significant improvements for the evacuees. In particular, we see that the improved and more reliable communications offered by Oppcomms, especially when the number of evacuees is larger, can help to compensate for the effects of congestion and improve the overall success of the evacuation scheme. Throughout the simulations we observe improvements of a few percent, which can translate into a valuable number of more people that are safely evacuated when human lives and safety are at risk.

11:20AM WiFi Localization on the International Space Station [#14508]

Jongwoon Yoo, Taemin Kim, Christopher Provencher and Terrence Fong, NASA Ames Research Center, United States

This paper explores the possibility of using WiFi localization techniques for autonomous free-flying robots on the International Space Station (ISS). We have collected signal strength samples from the ISS, built the WiFi map using Gaussian processes, implemented a localizer based on particle filters, and evaluated the performance. Our results show the average error of 1.59 meters, which is accurate enough to identify which ISS module the robot is currently in. However, we found that most errors occurred in some specific modules under the current WiFi settings. This paper describes the challenges of applying WiFi localization techniques to the ISS and suggests several approaches to achieve better performance.

CIHLI'14 Session 1: Various Aspects of Human-Level Intelligence

Wednesday, December 10, 10:20AM-12:00PM, Room: Antigua 4, Chair: Jacek Mandziuk

10:20AM Immersive Virtual Reality Environment of a Subway Evacuation on a Cloud for Disaster Preparedness and Response Training [#14239]

Sharad Sharma, Shanmukha Jerripothula, Stephon Mackey and Oumar Soumare, Bowie State University, United States

Virtual Reality (VR) based training and evacuation drills in disaster preparedness has been increasingly recognized as an alternative to traditional real-life drills and table-top exercises. Immersive collaborative VR evacuation drills offer a unique way for training in emergencies. The participants can enter the collaborative VR environment setup on the cloud and participate in the evacuation drill which leads to considerable cost advantages over large-scale real-life exercises. This paper presents an experimental design approach to gather data on human behavior and emergency response in a subway environment among a set of players in an immersive virtual reality environment. Our proposed multi-user VR-based training subway environment offers flexibility to run multiple scenarios and evacuation drills for disaster preparedness and response. We present three ways for controlling crowd behavior. First by defining rules for computer simulated agents, second by providing controls to the users to navigate in the VR environment as autonomous agents and the third by providing controls to the users with a keyboard/ joystick along with an immersive VR head set in real time. Our contribution lies in our approach to combine these three approaches of behavior in order to simulate the crowd behavior in emergencies.

10:40AM Autonomic Behaviors in an Ambient Intelligence System [#14592]

Alessandra De Paola, Pierluca Ferraro, Salvatore Gaglio and Giuseppe Lo Re, University of Palermo, Italy

Ambient Intelligence (AmI) systems are constantly evolving and becoming ever more complex, so it is increasingly difficult to design and develop them successfully. Moreover, because of the complexity of an AmI system as a whole, it is not always easy for developers to predict its behavior in the event of unforeseen circumstances. A possible solution to this problem might lie in delegating certain decisions to the machines themselves, making them more autonomous and able to self-configure and self-manage, in line with the paradigm of Autonomic Computing. In this regard, many researchers have emphasized the importance of adaptability in building agents that are suitable to operate in real-world environments, which are characterized by a high degree of uncertainty. In the light of these considerations, we propose a multi-tier architecture for an autonomic AmI system capable of analyzing itself and its monitoring processes, and consequently of managing and reconfiguring its own sub-modules to better satisfy users' needs. To achieve such a degree of autonomy and self-awareness, our AmI system exploits the knowledge contained in an ontology that formally describes the environment it operates in, as well as the structure of the system itself.

11:00AM On Efficiency-Oriented Support of Consensus Reaching in A Group of Agents in A Fuzzy Environment with A Cost Based Preference Updating Approach [#14712]

Dominika Golunska, Janusz Kacprzyk and Slawomir Zadrozny, Cracow Univ. of Technology, Poland; Systems Research Institute Pol. Acad. Sci., Poland

We deal with consensus reaching, and its related decision support system, based on the soft degree of consensus by Kacprzyk and Fedrizzi, fuzzy preferences, and a fuzzy majority. We assume that consensus reaching proceeds in a (small) group of agents who express their testimonies w.r.t.ith a set of options as fuzzy preferences. We develop tools and techniques to extract from those data, and from the consecutive steps of the consensus reaching process, additional information assumed as human consistent linguistic summaries that can be derived by using natural language generation (NLG). This information is meant to accelerate the consensus reaching process by pointing out to those individuals for whom the changed of testimonies, and with respect to specific pairs of options, can have the highest impact on the degree of consensus. It is therefore explicitly efficiency oriented. We assume a moderated consensus reaching process run by a specialized "super-agent", a moderator. In this paper we further extend a model and implementation of such a consensus reaching process proposed in our previous papers. We further develop linguistic tools and techniques, in the form of linguistic summaries, to help grasp relations and interplay between the agents' testimonies and their dynamics numerically analyzed by additional indicators pointing out agents and options that are most promising for the changes of preferences. We proposed a cost based scheme for the evaluation of preference updating so that the agents be not forced to change too often and too many of their preferences, which is not usually welcome by people for psychological reasons, and which should contribute to their better collaboration .

11:20AM HICMA: A Human Imitating Cognitive Modeling Agent using Statistical Methods and Evolutionary Computation [#14783]

Magda Fayek and Osama Farag, Cairo University, Egypt

Intelligent agents are becoming more sophisticated than ever. An intelligent agent (IA) interacts with the environment. It takes observations through sensors and acts on the environment through actuators for achieving some goals. An IA usually keeps models for the environment and the interesting objects in this environment. These models are adapted according to the environmental changes. Wide researches have been done on the techniques of building and tuning such models. This paper introduces the Human Imitating Cognitive Modeling Agent (HICMA) that combines different techniques for building and tuning appropriate models for dynamic environment objects. It is based on a proposed updated version of Minsky's society of mind theory where society agents evaluate and evolve each other in a novel way. HICMA has been tested by allowing it to play Robocode against the two opponents Shadow 3.66d and Walls. Results show that HICMA's evolved mathematical behavior models gracefully translate actual human behaviors.

11:40AM A Cortex-inspired Episodic Memory Toward Interactive 3D Robotic Vision [#14805]

Abdul Rahman Abdul Ghani and Kazuyuki Murase, Department of Human and Artificial Intelligence System, Graduate School of Engineering, University of Fukui, Japan

This paper shows the advantage of using a cortexinspired episodic memory model in a robotic vision-system. The robot can interact, learn, and recall 3D objects in real-time. The model forms sparse distributed memory traces of spatiotemporal episodes. These episodes consist of sequences of sensorimotor patterns. These patterns represent the visual scenes of 3D objects and the robot states when encountering the objects. The results show: 1) Dynamic recall, when the model is prompted with the initial items of the learned episode. 2) Recognition, by recalling the most similar stored objects when encountering new objects. 3) Sensorimotor learning, by generating the missing information when encountering either similar visual input or similar robot's states. The model learns by measuring the degree of similarity between the current input

pattern on each time slice and the expected input given the preceding time slice (G). Then adding an amount of noise, inversely proportional to G, to the process of choosing the Internal Representation of the model.

CCMB'14 Session 1: Cognitive, Mind, and Brain

Wednesday, December 10, 10:20AM-12:00PM, Room: Bonaire 1, Chair: Daniel S. Levine

10:20AM Learning Visual-Motor Cell Assemblies for the iCub Robot using a Neuroanatomically Grounded Neural Network [#14215]

Samantha Adams, Thomas Wennekers, Angelo Cangelosi, Max Garagnani and Friedemann Pulvermueller, Plymouth University, United Kingdom; Freie Universitaet Berlin, Germany

In this work we describe how an existing neural model for learning Cell Assemblies (CAs) across multiple neuroanatomical brain areas has been integrated with a humanoid robot simulation to explore the learning of associations of visual and motor modalities. The results show that robust CAs are learned to enable pattern completion to select a correct motor response when only visual input is presented. We also show, with some parameter tuning and the pre-processing of more realistic patterns taken from images of real objects and robot poses the network can act as a controller for the robot in visuo-motor association tasks. This provides the basis for further neurorobotic experiments on grounded language learning.

10:40AM Grounding Fingers, Words and Numbers in a Cognitive Developmental Robot [#14928]

Alessandro Di Nuovo, Vivian De La Cruz and Angelo Cangelosi, Plymouth University, United Kingdom; University of Messina, Italy

The young math learner must make the transition from a concrete number situation, such as that of counting objects (fingers often being the most readily available), to that of using a written symbolic form that stands for the quantities the sets of objects come to represent. This challenging process is often coupled to that of learning a verbal number system that is not always transparent to children. A number of theoretical approaches have been advanced to explain aspects of how this transition takes place in cognitive development. The results obtained with the model presented here, show that a symbol grounding approach can be used to implement aspects of this transition in a cognitive robot. In the current extended version, the model develops finger and word representations, through the use of finger counting and verbal counting strategies, together with the visual representations of learned number symbols, which it uses to perform basic arithmetic operations. In the final training phases, the model is able to do this using only the number symbols as addends. We consider this an example of symbolic grounding, in that through the direct sensory experience with the body (finger counting), a category of linguistic symbol is learned (number words), and both types of representations subsequently serve to ground higher level (numerical) symbols, which are later used exclusively to perform the arithmetic operations.

11:00AM Neuromodulation Based Control of Autonomous Robots in ROS Environment [#15001]

Biswanath Samanta and Cameron Muhammad, Georgia Southern University, United States

The paper presents a control approach based on vertebrate neuromodulation and its implementation on autonomous robots in the open-source, open-access environment of robot operating system (ROS) within a cloud computing framework. A spiking neural network (SNN) is used to model the neuromodulatory function for generating context based behavioral responses of the robots to sensory input signals. The neural network incorporates three types of neurons- cholinergic and noradrenergic (ACh/NE) neurons for attention focusing and action selection, dopaminergic (DA) neurons for rewards- and curiosity-seeking, and serotonergic (5-HT) neurons for risk aversion behaviors. The model depicts description of neuron activity that is biologically realistic but computationally efficient to allow for large- scale simulation of thousands of neurons. The model is implemented using graphics processing units (GPUs) for parallel computing in real-time using the ROS environment. The model is implemented to study the risk-taking, risk-aversive, and distracted behaviors of the neuromodulated robots in single- and multi-robot configurations. The entire process is implemented in a distributed computing framework using ROS where the robots communicate wirelessly with the computing nodes through the on-board laptops. Results are presented for both single- and multi-robot configurations demonstrating interesting behaviors.

11:20AM Combined Linguistic and Sensor Models For Machine Learning [#14615]

Roman Ilin, Air Force Research Laboratory, United States

this work builds on a cognitive theory called dynamic logic and considers the relationship between language and cognition. We explore the idea of dual models that combine linguistic and sensor features. We demonstrate that simultaneous learning of textual and image data results in formation of meaningful concepts and subsequent improvement in concept recognition.

11:40AM Completion and Parsing Chinese Sentences Using Cogent Confabulation [#14861]

Zhe Li and Qinru Qiu, Department of Electrical Engineering and Computer Science, Syracuse University, United States

Among different languages' sentence completion and parsing, Chinese is of great difficulty. Chinese words are not naturally separated by delimiters, which imposes extra challenge. Cogent confabulation based sentence completion has been proposed for English. It fills in missing words in an English sentence while maintains the semantic and syntactic consistency. In this work, we improve the cogent confabulation model and apply it to sentence completion in Chinese. Incorporating trained knowledge in parts-of-speech tagging and Chinese word compound segmentation, the model does not only fill missing words in a sentence but also performs linguistic analysis of the sentence with a high accuracy. We further investigate the optimization of the model and trade-offs between accuracy and training/recall complexity. Experimental results show that the optimized model improves recall accuracy by 9% and reduces training and recall time by 18.6% and 53.7% respectively.

CIPLS'14 Session 1: Computational Intelligence in Production Systems

Wednesday, December 10, 10:20AM-12:00PM, Room: Bonaire 2, Chair: Fatih Tasgetiren and Raymond Chiong

10:20AM Hybrid Harmony Search Algorithm to minimize total weighted tardiness in permutation flow shop [#14554]

Mohammad Komaki, Shaya Sheikh and Ehsan Teymourian, Case Western Reserve University, United States; University of Baltimore, United States; Mazandaran University of Science and Technology, Iran

We address the permutation flow shop scheduling problem with sequence dependent setup times between jobs. Each job has its weight of importance as well as due date. The goal is to find sequence of jobs such that total weighted tardiness of jobs is minimized. Due to NP-Hard complexity of this problem, a hybrid meta-heuristic algorithm based on Harmony Search Algorithm is developed. In the proposed algorithm, a new acceptance criterion of new improvised harmony is suggested which allows the algorithm to explore the solution space in earlier iterations (diversification), and as algorithm progresses the acceptance criterion leads the algorithm to accept the solutions in neighborhood of the current solution, (intensification). In order to improve the search ability of the algorithm, Variable Neighborhood Search Algorithm is applied to improve the quality of generated harmony. The computational experiments based on well-known benchmark instances are conducted. Results show that the proposed algorithm outperforms other state of the art algorithm used for solving studied problem.

10:40AM A Coordination Mechanism for Capacitated Lot-sizing in Non-hierarchical N-tier Supply Chains [#14740]

Frieder Reiss and Tobias Buer, University of Bremen, Germany

In the context of an n-tier supply chain, a coalition of agents is considered that has to jointly solve a distributed multi-level capacitated lot-sizing problem in order to minimize the agents joint total costs. Due to asymmetric information between the agents, e.g., with respect to setup costs, inventory holding costs or available machine capacities, this problem cannot be solved by a single, central decision maker. Therefore, this paper introduces a coordination mechanism to enable collaborative planning by taking asymmetric information into account. Furthermore, the coordination mechanism is able to deal with non-hierarchical assignment of items to agents within a mutual bill of material. To evaluate the coordination mechanism, test instances for the classical multi-level capacitated lot sizing problem are extended. A computational study shows that the coordination mechanism works well for instances without setup times. That is, for these instances solution quality for the distributed case deviates on average by less than five percent from best-known solutions in the non- distributed case.

11:00AM An Iterated Greedy Algorithm for the Hybrid Flowshop Problem with Makespan Criterion [#14818]

Damla Kizilay, M. Fatih Tasgetiren, Quan-Ke Pan and Ling Wang, Yasar University, Turkey; Northeastern University in China, China; Tsinghua University, China

The main contribution of this paper is to present some novel constructive heuristics for the the hybrid flowshop scheduling (HFS) problem with the objective of minimizing the makespan for the first time in the literature. We developed the constructive heuristics based the profile fitting heuristic by exploiting the waiting time feature of the HFS problem. In addition, we also developed an IG algorithm with a simple insertion based local search for the first time in the literature, too. The benchmark suite developed for the HFS problem are used to test the performance of the constructive heuristics and the IG algorithm. The computational results show that constructive heuristics developed were able to further improve the traditional NEH heuristics for the HFS problem with makespan criterion. Furthermore, with a very short CPU times of 50nm miliseconds, the performance of the IG algorithm was very competitive to the PSO and AIS algorithms that were run for 1600 seconds.

11:20AM An agent-based approach to simulate production, degradation, repair, replacement and preventive maintenance of manufacturing systems [#14838]

Emanuel Federico Alsina, Giacomo Cabri and Alberto Regattieri, University of Modena and Reggio Emilia, Italy; University of Bologna, Italy

The capacity to reconfigure production systems is considered fundamental for today's factories because of increasing demand for a high-level customer service (in terms of lead time and price). For this reason, the ability to simulate the productivity of a specific production line configuration can be a great assistance to the decision making process. This paper presents a multi-agent model used to simulate the failure behavior of a complex line production. This approach offers a decentralized alternative to designing decision-making system based on the simulation of distributed entities. The model is able to independently manage the variations in production rates and the tendency to fail, caused by the degradation of machines, repair actions, and replacements. In addition, random failures and preventive maintenance on the manufacturing system of a single product were considered. The blackboard system and the contract net protocol have inspired the coordination of the productivity of the different machines in the production line, to simulate the most feasible and balanced productivity for different states of the line.

11:40AM Common Due-Window Problem: Polynomial Algorithms for a Given Processing Sequence [#14916]

Abhishek Awasthi, Joerg Laessig, Oliver Kramer and Thomas Weise, University of Applied Sciences Zittau/Goerlitz, Goerlitz, Germany; University of Applied Sciences Zittau/Goerlitz, Goelitz, Germany; University of Oldenburg, Germany; University of Science and Technology of China, China

The paper considers the Common Due-Window (CDW) problem where a certain number of jobs is processed on a single machine against a common due-window. Each job possesses different processing times but different and asymmetric earliness and tardiness penalties. The objective of the problem is to find the processing sequence of jobs, their completion times and the position of the given due-window to minimize the total penalty incurred due to tardiness and earliness of the jobs. This work presents exact polynomial algorithms for optimizing a given job sequence for a single machine with the run-time complexity of O(n^2), where n is the number of jobs. We also provide an O(n) algorithm for optimizing the CDW with unit processing times. The algorithms take a sequence consisting of all the jobs (J_i, i=1,2,\dots,n) as input and return the optimal completion times, which offers the minimum possible total penalty for the sequence. Furthermore, we implement our polynomial algorithm in conjunction with Simulated Annealing (SA) to obtain the best processing sequence. We compare our results with that of Biskup and Feldmann for different due-window lengths.

CIComms'14 Session 1: CI for Communications

Wednesday, December 10, 10:20AM-12:00PM, Room: Bonaire 3, Chair: Maode Ma and Paolo Rocca

10:20AM Multiplexing Communication Routes with Proxy-Network to Avoid Intentional Barriers in Large Scale Network [#14375]

Hiroshi Fujikawa, Hirofumi Yamaki, Yukiko Yamamoto and Setsuo Tsuruta, Shanghai Maruka Computer Information Technology Co. Ltd, Japan; Tokyo Denki University, Japan

It has become common to operate an IT system where client computers in offices in a country access cloud computers in another country via the Internet. On the other hand, in some countries including China, network communication is often shut down by governmental bodies, in addition to network outage caused by network attacks. In the presence of these intentional or deliberate interruptions, users of such systems need some countermeasures to avoid them. In this paper, we propose a method to form bypass routes which consists of application-level gateways, and intelligent routers, which are placed at offices where client computers are run, to select bypass routes based on the status of the Internet. A method for applying asymmetric criteria in order to decide whether to apply bypass routes is proposed for robust operation of Internet-based applications. In our approach, differential values of network latency are used for detecting intentional barriers, and absolute values to determine their ends. This method is applied in practice and supports the continuity of network based systems in China.

10:40AM Modeling and Reasoning in Context-Aware Systems based on Relational Concept Analysis and Description Logic [#14087]

Anne Marie Amja, Abdel Obaid and Petko Valtchev, Univ. Of Quebec at Montreal, Canada

As we are moving towards pervasive, ubiquitous and computing paradigm, the interest and research for context-aware systems have substantially taken interest over the past decade and has become the new era of anytime, anywhere and anything computing. Delivering acceptable services for the users requires services to be aware of their contexts and able to adapt automatically to their changing contexts. Context modeling is an important part of a context life cycle to deal and represent context whereas awareness implies reasoning about the context. Each context modeling approach brings along a reasoning method. In this paper, we propose to model the context based on relational concept analysis, an extension of formal concept analysis, and employ the existing mapping rules between the source entity of relational concept analysis and the targeted element of description logic to obtain a FL-E knowledge base and be able to reason about context.

11:00AM Call Drop Minimization using Fuzzy Associated Memory [#14488]

Moses Ekpenyong, Inemesit Ekarika and Imeh Umoren, University of Uyo, Nigeria; Akwa Ibom State University, Nigeria

In this paper, a Fuzzy associated memory approach is adopted to minimize the effect of drop calls in wireless cellular networks. To implement this approach, a number of factors that contribute to call dropping in CDMA networks were identified and data for these factors collected from an operational telecommunication carrier. These data were then used to establish the membership functions for driving the fuzzy inference engine, and through extensive simulations, the overall efficiencies for the existing and optimized forms of the system were obtained. It was observed that as the traffic got burstier, the existing system failed, compared to the optimized system which sustained the efficiency at about 72%. Furthermore, the optimized system exhibited fair allocation of system resources, effectively managing processes such as handovers, and, precluding unnecessary wastage of the system resources. The performance of the optimized system, however, degraded when the drop call probability exceeded the recommended threshold of 0.02. In practical systems, this constraint is obligatory to avert severe network degradation. The interactive effect of the selected factors on the network efficiency was also investigated. We observed the independence of some of these factors, as the drop call probability and system efficiency remained unchanged. But as more channels became available for the growing number of users, there was need for optimal configuration settings to avert scenarios that may negatively impact on the overall system performance.

11:20AM ANN Based Optimization of Resonating Frequency of Split Ring Resonator [#14719]

Kumaresh Sarmah, Kandarpa Kumar Sarma and Sunandan Baruah, Gauhati University, India; Assam Don Bosco University, India

It has been found that resonating frequency of split ring resonator depends on its physical dimension of the split structure such as width, gap and radius. The best possible combinations of all such physical parameters provide the proper resonating frequency over which the metamaterial property of the structure can be obtained. Artificial Neural Network (ANN) is found to be one of the popular solutions for optimization and prediction issues. In this paper, we report the development of an ANN based soft computational framework for designing a circular split ring resonator for wireless application. Here, a trained Multi Layered Perceptron (MLP) ANN is used for optimizing the best possible combination of physical dimension for determining the resonate behavior of a split ring resonator (SRR) for antenna design.

11:40AM Using Evolutionary Algorithms for Channel Assignment in 802.11 Networks [#14673]

Marlon Lima, Thales Rodrigues, Rafael Alexandre, Ricardo Takahashi and Eduardo Carrano, UFOP, Brazil; UFMG, Brazil

Two evolutionary algorithms are proposed in this paper to handle with access point channel assignment in Wireless Local Area Network. The objective considered is to minimize the maximum level of interference experienced by the users. Two deterministic heuristics, commonly employed in the considered problem, are used as benchmark. The paper is focused on the IEEE 802.11ac standard, which operates exclusively in the 5 GHz band. This standard provides a bigger number of non-overlapped channels and higher throughput. Tests in three different scenarios and configurations, using channel width of 20, 40 and 80 MHz, are performed.

SDE'14 Session 1: Algorithms

Wednesday, December 10, 10:20AM-12:00PM, Room: Bonaire 4, Chair: Ferrante Neri

10:20AM Differential Evolution with Dither and Annealed Scale Factor [#14058]

Deepak Dawar and Simone Ludwig, North Dakota State University, United States

Differential Evolution (DE) is a highly competitive and powerful real parameter optimizer in the diverse community of evolutionary algorithms. The performance of DE depends largely upon its control parameters and is quite sensitive to their appropriate settings. One of those parameters commonly known as scale factor or F, controls the step size of the vector differentials during the search. During the exploration stage of the search, large step sizes may prove more conducive while during the exploitation stage, smaller step sizes might become favorable. This work proposes a simple and effective technique that alters F in stages, first through random perturbations and then through the application of an annealing schedule. We report the performance of the new variant on 20 benchmark functions of varying complexity and compare it with the classic DE algorithm (DE/Rand/1/bin), two other scale factor altering variants, and state of the art, SaDE.

10:40AM A Competitive Coevolution Scheme Inspired by DE [#14193]

Gudmundur Einarsson, Thomas Runarsson and Gunnar Stefansson, University of Iceland, Iceland

A competitive coevolutionary algorithm is used as a metaheuristic for making a combination of optimization algorithms more robust against poorly chosen starting values. Another objective of the coevolutionary algorithm is to minimize the computation time while still achieving convergence. Two scenarios are created. The species in the coevolution are parameters for the optimization procedure (called predators) and parameters defining starting points for the optimization algorithms (called prey). Two functions are considered for the prey and two algorithms are explored for the predators, namely simulated annealing and BFGS. The creation and selection of new individuals in the coevolution is done analogously to that of DE. The historical evolution of the prey is explored as a potential diagnostics tool for multimodality.

11:00AM Performance Comparison of Local Search Operators in Differential Evolution for Constrained Numerical Optimization Problems [#14455]

Saul Dominguez-Isidro, Efren Mezura-Montes and Guillermo Leguizamon, University of Veracruz, Mexico; National University of San Luis, Argentina

This paper analyzes the relationship between the performance of the local search operator within a Memetic Algorithm and its final results in constrained numerical optimi- zation problems by adapting an improvement index measure, which indicates the rate of fitness improvement made by the local search operator. To perform this analysis, adaptations of Nealder-Mead, Hooke-Jeeves and Hill Climber algorithms are used as local search operators, separately, in a Memetic DE-based structure, where the best solution in the population is used to exploit promising areas in the search space by the aforementioned local search operators. The epsilon-constrained method is adopted as a constraint-handling technique. The approaches are tested on thirty six benchmark problems used in the special session on "Single Objective Constrained Real-Parameter Optimization" in CEC'2010. The results suggest that the algorithm coordination proposed is suitable to solve constrained problems and those results also show that a poor value of the improvement index measure does not necessarily reflect on poor final results obtained by the MA in a constrained search space.

11:20AM A Study on Self-configuration in the Differential Evolution Algorithm [#14632]

Rodrigo Silva, Rodolfo Lopes, Alan Freitas and Frederico Guimaraes, McGill University, Canada; Universidade Federal de Minas Gerais, Brazil; Universidade Federal de Ouro Preto, Brazil

The great development in the area of evolutionary algorithms in recent decades has increased the range of applications of these tools and improved its performance in different fronts. In particular, the Differential Evolution (DE) algorithm has proven to be a simple and efficient optimizer in several contexts. Despite of its success, its performance is closely related to the choice of variation operators and the parameters which control these operators. To increase the robustness of the method and the ease of use for the average user, the pursuit for methods of self-configuration has been increasing as well. There are several methods in the literature for setting parameters and operators. In order to understand the effects of these approaches on the performance of DE, this paper presents a thorough experimental analysis of the main existing paradigms. The results show that simple approaches are able to bring significant improvements to the performance of DE.

11:40AM Comparative Analysis of a Modified Differential Evolution Algorithm Based on Bacterial Mutation Scheme [#14661]

Rawaa Al-Dabbagh, Janos Botzheim and Mohanad Al-Dabbagh, University of Malaya, Malaysia; Tokyo Metropolitan University, Japan; Al-Mamon University College, Iraq

A new modified differential evolution algorithm DE-BEA, is proposed to improve the reliability of the standard DE/current-to-rand/1/bin by implementing a new mutation scheme inspired by the bacterial evolutionary algorithm (BEA). The crossover and the selection schemes of the DE method are also modified to fit the new DE-BEA mechanism. The new scheme diversifies the population by applying to all the individuals a segment based scheme that generates multiple copies (clones) from each individual one-by-one and applies the BEA segment-wise mechanism. These new steps are embedded in the DE/current-to-rand/bin scheme. The performance of the new algorithm has been compared with several DE variants over eighteen benchmark functions including several CEC 2005 test problems and it shows reliability in most of the test cases.

CICS'14 Session 1

Wednesday, December 10, 10:20AM-12:00PM, Room: Bonaire 5, Chair: El-Sayed El-Alfy and Dipankar Dasgupta

10:20AM Biobjective NSGA-II for Optimal Spread Spectrum Watermarking of Color Frames: Evaluation Study [#14264]

El-Sayed El-Alfy and Ghaleb Asem, King Fahd University of Petroleum and Minerals, Saudi Arabia

In this work, a spread spectrum watermarking optimization algorithm is explored for digital color images using biobjective genetic algorithms and full-frame discrete-cosine transform. The aim of optimization is to generate the trade-off curve, a.k.a. optimal Pareto points, of watermark imperceptibility and robustness. The watermark imperceptibility is evaluated using the Structural SIMilarity (SSIM) index between the original image and the watermarked image whereas the watermark robustness is evaluated in terms of the Normalized Correlation Coefficient (NCC) between the original watermark and the recovered watermark. The watermarked image is susceptible to various types of attacks or processing distortions such as additive Gaussian noise, pepper-and-salt noise, JPEG compression, camera motion and median filtering. For the biobjective genetic algorithm, we used the fast elitist Non-dominated Sorting Genetic Algorithm (NSGA-II). We reviewed related work and investigated two color spaces (YCbCr and HSV) in addition to gray scale images where embedding is conducted in different frames and various distortions are applied before the extraction of the watermark. The results are compared for various cases under similar conditions.

10:40AM G-NAS: A Grid-Based Approach for Negative Authentication [#14559]

Dipankar Dasgupta, Denise Ferebee, Sanjib Saha, Abhijit Kumar Nag, Alvaro Madero, Abel Sanchez, John Williams and Kul Prasad Subedi, The University of Memphis, United States; MIT, United States

Surveys show that more than 80% authentication systems are password based, and these systems are increasing under direct and indirect attacks every day. In an effort to alleviate the security situation, the concept of negative authentication was introduced [9]. In a Negative Authentication System (NAS), the password profile or positive profile is called self-region; any element outside this self-region is defined as the non-self-region. Then anti-password detectors (clusters) are generated which cover most of the non-self-region while leaving some space uncovered for obfuscation purpose. In this work, we investigate a Grid-based NAS approach, called G-NAS, where anti-password detectors are generated deterministically; this approach allows faster detector generation compared to previous NAS approaches. We reported some experimental results of G-NAS using different real-world password datasets. These realistic experiments show that significant improvements can be achieved when compared with earlier NAS approaches. Results also demonstrate the efficiency of the proposed approach in detecting guessing attacks and appears to be more robust and scalable with respect to the size of password profiles and able to update of detector sets on-the-fly

11:00AM User Identification Through Command History Analysis [#14949]

Foaad Khosmood, Phillip Nico and Jonathan Woolery, California Polytechnic State University, United States

As any veteran of the editor wars can attest, Unix users can be fiercely and irrationally attached to the commands they use and the manner in which they use them. In this work, we investigate the problem of identifying users out of a large set of candidates (25 to 97) through their command-line histories. Using standard algorithms and feature sets inspired by natural language authorship attribution literature, we demonstrate conclusively that individual users can be identified with a high degree of accuracy through their command-line behavior. Further, we report on the best performing feature combinations, from the many thousands that are possible, both in terms of accuracy and generality. We validate our work by experimenting on three user corpora comprising data gathered over three decades at three distinct locations. These are the Greenberg user profile corpus (168 users), Schonlau masquerading corpus (50 users) and Cal Poly command history corpus (97 users). The first two are well known corpora published in 1991 and 2001 respectively. The last is developed by the authors in a year-long study in 2014 and represents the most recent corpus of its kind. For a 50 user configuration, we find feature sets that can successfully identify users with over 90% accuracy on the Cal Poly, Greenberg and one variant of the Schonlau corpus, and over 87% on the other Schonlau variant.

11:20AM Quantifying the Impact of Unavailability in Cyber-Physical Environments [#14983]

Anis Ben Aissa, Robert Abercrombie, Frederick Sheldon and Ali Mili, University of Tunis El Manar, Tunisia; Oak Ridge National Laboratory, United States; University of Memphis, United States; New Jersey Institute of Technology, United States

The Supervisory Control and Data Acquisition (SCADA) system discussed in this work manages a distributed control network for the Tunisian Electric and Gas Utility. The network is dispersed over a large geographic area that monitors and controls the flow of electricity/gas from both remote and centralized locations. The availability of the SCADA system in this context is critical to ensuring the uninterrupted delivery of energy, including safety, security, continuity of operations and revenue. Such SCADA systems are the backbone of national critical cyber-physical infrastructures. Herein, we propose adapting the Mean Failure Cost (MFC) metric for quantifying the cost of unavailability. This new metric combines the classic availability formulation with MFC. The resulting metric, so-called Econometric Availability (EA), offers a omputational basis to evaluate a system in terms of the gain/loss ($/hour of operation) that affects each stakeholder due to unavailability.

CIEL'14 Session 1: Ensemble Classifiers

Wednesday, December 10, 10:20AM-12:00PM, Room: Bonaire 6, Chair: Alok Kanti Deb and Michal Wozniak

10:20AM Experiments on Simultaneous Combination Rule Training and Ensemble Pruning Algorithm [#14856]

Bartosz Krawczyk and Michal Wozniak, Wroclaw University of Technology, Poland

Nowadays many researches related to classifier design are trying to exploit strength of the ensemble learning. Such hybrid approach looks for the valuable combination of individual classifiers' outputs, which should at least outperforms quality of the each available individuals. Therefore the classifier ensembles are recently the focus of intense research. Basically, it faces with two main problems. On the one hand we look for the valuable, highly diverse pool of individual classifiers, i.e., they are expected to be mutually complimentary. On the other hand we try to propose

an optimal combination of the individuals' outputs. Usually, mentioned above tasks are considering independently, i.e., there are several approaches which focus on the ensemble pruning only for a given combination rule, while the others works are devoted to the problem how to find an optimal combination rule for a fixed line-up of classifier pool. In this work we propose to put ensemble pruning and combination rule training together and consider them as the one optimization task. We employ a canonical genetic algorithm to find the best ensemble line-up and in the same time the best set-up of the combination rule parameters. The proposed concept (called CRUMP - simultaneous Combination RUle training and enseMble Pruning) was evaluated on the basis the wide range of computer experiments, which confirmed that this is the very promising direction which is able to outperform the traditional approaches focused on either the ensemble pruning or combination rule.

10:40AM Fast Image Segmentation based on Boosted Random Forests, Integral Images, and Features On Demand [#15087]

Uwe Knauer and Udo Seiffert, Fraunhofer IFF, Germany

The paper addresses the tradeoff between speed and quality of image segmentation typically found in real-time or high-throughput image analysis tasks. We propose a novel approach for high-quality image segmentation based on a rich and high-dimensional feature space and strong classifiers. To enable fast feature extraction in color images, multiple integral images are used. A decision tree based approach based on two-stage Random Forest classifiers is utilized to solve several binary as well as multiclass segmentation problems. It is an intrinsic property of the tree based approach, that any decision is based on a small subset of input features only. Hence, analysis of the tree structures enables a sequential feature extraction. Runtime measurements with several real-world datasets show that the approach enables fast high-quality segmentation. Moreover, the approach can be easily used in parallel computation frameworks because calculation of integral images as well as computation of individual decisions can be done separately. Also, the number of base classifiers can be easily adapted to meet a certain time constraint.

11:00AM Ensemble based Classification using Small Training sets : A Novel Approach [#14811]

Krishnaveni C Venkata and Sobha Rani Timmappareddy, University of Hyderabad, India

Classification is a supervised learning technique. It develops a classification model by using typically, two- thirds of the given annotated data set(training set) and uses the developed model to label the unseen instances(test set). Here, we developed a frame work which uses less than one-third of the data set for training and tests the remaining two-thirds of the data and still gives results comparable to other classifiers. To achieve good classification accuracy with small training sets, we focus on three issues: The first is that, one- third(30%) of the data should represent the entire data set. The second is on increasing the classification accuracy even with these small training sets, and the third issue is on taking care of deviations in the small training sets like noise or outliers. To address the first issue, we proposed three methods: Divide the instances into 10 bins based on their distances from the centroid, a reference point 3/2(min+max) and a distribution specific binning. The second issue is dealt using the concept of ensemble based weighted majority voting for classification. To handle the third issue, we implemented four filters on training sets. The experiments are conducted on five binary class data sets by taking only 10% to 18% of the data for training and implemented the proposed three methods without any filters for noise and outlier removal and with them too on the training sets. We compare our results with two popular ensemble methods Ada-boost and Bagging ensemble techniques, ENN, CNN, RNN instance selection methods and the empirical analysis shows that our three proposed methods yield comparable classification results to those available in literature which use small training sets.

CIR2AT'14 Session 1: Robotic Assistive Technology

Wednesday, December 10, 10:20AM-12:00PM, Room: Bonaire 7, Chair: Georgios Kouroupetroglou

10:20AM VirtuNav: A Virtual Reality Indoor Navigation Simulator with Haptic and Audio Feedback for the Visually Impaired [#14037]

Catherine Todd, Swati Mallya, Sara Majeed, Jude Rojas and Katy Naylor, University of Wollongong in Dubai, United Arab Emirates; Moorfields Eye Hospital Dubai, United Arab Emirates

VirtuNav provides a haptic-enabled Virtual Reality (VR) environment that facilitates persons with visual impairment to explore a 3D computerized model of a real-life indoor location, such as a classroom or hospital. For administrative purposes, the screen displays a 2D overhead view of the map to monitor user progress and location in the environment as well as the reconstructed 3D environment itself. The system offers two unique interfaces: a free-roam interface where the user can freely navigate and interact with the environment, and an edit mode where the administrator can manage test users, manage maps and retrieve test data. VirtuNav is developed as a practical application offering several unique features including map design, semi- automatic 3D map reconstruction and object classification from 2D map data. Visual and haptic rendering of real-time 3D map navigation are provided as well as automated administrative functions including determination of shortest path taken, comparison with the actual path taken, and assessment of performance indicators relating to time taken for exploration and collision data. VirtuNav is a research tool for investigation of user familiarity developed after repeated exposure to the indoor location, to determine the extent to which haptic and/or sound cues can improve a visually impaired user's ability to navigate a room or building with or without occlusion. System testing reveals that spatial awareness and memory mapping improve with user iterations within the VirtuNav environment.

10:40AM A Guidance Robot for the Visually Impaired: System Description and Velocity Reference Generation [#14844]

Hironori Ogawa, Kazuteru Tobita, Katsuyuki Sagayama and Masayoshi Tomizuka, NSK Ltd., Japan; University of California at Berkeley, United States

This paper presents a guidance robot for the visually impaired along with generation of velocity reference signals. The guidance robot has an interface grip with a force sensor on the top. The robot can be operated intuitively through the interface grip, and at the same time, the position and the behavior of the robot can be provided to the user. An underactuated mobile mechanism is used. It can be moved in X and Y directions and is unconstrained in turning direction. The rotation center of the robot is determined by the user's position. Environmental sensors are equipped for avoiding obstacles and hazards. In addition, the robot has redundant anti-falling systems for safety. The systems work independently from the environmental sensors. The robot is lightweight, foldable, and easy to carry. A versatile time-optimal reference generation algorithm is proposed for the robot's velocity reference. The algorithm can set the bounds for the acceleration, jerk, and snap. Moreover, initial conditions and final conditions of the velocity, acceleration, and jerk can be specified. The switching surfaces are obtained with

these parameters in the three-dimensional phase space, which allows the determination of the snap command for easy motion pattern generation. These parameters are changeable online.

11:00AM Assistive Mobile Manipulation for Self-Care Tasks Around the Head [#14988]

Kelsey P. Hawkins, Phillip M. Grice, Tiffany L. Chen, Chih-Hung King and Charles C. Kemp, Georgia Institute of Technology, United States

Human-scale mobile robots with arms have the potential to assist people with a variety of tasks. We present a proof-of-concept system that has enabled a person with severe quadriplegia named Henry Evans to shave himself in his own home using a general purpose mobile manipulator (PR2 from Willow Garage). The robot primarily provides assistance by holding a tool (e.g., an electric shaver) at user-specified locations around the user's head, while he/she moves his/her head against it. If the robot detects forces inappropriate for the task (e.g., shaving), it withdraws the tool. The robot also holds a mirror with its other arm, so that the user can see what he/she is doing. For all aspects of the task, the robot and the human work together. The robot uses a series of distinct semi-autonomous subsystems during the task to navigate to poses next to the wheelchair, attain initial arm configurations, register a 3D model of the person's head, move the tool to coarse semantically-labeled tool poses (e.g, ``Cheek''), and finely position the tool via incremental movements. Notably, while moving the tool near the user's head, the robot uses an ellipsoidal coordinate system attached to the 3D head model. In addition to describing the complete robotic system, we report results from Henry Evans using it to shave both sides of his face while sitting in his wheelchair at home. He found the process to be long (54 minutes) and the interface unintuitive. Yet, he also found the system to be comfortable to use, felt safe while using it, was satisfied with it, and preferred it to a human caregiver.

11:20AM A Novel Approach of Prosthetic Arm Control using Computer Vision, Biosignals, and Motion Capture [#15000]

Harold Martin, Jaime Donaw, Robert Kelly, Youngjin Jung and Jong-Hoon Kim, Florida International University, United States; Louisiana State University, United States

Traditional prosthetics are controlled using EMG readings, which allow the user to control only one degree of freedom at a time. This creates a serious disadvantage compared to a biological arm because it constrains the fluid motion and dynamic functionality of the device. We present a novel architecture for controlling a transhumeral prosthetic device through the combination of a computer vision algorithm operating on "eye gaze" data with traditional prosthesis control methods and operator's motion capture data. This sensor fusion algorithm allows the prosthetic device to locate itself in a 3D environment as well as the locations of objects of interest. Moreover, this architecture enables a more seamless motion and intuitive control of the prosthetic device. In this paper, we demonstrate the feasibility of this architecture and its implementation with a prototype.

11:40AM Tactile pitch feedback system for deafblind or hearing impaired persons -Singing accuracy of hearing persons under conditions of added noise- [#14862]

Masatsugu Sakajiri, Shigeki Miyoshi, Junji Onishi, Tsukasa Ono and Tohru Ifukube, Tsukuba University of Technology, Japan; The University of Tokyo, Japan

Deafblind and hearing impaired persons cannot perceive their own voice pitch, and thus have difficulty controlling it. While singing, the voice pitch needs to be controlled to maintain a stable tone. To address this problem, a tactile voice pitch control system was developed to assist such people in singing. In a previous study, two deafblind subjects used the proposed system to control their voice pitch with accuracy comparable to that of the hearing children. In the present study, we investigate the proprioceptive pitch control and the effect of the proposed voice pitch control system on normal-hearing people under conditions of added noise. The results show that the total average mean deviation without tactile feedback is 405.6 cents (SD: 42.4), whereas, with tactile feedback, it is 57.5 cents (SD: 12.2).

CIMSIVP'14 Session 1: Action Recognition

Wednesday, December 10, 10:20AM-12:00PM, Room: Bonaire 8, Chair: Nizar Bouguila

10:20AM Stereoscopic Video Description for Human Action Recognition [#14152]

Ioannis Mademlis, Alexandros Iosifidis, Anastasios Tefas, Nikos Nikolaidis and Ioannis Pitas, Aristotle University of Thessaloniki, Greece

In this paper, a stereoscopic video description method is proposed that indirectly incorporates scene geometry information derived from stereo disparity, through the manipulation of video interest points. This approach is flexible and able to cooperate with any monocular low-level feature descriptor. The method is evaluated on the problem of recognizing complex human actions in natural settings, using a publicly available action recognition database of unconstrained stereoscopic 3D videos, coming from Hollywood movies. It is compared both against competing depth-aware approaches and a state-of-the-art monocular algorithm. Experimental results denote that the proposed approach outperforms them and achieves state-of-the-art performance.

10:40AM Cascade Dictionary Learning for Action Recognition [#15083]

Jian Dong, Changyin Sun and Chaoxu Mu, Southeast University, China

In this paper, we propose a cascade dictionary learning algorithm for action recognition. In the first stage, a dictionary for basic sparse coding is learned based on local descriptors. And then spatial pyramid features are extracted to represent all the images in the same dimensions. Instead of performing dimension reduction, all the features are regrouped and then fed into second dictionary learning. In the second stage, a supervised dictionary for block and group sparse coding is learned to get discriminative representations based on the regrouped features. Without lowering classification performance, the size of the second dictionary is much smaller than other dictionary based on spatial pyramid features. We evaluate our algorithm on two publicly available databases about action recognition: Willows and People Playing Music Instrument. The numerical results show the effectiveness of the proposed algorithm.

11:00AM Human Action Recognition using Normalized Cone Histogram Features [#14678]

Stephen Karungaru, Terada Kenji and Fukumi Minoru, University of Tokushima, Japan

In this paper, we propose a normalized cone histogram features method to recognize human actions in video clips. The cone features are extracted based not on the center of gravity as is common, but on the head position of the extracted human region. Initially, the head, hands and legs positions are determined. Thereafter, the distances and orientations between the head and the hands and legs are the extracted and employed as the features. The histogram's x-axis represents the orientations and the y-axis the distances. To make the method invariant to human region sizes, the features are normalized using the L2 normalization technique. The classification method used was the perceptron neural network. We conducted experiments using the ucf-sports-actions database to verify the effectiveness of our approach. We achieved an accuracy of about 75% on a selected test set.

11:20AM Fuzzy Rules based Indoor Human Action Recognition using Multi Cameras [#14680]

Masayuki Daikoku, Stephen Karungaru and Kenji Terada, University of Tokushima, Japan

In this paper, we propose a method for recognizing human actions indoors using fuzzy rules and multi cameras. To recognize the human actions, initially, we use the background difference method to extract human area candidates. We then extract HOG features and learn to detect humans using the features and AdaBoost. Fuzzy rules are then used of detect the human actions. The detected human is determined to be stationary or not using the distance between the detected areas in consecutive frames. We also estimate the direction the human is facing using the width of detection, and finally recognize the standard action using the height of the detected region. In addition, we recognize suspicious action using duration of detection and presence of abandoned object. After experiments, recognition accuracy achieved for "walking" and "stop" actions is about 87% , for "running" action about 54%, for "sitting" about 96%, for "desk working" about 83%, and "falling" about 88%.

11:40AM Improving Codebook generation for action recognition using a mixture of Asymmetric Gaussians [#15009]

Tarek Elguebaly and Nizar Bouguila, Concordia University, Canada

Human activity recognition is a crucial area of computer vision research and applications. The goal of human activity recognition aims to automatically analyze and interpret ongoing events and their context from video data. Recently, the bag of visual words (BoVW) approach has been widely applied for human action recognition. Generally, a representative corpus of videos is used to build the Visual Words dictionary or codebook using a simple k-means clustering approach. This visual dictionary is then used to quantize the extracted features by simply assigning the label of the closest cluster centroid using Euclidean distance between the cluster centers and the input descriptor. Thus, each video can be represented as a frequency histogram over visual words. However, the BoVW approach has several limitations such as its need for a predefined codebook size, dependence on the chosen set of visual words, and the use of hard assignment clustering for histogram creation. In this paper, we are trying to overcome these issues by using a mixture of Asymmetric Gaussians to build the codebook. Our method is able to identify the best size for our dictionary in an unsupervised manner, to represent the set of input feature vectors by an estimate of their density distribution, and to allow soft assignments. Furthermore, we validate the efficiency of the proposed algorithm for human action recognition.

ADPRL'14 Reinforcement Learning 1: Representation and Function Approximation

Wednesday, December 10, 10:20AM-12:00PM, Room: Curacao 1, Chair: Olivier Pietquin and Joschka Boedecker

10:20AM Approximate Real-Time Optimal Control Based on Sparse Gaussian Process Models [#14804]

Joschka Boedecker, Jost Tobias Springenberg, Jan Wuelfing and Martin Riedmiller, University of Freiburg, Germany

In this paper we present a fully automated approach to (approximate) optimal control of non-linear systems. Our algorithm jointly learns a non-parametric model of the system dynamics - based on Gaussian Process Regression (GPR) - and performs receding horizon control using an adapted iterative LQR formulation. This results in an extremely data-efficient learning algorithm that can operate under real-time constraints. When combined with an exploration strategy based on GPR variance, our algorithm successfully learns to control two benchmark problems in simulation (two-link manipulator, cart-pole) as well as to swing-up and balance a real cart-pole system. For all considered problems learning from scratch, that is without prior knowledge provided by an expert, succeeds in less than 10 episodes of interaction with the system.

10:40AM Subspace Identification for Predictive State Representation by Nuclear Norm Minimization [#14797]

Hadrien Glaude, Olivier Pietquin and Cyrille Enderli, Thales Airborne Systems, France; University Lille 1, France

Predictive State Representations (PSRs) are dynamical systems models that keep track of the system's state using predictions of future observations. In contrast to other models of dynamical systems, such as partially observable Markov decision processes, PSRs produces more compact models and can be consistently learned using statistics of the execution trace and spectral decomposition. In this paper we make a connection between rank minimization problems and learning PSRs. This allows us to derive a new algorithm based on nuclear norm minimization. In addition to estimate automatically the dimension of the system, our algorithm compares favorably with the state of art on randomly generated realistic problems of different sizes.

11:00AM Active Learning for Classification: An Optimistic Approach [#14316]

Timothe Collet and Olivier Pietquin, Supelec, MaLIS Research group, GeorgiaTech-CNRS UMI 2958, France; University Lille 1, LIFL (UMR 8022 CNRS / Lille 1), SequeL Team, France

In this paper, we propose to reformulate the active learning problem occurring in classification as a sequential decision making problem. We particularly focus on the problem of dynamically allocating a fixed budget of samples. This raises the problem of the trade off between exploration and exploitation which is traditionally addressed in the framework of the multi-armed bandits theory. Based on previous work on bandit theory applied to active learning for regression, we introduce four novel algorithms for solving the online allocation of the budget in a classification problem. Experiments on a generic classification problem demonstrate that these new algorithms compare positively to state-of-the-art methods.

11:20AM Accelerated Gradient Temporal Difference Learning Algorithms [#14191]

Dominik Meyer, Remy Degenne, Ahmed Omrane and Hao Shen, Technische Universitaet Muenchen, Germany

In this paper we study Temporal Difference (TD) Learning with linear value function approximation. The classic TD algorithm is known to be unstable with linear function approximation and off-policy learning. Recently developed Gradient TD (GTD) algorithms have addressed this problem successfully. Despite their prominent properties of good scalability and convergence to correct solutions, they inherit the potential weakness of slow convergence as they are a stochastic gradient descent algorithm. Accelerated stochastic gradient descent algorithms have been developed to speed up convergence, while still keeping computational complexity low. In this work, we develop an accelerated stochastic gradient descent method for minimizing the Mean Squared Projected Bellman Error (MSPBE), and derive a bound for the Lipschitz constant of the gradient of the MSPBE, which plays a critical role in our proposed accelerated GTD algorithms. Our comprehensive numerical experiments demonstrate promising performance in solving the policy evaluation problem, in comparison to the GTD algorithm family. In particular, accelerated TDC surpasses state-of-the-art algorithms.

11:40AM Convergent Reinforcement Learning Control with Neural Networks and Continuous Action Search [#14527]

Minwoo Lee and Charles Anderson, Colorado State University, United States

We combine a convergent TD-learning method and direct continuous action search with neural networks for function approximation to obtain both stability and generalization over inexperienced state-action pairs. We extend linear Greedy-GQ to nonlinear neural networks for convergent learning. Direct continuous action search with back-propagation leads to efficient high-precision control. A high dimensional continuous state and action problem, octopus arm control, is examined to test the proposed algorithm. Comparing TD, linear Greedy-GQ, and nonlinear Greedy-GQ, we discuss how the correction term contributes to learning with nonlinear Greedy-GQ algorithm and how continuous action search contributes to learning speed and stability.

CIDM'14 Session 1: Advances in clustering

Wednesday, December 10, 10:20AM-12:00PM, Room: Curacao 2, Chair: Barbara Hammer

10:20AM Clustering data over time using kernel spectral clustering with memory [#14071]

Rocco Langone, Raghvendra Mall and Johan Suykens, KU LEUVEN (ESAT-STADIUS), Belgium

This paper discusses the problem of clustering data changing over time, a research domain that is attracting increasing attention due to the increased availability of streaming data in the Web 2.0 era. In the analysis conducted throughout the paper we make use of the kernel spectral clustering with memory (MKSC) algorithm, which is developed in a constrained optimization setting. Since the objective function of the MKSC model is designed to explicitly incorporate temporal smoothness, the algorithm belongs to the family of evolutionary clustering methods. Experiments over a number of real and synthetic datasets provide very interesting insights in the dynamics of the clusters evolution. Specifically, MKSC is able to handle objects leaving and entering over time, and recognize events like continuing, shrinking, growing, splitting, merging, dissolving and forming of clusters. Moreover, we discover how one of the regularization constants of the MKSC model, referred as the smoothness parameter, can be used as a change indicator measure. Finally, some possible visualizations of the cluster dynamics are proposed.

10:40AM Agglomerative Hierarchical Kernel Spectral Data Clustering [#14073]

Raghvendra Mall, Rocco Langone and Johan Suykens, KU Leuven, Belgium

In this paper we extend the agglomerative hierarchical kernel spectral clustering (AH-KSC [1,3]) technique from networks to datasets and images. The kernel spectral clustering (KSC) technique builds a clustering model in a primal-dual optimization framework. The dual solution leads to an eigen-decomposition. The clustering model consists of kernel evaluations, projections onto the eigenvectors and a powerful out-of-sample extension property. We first estimate the optimal model parameters using the balanced angular fitting (BAF) [2] criterion. We then exploit the eigen-projections corresponding to these parameters to automatically identify a set of increasing distance thresholds. These distance thresholds provide the clusters at different levels of hierarchy in the dataset which are merged in an agglomerative fashion as shown in [3,4}. We showcase the effectiveness of the AH-KSC method on several datasets and real world images. We compare the AH-KSC method with several agglomerative hierarchical clustering techniques and overcome the issues of hierarchical KSC technique proposed in [5].

11:00AM Quantum Clustering -- A Novel Method for Text Analysis [#14293]

Ding Liu, Minghu Jiang and Xiaofang Yang, Tianjin Polytechnic University, China; Tsinghua University, China

The article introduces quantum clustering inspired from the quantum mechanics and extended to text analysis. This novel method upgrades the nonparametric density estimation and, different from the latter, quantum clustering constructs the potential function to determine the cluster center instead of the Gaussian kernel function. The result of a comparative experiment proves the advantage of quantum clustering over the conventional Parzen-window, and the further trial on authorship identification illustrates the wide application scope of this novel method.

11:20AM Generalized Information Theoretic Cluster Validity Indices for Soft Clusterings [#14317]

Yang Lei, James C. Bezdek, Jeffrey Chan, Nguyen Xuan Vinh, Simone Romano and James Bailey, The University of Melbourne, Australia

There have been a large number of external validity indices proposed for cluster validity. One such class of cluster comparison indices is the information theoretic measures, due to their strong mathematical foundation and their ability to detect non-linear relationships. However, they are devised for evaluating crisp (hard) partitions. In this paper, we generalize eight information theoretic crisp indices to soft clusterings, so that they can be used with partitions of any type (i.e., crisp or soft, with soft including fuzzy, probabilistic and possibilistic cases). We present experimental results to demonstrate the effectiveness of the generalized information theoretic indices.

11:40AM A Density-Based Clustering of the Self-Organizing Map Using Graph Cut [#14965]

Leonardo Enzo Brito da Silva and Jose Alfredo Ferreira Costa, Universidade Federal do Rio Grande do Norte, Brazil

In this paper, an algorithm to automatically cluster the Self-Organizing Map (SOM) is presented. The proposed approach consists of creating a graph based on the SOM grid, whose connection strengths are measured in terms of pattern density. The connection of this graph are filtered in

order to remove the mutually weakest connections between two adjacent neurons. The remaining graph is then pruned after transposing its connections to a second slightly larger graph by using a blind search algorithm that aims to grow the seed of the cluster's boundaries until they reach the outermost nodes of the latter graph. Values for the threshold regarding the minimum size of the seeds are scanned and possible solutions are determined. Finally, a figure of merit that evaluates both the connectedness and separation selects the optimal partition. Experimental results are depicted using synthetic and real world datasets.

Special Session: SIS'14 Session 1: Theory and Applications of Nature-Inspired Optimization Algorithms I

Wednesday, December 10, 10:20AM-12:00PM, Room: Curacao 3, Chair: Xin-She Yang and Xingshi He

10:20AM Evolving Novel Algorithm Based on Intellectual Behavior of Wild Dog Group as Optimizer [#14022]

Avtar Buttar, Ashok Goel and Shakti Kumar, Punjab Technical University, Jalandhar (Punjab) INDIA, India; GZS PTU campus ,Bathinda, India; Institute of Science and Technology, Kalawad (Haryana) INDIA, India

Numerous algorithms have been invented for optimizations which are nature inspired and based on real life behaviour of species. In this paper, intelligent chasing and hunting methods adopted by the dogs to chase and hunt their prey in groups are used to develop the novel methodology named as "Dog Group Wild Chase and Hunt Drive (DGWCHD) Algorithm". The proposed algorithm has been implemented on some TSP benchmark problems. These benchmark problems have been solved by different researchers for optimization as test bed for performance analysis of their proposed novel intelligent algorithms like Ant Colony System (ACS), Genetic Algorithms (GA), Simulated Annealing (SA), Evolutionary Programming (EP), The Multi-Agent Optimization System (MAOS), Particle Swarm Optimization (PSO) and Neural Networks (NN). The performance analysis of the novel proposed DGWCHD algorithm has been done and results are compared with other nature inspired techniques. The results obtained are very optimistic and encouraging.

10:40AM A Social-Spider Optimization Approach for Support Vector Machines Parameters Tuning [#14092]

Danillo Pereira, Mario Pazoti, Luis Pereira and Joao Papa, University of Western Sao Paulo, Brazil; University of Campinas, Brazil; Sao Paulo State University, Brazil

The choice of hyper-parameters in Support Vector Machines (SVM)-based learning is a crucial task, since different values may degrade its performance, as well as can increase the computational burden. In this paper, we introduce a recently developed nature-inspired optimization algorithm to find out suitable values for SVM kernel mapping named Social-Spider Optimization (SSO). We compare the results obtained by SSO against with a Grid-Search, Particle Swarm Optimization and Harmonic Search. Statistical evaluation has showed SSO can outperform the compared techniques for some sort of kernels and datasets.

11:00AM A Parametric Testing of the Firefly Algorithm in the Determination of the Optimal Osmotic Drying Parameters for Papaya [#14093]

Julian Yeomans and Raha Imanirad, Schulich School of Business, York University, Canada; Harvard Business School, United States

This study employs the Firefly Algorithm (FA) to determine optimal parameter settings for the osmotic dehydration process of papaya. The functional formulation of the osmotic dehydration model is established using a response surface technique with the format of the resulting optimization model being a non-linear goal programming problem. For optimization purposes, a computationally efficient, FA-driven method is employed and the resulting solution for the osmotic process parameters is superior to those from previous approaches. The final component of this study provides a computational experimentation performed on the FA to illustrate the relative sensitivity of this nature-inspired metaheuristic approach over the range of two key parameters.

11:20AM Engineering Optimization using Interior Search Algorithm [#14382]

Amir H. Gandomi and David A. Roke, Department of Civil Engineering, The University of Akron, Akron, OH 44325, United States

A new global optimization algorithm, the interior search algorithm (ISA), is introduced for solving engineering optimization problems. The ISA has been recently proposed and has two new search operators, composition optimization and mirror search. In this study, the optimization process starts with composition optimization and linearly switches to mirror search. For validation against engineering optimization problems, ISA is applied to several benchmark engineering problems reported in the literature. The optimal solutions obtained by ISA are better than the best solutions obtained by the other methods representative of the state-of-the-art in optimization algorithms.

11:40AM Non-dominated Sorting Cuckoo Search for Multiobjective Optimization [#14183]

Xing-shi He, Na Li and Xin-She Yang, Xi'an Polytechnic University, China; Middlesex University, United Kingdom

Cuckoo search is a swarm-intelligence-based algorithm that is very effective for solving highly nonlinear optimization problems. In this paper, the multiobjective cuckoo search is extended so as to obtain high-quality Pareto fronts more accurately for multiobjective optimization problems with complex constraints. The proposed approach uses a combination of the cuckoo search with non-dominated sorting and archiving techniques. The performance of the proposed approach is validated by seven test problems. The convergence property and diversity as well as uniformity are compared with those of the NSGA-II. The results show that the proposed approach can find Pareto fronts with better uniformity and quicker convergence.

CIASG'14 Session 1: Forecasting and Predictions in Smart Grids

Wednesday, December 10, 10:20AM-12:00PM, Room: Curacao 4, Chair: Ganesh Kumar Venayagamoorthy

10:20AM A Time Series Ensemble Method to Predict Wind Power [#15063]

Sumaira Tasnim, Ashfaqur Rahman, Gm Shafiullah, Amanullah Oo and Alex Stojcevski, Deakin University, Australia; CSIRO, Australia

Wind power prediction refers to an approximation of the probable production of wind turbines in the near future. We present a time series ensemble framework to predict wind power. Time series wind data is transformed using a number of complementary methods. Wind power is predicted on each transformed feature space. Predictions are aggregated using a neural network at a second stage. The proposed framework is validated on wind data obtained from ten different locations across Australia. Experimental results demonstrate that the ensemble predictor performs better than the base predictors

10:40AM Neural Network Forecasting of Solar Power for NASA Ames Sustainability Base [#15014]

Chaitanya Poolla, Abe Ishihara, Steve Rosenberg, Rodney Martin, Chandrayee Basu, Alex Fong and Sreejita Ray, Carnegie Mellon University, United States; NASA Ames Research Center, United States

Solar power prediction remains an important challenge for renewable energy integration primarily due to its inherent variability and intermittency. In this work, a neural network based solar power forecasting framework is developed for the NASA Ames Sustainability Base (SB) solar array using the publicly available National Oceanic and Atmospheric Administration (NOAA) weather data forecasts. The prediction inputs include temperature, irradiance and wind speed obtained through the NOAA NOMADS server in real-time. The neural network (ANN) is trained and tested on input-output data from on-site sensors. The NOAA archived forecast data is then input to the trained ANN model to predict power output spanning over nine months (June 2013 - March 2014). The efficacy of the model is determined by comparing predicted power output against on-site sensor data.

11:00AM Comparison of Echo State Network and Extreme Learning Machine for PV Power Prediction [#14968]

Iroshani Jayawardene and Ganesh Kumar Venayagamoorthy, Clemson University, United States

The increasing use of solar power as a source of electricity has introduced various challenges to the grid operator due to the high PV power variability. The energy management systems in electric utility control centers make several decisions at different time scales. In this paper, power output predictions of a large photovoltaic (PV) plant at eight different time instances, ranging from few seconds to a minute plus, is presented. The predictions are provided by two learning networks: an echo state network (ESN) and an extreme learning machine (ELM). The predictions are based on current solar irradiance, temperature and PV plant power output. A real-time study is performed using a real-time and actual weather profiles and a real-time simulation of a large PV plant. Typical ESN and ELM prediction results are compared under varying weather conditions.

11:20AM Accurate Localized Short Term Weather Prediction for Renewables Planning [#14951]

David Corne, Manjula Dissanayake, Andrew Peacock, Stuart Galloway and Edward Owens, Heriot-Watt University, United Kingdom; Strathclyde University, United Kingdom

Short-term prediction of meteorological variables is important for many applications. In particular, many 'smart grid' planning and control scenarios rely on accurate short term predictions of renewable energy generation, which in turn requires accurate forecasting of wind-speed, cloud-cover, and other variables. Accurate short-term weather forecasting therefore enables smooth integration of renewables into intelligent power systems. Weather forecasting at a specific location is currently achieved (broadly) either by (i) numerical weather prediction (NWP) (ii) statistical models built from local time series data, or (iii) a combination of the latter. We introduce a new data-intensive approach to localized short-term weather prediction that relies on harvesting multiple observations and forecasts pertaining to the wider region. The underlying hypothesis is that NWP-based forecasts, despite the benefit of a dynamical physics-based model, tend to be only sparsely informed by observation-based inputs at a local level, while statistical downscaling models, though locally well-informed, miss the opportunity to include rich additional data sources concerning the wider local region. By harvesting a freely available data stream of multiple forecasts and observations from the wider local region we expect to achieve better accuracy than available otherwise. We describe the approach and demonstrate results for three locations, focusing on the 1hr--24hrs ahead forecasting of variables crucial for renewables forecasting. This work is part of the ORIGIN project (www.originconcept. eu) and the weather forecasting approach, used in ORIGIN as input for both demand and renewables prediction, will be in operation from October 2014.

11:40AM Intelligent Analysis of Wind Turbine Power Curve Models [#14645]

Arman Goudarzi, Innocent Davidson, Afshin Ahmadi and Ganesh Kumar Venayagamoorthy, University of KwaZulu-Natal, South Africa; Clemson University, United States

The wind turbine power curve shows the relationship between the wind speed and power output of the turbine. Power curves, which are provided by the manufacturers, are mainly used in planning, forecasting, performance monitoring and control of the wind turbines. Hence an accurate model of wind power curves is a very important tool for predictive control and monitoring. This paper presents comparative analysis of various parametric and non-parametric techniques for modeling of wind turbine power curves, with reference to three commercial wind turbines; 330, 800 and 900 kW, respectively. Firstly, Wind turbine power curves (WTPC) were modeled with a number of previously developed mathematical models to find the most accurate one based on the actual power curve data provided by the manufacturer and utilizing error measurement techniques, i.e. normalized root mean square error (NRMSE) and r-square. At this point, genetic algorithm (GA) was utilized to improve the accuracy of the selected model. Finally, WTPCs were modeled using artificial neural network (ANN) and the result was compared with previously optimized mathematical model.

SSCI DC Session 1

Wednesday, December 10, 10:20AM-12:00PM, Room: Curacao 7, Chair: Xiaorong Zhang

10:20AM Seismic Response Formulation of Self-Centering Concentrically Braced Frames Using Genetic Programming [#14383]

AmirHossein Gandomi, Department of Civil Engineering, The University of Akron, Akron, OH 44325, United States

In this study, at first, the SC-CBF design process is automated in MATLAB based on the defined SC-CBF design procedure on design basis earthquake level. OpenSees software is used in the framework for modal and finite element analyzes. Then seventy five SC-CBFs with different mechanical and geometrical parameters are designed. After applying 170 earthquake records to each designed structure a database including 12,750 structure responses. Here, the responses of the structures for fifty earthquakes in DBE level are determined through nonlinear time history analyses. Then, GEP algorithm is used to formulate the statistical parameters of the roof drift response. Equations based on genetic programming results are developed to predict the mean and standard deviation of the responses. The resulting equations are very simple and correlate well with the numerical analysis results. Predicting the exact response of a structure under each individual earthquake is the next step in this study that involves additional uncertainties. In addition to the design mechanical and geometrical parameters, earthquake intensity measures are very important to predict its response. A new feature selection strategy based on genetic programming, called evolutionary correlation, is proposed in this study to select the most correlated ground motion intensities to the SC-CBF response. Then the selected intensities and the mechanical and geometrical parameters are used as the variables in model development. MGGP is used to formulate the response, as it is particularly accurate when there are several input variables. The results show that the MGGP- based formula can predict the response of each earthquake with the high degree of accuracy.

10:40AM Coevolutionary Nonlinear System Identification Based on Correlation Functions and Neural Networks [#14656]

Helon Vicente Hultmann Ayala and Leandro dos Santos Coelho, PUCPR, Brazil; PUCPR, UFPR, Brazil

We present a procedure for input selection and parameter estimation for system identification based on Radial Basis Functions Neural Networks (RBFNNs) models. We use the concept of coevolution and decomposition to define the model orders and the related model parameters based on correlation functions. We show preliminary results when the proposed methodology is successfully applied to two systems.

11:00AM Integrated Optimization and Prediction based on Adaptive Dynamic Programming (ADP) for Machine Intelligence [#14120]

Zhen Ni, University of Rhode Island, Department of Electrical Engineering, United States

With the continuous significant increasing demand of cyber-physical system (CPS), the development of intelligent and adaptive system has become one of the critical research topics worldwide [1,2,3]. Among many efforts towards this objective, the computational intelligence (CI) research provides one of the key technical innovations based on the adaptive dynamic programming (ADP) [4,5]. To this end, various aspects of intelligent system have been improved in terms of learning and optimization capabilities, such as the smart grid operation and control, and the robotics, as well as its theoretical analysis. The main focus of my dissertation research involves: (1) Integrated learning and optimization ADP architecture; (2) Intelligent power grid operation and control; (3) Stability analysis of the proposed GrADP design.

11:20AM Efficient Grouping and Cluster Validity Measures for NGS Data [#14831]

Markus Lux, Bielefeld University, Germany

Next generation sequencing (NGS) methods will deliver numerous promising applications such as metagenome analysis in the future. Often it is the task to automatically group species in a given DNA or RNA probe. This corresponds to the computational challenge to reliably detect clusters in high dimensional spaces in the context of big data. In my research I will evaluate and adapt different dimension reduction and clustering techniques that are suitable for this task. The goal is to create tools which efficiently combine novel machine learning techniques and are useful for the analysis of such data.

11:40AM Optimizing Non-traditional Designs for Order Picking Warehouses [#15018]

Sabahattin Gokhan Ozden, Alice Smith and Kevin Gue, Auburn University, United States

For more than 50 years facilities that are the backbone of supply chain still look like much the same (rows of straight,parallel picking aisles with perpendicular cross aisle). The proposed research offers an approach that reduces the costs of most costly operation in a warehouse - order picking. Order picking operation requires workers to visit multiple locations per tour. Due to shipment size decrease, labor costs associated with filling customer orders has increased. We estimated $13.1 B was spent in 2011 on workers associated with order picking in United States. We already have seen the improvements in unit-load warehouses (where you only pick or put away a single item per tour) by applying non-traditional designs, however these particular designs (Flying V and Fishbone) do not perform in order picking operations where you have to perform multiple picks per tour. In order picking, travel takes more than 50% of time of picking and it is a non-value adding activity. We believe that the average travel distance within order picking operations can be reduced with other non-traditional designs. According to our preliminary results, a non-traditional design can achieve 9.4% than the traditional counterpart for particular order data. When we are done with the development, we will be able to know which designs performs better under which storage policies, and if there exists any non-traditional design that can lower the average travel distance of picking tours over traditional warehouses. Our research is sponsored by National Science Foundation.

Special Session: CIBD'14 Session 2: Big Data Analytic for Healthcare

Wednesday, December 10, 1:30PM-3:10PM, Room: Antigua 2, Chair: Norman Poh and David Windridge

1:30PM A Human Geospatial Predictive Analytics Framework With Application to Finding Medically Underserved Areas [#14628]

James Keller, Andrew Buck, Mihail Popescu and Alina Zare, University of Missouri, United States

Human geography is a concept used to indicate the augmentation of standard geographic layers of information about an area with behavioral variations of the people in the area. In particular, the actions of people can be attributed to both local and regional variations in physical (i.e., terrain) and human (e.g., income, political, cultural) variables. In this paper, we study the utility of a human geographic data cube coupled with computational intelligence as a means to predict conditions across a geographic area. This becomes a Big data problem. In this sense, we are using genotype information to predict phenotype states. We demonstrate the approach on the prediction of medically underserved areas in Missouri.

1:50PM Challenges in Designing an Online Healthcare Platform for Personalised Patient Analytics [#14196]

Norman Poh, Santosh Tirunagari and Windridge David, University of Surrey, United Kingdom

The growing number and size of clinical medical records (CMRs) represents new opportunities for finding meaningful patterns and patient treatment pathways while at the same time presenting a huge challenge for clinicians. Indeed, CMR repositories share many characteristics of the classical 'big data' problem, requiring specialised expertise for data management, extraction, and modelling. In order to help clinicians make better use of their time to process data, they will need more adequate data processing and analytical tools, beyond the capabilities offered by existing general purpose database management systems or database servers. One modelling technique that can readily benefit from the availability of big data, yet remains relatively unexplored is personalised analytics where a model is built for each patient. In this paper, we present a strategy for designing a secure healthcare platform for personalised analytics by focusing on three aspects: (1) data representation, (2) data privacy and security, and (3) personalised analytics enabled by machine learning algorithms.

2:10PM Feature Selection/Visualisation of ADNI Data with Iterative Partial Least Squares [#14824]

Li Bai and Torbjorn Wasterlid, University of Nottingham, United Kingdom

This article introduces a variable selection and visualisation approach for medical imaging big data analysis based on Partial Least Squares, dubbed Picky Partial Least Squares. The method can handle very high-dimensional data and appears to be able to find relevant clusters of data points. It has been developed to deal in particular with large datasets. The method is validated experimentally on medical images from the ADNI (Alzheimer's Disease Neuroimaging Initiative). It is shown to perform better than standard PLS on the datasets and identifies relevant brain areas and SNPs as linked to Alzheimer's Disease. In particular the temporal lobes of the brain are highlighted by the algorithm, along with SNPs such as rs157580, which have previously been linked to Alzheimer's Disease. The method is also able to classify Alzheimer's patients from controls directly from the original high-dimensional imaging data, without any feature selection and dimension reduction. Unlike existing publications, the focus of this paper will be to select and visualise the image features that PPLS considers as related to Alzheimer's Disease.

2:30PM Application of Sparse Matrix Clustering with Convex-Adjusted Dissimilarity Matrix in an Ambulatory Hospital Specialist Service [#14829]

Xiaobin You, Bee Hoon Heng and Kiok Liang Teow, Health Services and Outcomes Research, National Healthcare Group, Singapore

Objective: Patients with chronic diseases and complications may frequently visit different specialists. A new perspective focusing on patients' specialist utilization records combined with statistical learning methodology can quantify the tightness of links between different specialties and highlight important specialist clusters. Method and Data: Cosine angular dissimilarity matrix was used to measure connections among 163 specialties in 3 Singapore general hospitals based on 931,504 specialist attendance cases in 2013. A convex transformation on angular dissimilarity was introduced to solve low similarity problem caused by matrix sparsity and thus improved hierarchical clustering performance. The objective was to improve transformation by maximizing variance of off-diagonal dissimilarity coefficients. Ward's method was used in clustering with dissimilarity matrix. Interactive visualization of sortable matrix was used to highlight important specialist clusters. Results: Through clustering, 20 significant clusters were identified in 3 hospitals. Common clusters such as orthopedics, oncology-surgery, nternal medicine, neuroscience, etc. were found among the 3 hospitals. Components of common clusters among hospitals were similar. Conclusion: Patient utilization records can bring new and systematic insight of cooperative specialist services alongside traditional clinical research. Convex adjustment improves performance of Ward's method on low similarity distance matrix significantly. Hierarchical clustering on convex-adjusted dissimilarity matrix is effective in discovering specialist clusters.

2:50PM Microarray Big Data Integrated Analysis for the Prediction of Robust Diagnostics Signature for Triple-Negative Breast Cancer [#14363]

Masood Zaka, Yonghong Peng and Chris W Sutton, University of Bradford, United Kingdom

Triple-negative breast cancers (TNBC) are clinically heterogeneous, an aggressive form of breast cancer with poor diagnosis and highly therapies- resistant. Therefore, it is a need to identify novel biomarkers with increased sensitivity and specificity in detecting TNBC and personalised therapeutic intervention. Big data microarray gene expression-based studies has offered significant advances in molecular classification and identification of novel diagnostic signatures along major challenges in sample scarcity and cohort heterogeneity. We performed integrated meta-analysis on independent microarray big data studies and identified a robust 880-genes diagnostic signature for triple-negative breast cancer. We have also identified 16-gene (OGN, ESR1, GPC3, LHFP, AGR3, LPAR1, LRRC17, TCEAL1, CIRBP, NTN4, TUBA1C, TMSB10, RPL27, RPS3A, RPS18, and NOSTRIN) unique to TNBC class. The proposed 880-gene signature have shown excellent overall classification ratio of 99.06% during the cross- validation cohort on independent expression data sets. Our finding suggest that further validation on wet-lab and large scale independent big data could provide additive knowledge on diagnosis of basal type or triple-negative breast cancer. The study also suggests cell cycle pathway plays an important role in the TNBC disease progression and may provide pivotal target for therapeutic intervention.

IES'14 Session 2

Wednesday, December 10, 1:30PM-3:10PM, Room: Antigua 3, Chair: Manuel Roveri

1:30PM Self-aware and Self-expressive Driven Fault Tolerance for Embedded Systems [#14731]

Tatiana Djaba Nya, Stephan C. Stilkerich and Christian Siemers, Airbus Group Innovations, Germany; Clausthal University of Technology, Germany

The growing complexity and size of computing systems as well as the unpredictability about changes in their deployment environment make their design increasingly challenging; especially for safety critical systems. Specifically the recognition of a fault within a system might be not only time consuming but also difficult in terms of reliability and completeness. This paper presents an approach to fault tolerance based on statistical features using the concepts of self-awareness and self-expression. These features characterize the behaviour of components, they are weighted and can be compared to measured values during runtime to characterize the well-behaviour of the system. Simulations show that this approach, used with the selfawareness and self-expression system layers, combines failure recognition and recovery with effective system design.

1:50PM Learning Causal Dependencies to Detect and Diagnose Faults in Sensor Networks [#14436]

Cesare Alippi, Manuel Roveri and Francesco Trovo', Politecnico di Milano, Italy

Exploiting spatial and temporal relationships in acquired datastreams is a primary ability of Cognitive Fault Detection and Diagnosis Systems (FDDSs) for sensor networks. In fact, this novel generation of FDDSs relies on the ability to correctly characterize the existing relationships among acquired datastreams to provide prompt detections of faults (while reducing false positives) and guarantee an effective isolation/identification of the sensor affected by the fault (once discriminated from a change in the environment or a model bias). The paper suggests a novel framework to automatically learn temporal and spatial relationships existing among streams of data to detect and diagnose faults. The suggested learning framework is based on a theoretically grounded hypothesis test, able to capture the Granger causal dependency existing among datastreams. Experimental results on both synthetic and real data demonstrate the effectiveness of the proposed solution for fault detection.

2:10PM Salted Hashes for Message Authentication - Proof of concept on Tiny Embedded Systems [#14636]

Rene Romann and Ralf Salomon, University of Rostock, Germany

Intelligent embedded systems become more and more widespread. Especially in the field of smart environments, such as smart homes, the systems are communicating with each other. If wireless communication is used, security becomes important. This paper explores to what extent salted hashes might be used on tiny embedded systems to provide message authentication. To this end, this paper uses two very different microcontrollers for calculating salted hases using SHA-1 and SHA-256. The execution times vary between 2.5 and 160 milliseconds, which is fast enough to provide user responses in time.

2:30PM Novelty Detection in Images by Sparse Representations [#14943]

Giacomo Boracchi, Diego Carrera and Brendt Wohlberg, Politecnico di Milano, Italy; Los Alamos National Laboratory, United States

We address the problem of automatically detecting anomalies in images, i.e., patterns that do not conform to those appearing in a reference training set. This is a very important feature for enabling an intelligent system to autonomously check the validity of acquired data, thus performing a preliminary, automatic, diagnosis. We approach this problem in a patch-wise manner, by learning a model to represent patches belonging to a training set of normal images. Here, we consider a model based on sparse representations, and we show that jointly monitoring the sparsity and the reconstruction error of such representation substantially improves the detection performance with respect to other approaches leveraging sparse models. As an illustrative application, we consider the detection of anomalies in scanning electron microscope (SEM) images, which is essential for supervising the production of nanofibrous materials.

Special Session: CIHLI'14 Session 2: Grounded Cognition, Creativity and Motivated Learning

Wednesday, December 10, 1:30PM-3:10PM, Room: Antigua 4, Chair: Kathryn Merrick and Janusz Starzyk

1:30PM Evolution of Intrinsic Motives in a Multi-Player Common Pool Resource Game [#14089]

Kathryn Merrick, University of New South Wales, Australia

This paper proposes a game theoretic framework to model the evolution of individuals with different motives. First, the altered perception of individuals with different motives is modeled assuming they are engaged in a common pool resource game. It is shown that agents with different motives perceive the payoff matrix of the game differently. An evolutionary process is then simulated using replicator dynamics and mutation rules to study the evolution of agents with different motives. Results demonstrate that the average objective payoff achieved by a population of agents is higher in the presence of agents with different motives, even though some of these agents may misperceive the original game. These results illustrate the evolutionary benefit of motivation and provide evidence in support of further study of subjective rationality as a result of motivation in game theoretic settings.

1:50PM Self-Motivated Learning of Achievement and Maintenance Tasks for Non-Player Characters in Computer Games [#14146]

Hafsa Ismail, Kathryn Merrick and Michael Barlow, University of New South Wales, Australia

This paper presents a framework for motivated reinforcement learning agents that can identify and solve either achievement or maintenance tasks. To evaluate and compare agents using these approaches, we also introduce two new metrics to better characterise and differentiate the behaviour of characters motivated to learn different kinds of tasks. These metrics quantify the focus of attention and dwell time of agents. We perform an empirical evaluation of motivated reinforcement learning agents controlling characters in a simulated game scenario, comparing the effect of three different motivations for learning achievement and maintenance tasks. Results show that we can generate characters with quantifiably different achievement and maintenance oriented behaviour using our proposed task identification approach. Of the three motivations

studied - novelty, interest and competence - novelty-seeking motivation is the most effective for creating agents with distinctive maintenance or achievement oriented behaviours.

2:10PM Effective Motive Profiles and Swarm Compositions for Motivated Particle Swarm Optimisation Applied to Task Allocation [#14314]

Medria Hardhienata, Kathryn Merrick and Valery Ugrinovskii, University of New South Wales Canberra, Australia

This paper examines the behaviour of agents with four distinct motive profiles with the aim of identifying the most effective profiles and swarm compositions to aid task discovery and allocation in a motivated particle swarm optimisation algorithm. We first examine the behaviour of agents with affiliation, achievement and power motive profiles and the impact on behaviour when these profiles are perturbed. We then examine the behaviour of swarms with different compositions of agents motivated by affiliation, achievement, power and a new leadership motive profile. Results show that affiliation- motivated agents tend to perform local search and allocate themselves to tasks. In contrast, power-motivated agents tend to explore to find new tasks. These agents perform better in the presence of achievement-motivated agents, informing the design of the leadership motive profile, which demonstrates good performance in two task allocation settings studied in this paper.

2:30PM Applying Behavior Models in a System Architecture [#14238]

Bruce Toy, Lockheed Martin (Retired), United States

This paper describes a functional model for understanding the multiple roles that internal behavior modeling plays in an integrated functional architecture of the brain. Using a protocol for AI structure that is based on system engineering principles, we can look at the individual's process for understanding the behavior of, and interaction with, other entities. The analysis shows a complex inter-relationship between behavior models, motivations, and location models in the brain that allow us to interact with our environment with minimum demand on our mental resources.

2:50PM Advancing Motivated Learningn with Goal Creation [#14132]

James Graham, Janusz Starzyk, Zhen Ni and Haibo He, Ohio University, United States; University of Rhode Island, United States

This paper reports improvements to our Motivated Learning (ML) model. These include modifications to the calculation of need/pain biases, pain-goal weights, and how actions are selected. Resource based abstract pains are complemented with pains related to desired and undesired actions by other agents. Probability based selection of goals is discussed. The minimum amount of desired resources is now set automatically by the agent. Additionally, we have presented several comparisons of Motivated Learning performance against some well-known reinforcement learning algorithms.

CCMB'14 Session 2: Cognitive, Mind, and Brain

Wednesday, December 10, 1:30PM-3:10PM, Room: Bonaire 1, Chair: Angelo Cangelosi

1:30PM Assessing real-time cognitive load based on psycho-physiological measures for younger and older adults [#14743]

Eija Ferreira, Denzil Ferreira, SeungJun Kim, Pekka Siirtola, Juha Roning, Jodi F. Forlizzi and Anind K. Dey, Department of Computer Science and Engineering, University of Oulu, Finland; Human-Computer Interaction Institute, Carnegie Mellon University, United States

We are increasingly in situations of divided attention, subject to interruptions, and having to deal with an abundance of information. Our cognitive load changes in these situations of divided attention, task interruption or multitasking; this is particularly true for older adults. To help mediate our finite attention resources in performing cognitive tasks, we have to be able to measure the real-time changes in the cognitive load of individuals. This paper investigates how to assess real-time cognitive load based on psycho-physiological measurements. We use two different cognitive tasks that test perceptual speed and visio-spatial cognitive processing capabilities, and build accurate models that differentiate an individual's cognitive load (low and high) for both young and older adults. Our models perform well in assessing load every second with two different time windows: 10 seconds and 60 seconds, although less accurately for older participants. Our results show that it is possible to build a real-time assessment method for cognitive load. Based on these results, we discuss how to integrate such models into deployable systems that mediate attention effectively.

1:50PM Toward a Neural Network Model of Framing with Fuzzy Traces [#14404]

Daniel Levine, University of Texas at Arlington, United States

In a decision study called the Asian Disease Problem, Tversky and Kahneman [1] found that framing risky health choices in terms of gains or losses of lives leads to radically different choices: risk seeking for losses and risk avoidance for gains. The difference between the two choices is called the framing effect. The authors explained framing effects via psychophysics of the numbers of lives saved or lost. Yet Reyna and Brainerd [2] showed that the strength of the framing effect depended not on the numbers but on whether one of options explicitly contained the possibility of no lives lost or saved. They fit their explanation into fuzzy trace theory whereby decisions are based not on details of the options given but on the gist (underlying meaning) of the options. We discuss how a brain-based neural network model of other decision data [3] that combines fuzzy trace theory with adaptive resonance theory can be extended to these framing data. Simulations are in progress.

2:10PM An Arousal-Based Neural Model of Infant Attachment [#14688]

David Cittern and Abbas Edalat, Imperial College London, United Kingdom

We develop an arousal-based neural model of infant attachment using a deep learning architecture. We show how our model can differentiate between attachment classifications during strange situation-like separation and reunion episodes, in terms of both signalling behaviour and patterns of autonomic arousal, according to the sensitivity of previous interaction.

2:30PM Solving a Cryptarithmetic Problem Using a Social Learning Heuristic [#14036]

Jose Fontanari, Universidade de Sao Paulo, Brazil

The premiss that a group of cooperating agents - a collective brain - can solve a problem more efficiently than the same group of agents working independently is widespread, despite the little quantitative groundwork to support it. Here we use extensive agent-based simulations to

investigate the performance of a system of N agents in solving a cryptarithmetic problem. Cooperation is taken into account through imitative learning which allows information to pass from one agent to another. At each trial the agents can either perform individual trial-and-test operations to explore the solution space or copy cues from a model agent, i.e., the agent that exhibits the lowest cost solution at the trial. We find a trade-off between the number of trial and-test operations and the number of imitation attempts: too much imitation results in a performance which is poorer than that exhibited by noncooperative agents. For the optimal balance between trial-and-test operations and imitation attempts we find a thirtyfold speedup of the mean time to find the correct solution with respect to the time taken by the noncooperative group. Most significantly, we find that increasing the number of agents N beyond a certain value can greatly harm the performance of the cooperative system which can then perform much worse than in the noncooperative case. Low diversity and the following of a bad leader are the culprits for the poor performance in this case.

2:50PM iflows: A Novel Simulation Model for Predicting the Effectiveness of a Research Community [#14906]

Alex Doboli and Simona Doboli, Stony Brook University, Department of ECE, United States; Hofstra University, Department of CS, United States

This paper presents a simulation model for observing the dynamics of a research community in engineering. The objective is to study how parameters, like group expertise and resources, influence the effectiveness of the group and community as a whole. The model implements a game-theoretic approach in which every group maximizes the difference between its rewards and costs (e.g., time and resources). Experiments studied the total reward and the number of problems solved over time by a community made of twenty groups for different conditions, i.e. allocated resources and group characteristics.

CIPLS'14 Session 2: Computational Intelligence in Logistics Systems

Wednesday, December 10, 1:30PM-3:10PM, Room: Bonaire 2, Chair: Sona Kande and Bülent Çatay

1:30PM Design of Multi-product / Multi-period Closed-Loop Reverse Logistics Network Using a Genetic Algorithm [#14061]

Helga Hernandez-Hernandez, Jairo R. Montoya-Torres and Fabricio Niebles-Atencio, Universidad de La Sabana, Colombia; Servicio Nacional de Aprendizaje (SENA), Colombia

Environmental impact has become a key issue in business management. Nowadays, the optimal design of supply chains has to deal with green management practices. Among the different components of the green supply chain management, reverse logistics play a crucial role. This paper studies the problem of designing a closed-loop reverse supply chain network. Since the problem in NP-hard, a solution approach based on genetic algorithm is proposed. A case study is employed to run the numerical experiments. Computational results show the positive impact of minimizing total operational costs.

1:50PM Solving capacitated vehicle routing problem by artificial bee colony algorithm [#14088]

Alberto Gomez and Said Salhi, University of Oviedo, Spain; University of Kent, United Kingdom

This paper presents a new Artificial Bee Colony algorithm for solving the capacitated vehicle routing problem. The main novel characteristic of the proposed approach relies upon an efficient way of coordinating, for each group of bees, a well-defined focus of work. In the algorithm, we provide two specializations namely diversification and intensification where the former is controlled by the employed and the scout bees whereas the latter by the onlookers. The two datasets commonly used as benchmark instances are used to assess the performance of the proposed algorithm. The results show that the proposed algorithm obtains interesting results.

2:10PM A genetic algorithm with an embedded Ikeda map applied to an order picking problem in a multi-aisle warehouse [#14174]

Michael Stauffer, Remo Ryter, Donald Davendra, Rolf Dornberger and Thomas Hanne, Institute for Information Systems, School of Business, University of Applied Sciences and Arts Northwestern Switzerland, Switzerland; Department of Computer Science, VSB-Technical University of Ostrava, Czech Republic

An Ikeda map embedded genetic algorithm is introduced in this research in order to solve the order picking problem. The chaos based algorithm is compared against the canonical pseudo-random number based genetic algorithm over thirty test instances of varying complexity. From the results, the chaos based genetic algorithm is shown to have better overall performance, especially for larger sized problem instances. The statistical paired t-test comparison of the results further reinforces the fact that the chaos based genetic algorithm is significantly better performing.

2:30PM An Improved Optimization Method based on Intelligent Water Drops Algorithm for the Vehicle Routing Problem [#14867]

Zahra Booyavi, Ehsan Teymourian, Mohammad Komaki and Shaya Sheikh, University of Science and Technology Tehran, Iran; Mazandaran University of Science and Technology, Iran; Case Western Reserve University, United States; University of Baltimore, United States

We introduce an improved intelligent water drops (IIWD) algorithm as a new swarm-based nature inspired algorithm to solve capacitated vehicle routing problem. IIWD algorithm introduces new adjustments and features that help to optimize the VRP problem with higher efficiency. We reinforce this algorithm to have satisfactory consequences in controlling the balance between diversification and intensification of the search process. We solve 14 well- known benchmark instances in the literature to compare the solutions with the best reported solutions in the literature. Experimental results demonstrate that the suggested technique can well and effectively cope with such problems.

2:50PM Iterated Local Search with neighborhood space reduction for two-echelon distribution network for perishable products [#14904]

Sona Kande, Christian Prins, Lucile Belgacem and Redon Benjamin, University of Technology of Troyes, France; FuturMaster, France

This article presents a planning problem in a distribution network incorporating two levels inventory management of perishable products, lot-sizing, multi-sourcing and transport capacity with a homogeneous fleet of vehicles. A mixed integer linear programming (MILP) and a greedy heuristic were developed to solve this real planning problem. There are some instances for which the solver cannot give a good lower bound within the limited time and for other instances it takes a lot of time to solve MILP. The greedy heuristic is an alternative to the mixed integer linear program to quickly solve some large instances taking into account original and difficult constraints. For some instances the gap between the solution provided by the solver (MILP) and the heuristic becomes quite significant. An iterated local search (ILS) using the variable neighborhood descent (VND) method has been implemented to improve the quality of heuristic solutions. We have included the ILS method in an APS (Advanced Planning System) and have compared it with an exact resolution of the MILP. Two types of instances are tested: derived from actual data or built using a random generator of instances to have wider diversity for computational evaluation. The ILS procedure significantly improves the quality of solutions and average computational time is much shorter than MILP resolution.

Special Session: CIComms'14 Session 2: Advanced Nature-Inspired Optimization for New Generation Antenna Devices

Wednesday, December 10, 1:30PM-3:10PM, Room: Bonaire 3, Chair: Paolo Rocca and Andrea Massa

1:30PM An Overview of Several Recent Antenna Designs Utilizing Nature-Inspired Optimization Algorithms [#14205]

Douglas Werner, Micah Gregory, Zhi Hao Jiang, Donovan Brocker, Clinton Scarborough and Pingjuan Werner, The Pennsylvania State University, United States

Many new, high-performance antenna designs have employed optimization strategies to tune their geometric parameters for optimal electromagnetic properties such as return loss and gain. Several antenna designs are presented here that demonstrate the ability of these optimization strategies to competently fulfill the designer's performance criteria. Designs such as the anisotropic zero-index and low-index metamaterial-enabled antennas illustrate the benefits of applying evolutionary strategies to create metamaterials for integration into classical antennas as well as tune the final, integrated antenna system. The folded meander-slot and embedded- element stacked patch antenna designs illustrate how the algorithms can be used to directly optimize antenna geometries for wide-band and multi-band purposes.

1:50PM A technique for the aperture partitioning [#14749]

Amedeo Capozzoli, Claudio Curcio, Giuseppe D'Elia, Angelo Liseno and Francesco Marano, Dipartimento di Ingegneria Elettrica e delle Tecnologie dell'Informazione, Italy

This paper presents a method for the partitioning of an aperture into sub- apertures preserving the performance. The technique represents a first stage towards a subarray synthesis and is based on a multi-stage approach wherein an aperture synthesis, an evolutionary algorithm, and, finally, a local search are adopted. A proper representation has been considered to reduce the number of the parameters defining the sub-aperture partitioning and simplify the use of a global optimizer.

2:10PM Evolution of Nature-Inspired Optimization for New Generation Antenna Design [#14370]

Giacomo Oliveri, Paolo Rocca, Marco Salucci and Andrea Massa, ELEDIA Research Center, University of Trento, Italy

The use of nature-inspired optimization strategies based computational intelligence, like Evolutionary Algorithms (EAs), has had a revolutionary impact in various frameworks of electromagnetics since has enabled the design of complex structures (e.g., antenna arrays) with improved performance. The main issues that still remain are related to the high computational costs and the non-efficient sampling of the solution space which limit convergence rate and the possibility to retrieve optimal solutions. To address these drawbacks, several research efforts are currently dedicated to the development of hybrid optimization procedures where sub-optimal solutions, easily defined by means of either analytic or deterministic techniques, are used as starting guess or the search spaces are suitably re-defined to enable the use of state-of-the-art EAs. Two representative examples are revised and discussed in this paper aimed to the design of antenna arrays generating compromise sum-difference patterns on the same antenna aperture and of large thinned arrays.

2:30PM Antenna Design by Using MOEA/D-Based Optimization Techniques [#14364]

Dawei Ding, Gang Wang, Chenwei Yang and Lu Wang, University of Science and Technology of China, China

Recent progress in design of antenna and antenna array by using MOEA/D-based optimization techniques in our group is summarized. We first give a brief introduction to framework of MOEA/D and several MOEA/D-based variants, including modified MOEA/D-DE (MOEA/D combined with differential evolution), MOEA/D-GO (MOEA/D combined with enhanced genetic operators), MOEA/D-GO-II (enhanced MOEA/D-GO), MOEA/D-SL (MOEA/D combined with statistic location information), and MOEA/D-IOO (MOEA/D combined with inverse onion operator). Then we report several antenna design examples in USTC, including designs of multi-band antenna, dielectric-loaded circularly-polarized wideband antenna, distributed UHF RFID reader antenna, versatile fragment-type RFID tag antenna, fragment-type isolation structure for MIMO antennas, and pattern synthesis of compact antenna array. More promising applications of MOEA/D-based optimization in antenna and microwave circuit design are expected.

SDE'14 Session 2: Algorithms and Applications

Wednesday, December 10, 1:30PM-3:10PM, Room: Bonaire 4, Chair: Ferrante Neri

1:30PM MDE: Differential Evolution with Merit-based Mutation Strategy [#14252]

Ibrahim Ibrahim, Shahryar Rahnamayan and Miguel Vargas Martin, University of Ontario Institute of Technology, Canada

Currently Differential Evolution (DE) is arguably the most powerful and widely used stochastic population-based real-parameter optimization algorithm. There have been variant DE-based algorithms in the literature since its introduction in 1995. This paper proposes a novel merit-based mutation strategy for DE (MDE); it is based on the performance of each individual in the past and current generations to improve the solution accuracy. MDE is compared with three commonly used mutation strategies on 28 standard numerical benchmark functions introduced in the IEEE Congress on Evolutionary Computation (CEC- 2013) special session on real parameter optimization. Experimental results confirm that MDE outperforms the classical DE mutation strategies for most of the test problems in terms of convergence speed and solution accuracy.

1:50PM Multi-Objective Compact Differential Evolution [#14472]

Moises Osorio Velazquez, Carlos Coello Coello and Alfredo Arias-Montano, CINVESTAV-IPN, Mexico; IPN-ESIME Unidad Ticoman, Mexico

A wide range of problems in engineering require the simultaneous optimization of several objectives. Given the nature of such problems, it is often the case that the optimization process needs to take place from a device with very limited resources. Compact algorithms are a suitable alternative for being implemented in devices with limited computing resources, but so far, they have been used only to solve single-objective optimization problems. Here, we present a multi-objective compact algorithm based on differential evolution. The proposed algorithm obtains competitive results (and even better in some cases) than state-of-the-art multi-objective evolutionary algorithms while using less memory resources because of its statistical representation of the population.

2:10PM On the Efficient Design of a Prototype-Based Classifier Using Differential Evolution [#14490]

Luiz Soares Filho and Guilherme Barreto, Federal University of Ceara (UFC), Brazil

In this paper we introduce an evolutionary approach for the efficient design of prototype-based classifiers using differential evolution (DE). For this purpose we amalgamate ideas from the Learning Vector Quantization (LVQ) framework for supervised classification by Kohonen [1], [2], with the DE-based automatic clustering approach by Das et al. [3] in order to evolve supervised classifiers. The proposed approach is able to determine both the optimal number of prototypes per class and the corresponding positions of these prototypes in the data space. By means of comprehensive computer simulations on benchmarking datasets, we show that the resulting classifier, named LVQ-DE, consistently outperforms state-of-the-art prototype-based classifiers.

2:30PM Complex Network Analysis of Differential Evolution Algorithm applied to Flowshop with No-Wait Problem [#14148]

Donald Davendra, Ivan Zelinka, Magdalena Metlicka, Roman Senkerik and Michal Pluhacek, VSB-Technical University of Ostrava, Czech Republic; Tomas Bata University in Zlin, Czech Republic

This paper analyses the attributes of population dynamics of Differential Evolution algorithm using Complex Network Analysis tools. The population is visualised as an evolving complex network, which exhibits non-trivial features. Complex network attributes such as adjacency graph gives interconnectivity, centralities give the overview of convergence and stagnation, whereas cliques outlines the depth of interconnection and subgraphs within the population. The community graph plot gives an overview of the hierarchical grouping of the individuals in the population. These attributes give a clear description of the population during evaluation and can be utilised for adaptive population and parameter control.

2:50PM Some Improvements of the Self-Adaptive jDE Algorithm [#14734]

Janez Brest, Ales Zamuda, Iztok Fister and Borko Boskovic, University of Maribor, FEECS, Slovenia

Differential Evolution (DE) is widely used in real-parameter optimization problems in many domains, such as single objective optimization, constrained optimization, multi-modal optimization, and multi-objective optimization. Self-adaptive DE algorithm, called jDE, was introduced in 2006, and since then many other DE-based algorithms were proposed and many excellent mechanisms have improved DE a lot. In this paper we adopt two mutation strategies into the jDE algorithm. Additionally, the new algorithm (jDErpo) uses a gradually increasing mechanism for controlling lower bound of control parameters, JADE's mechanism for a mutant vector if some their components are out of bounds of a search space. Experimental results of the new algorithm are presented using CEC 2013 benchmark functions. The obtained results show that new mechanisms improve performance of the jDE algorithm and the jDErpo algorithm indicates competitive performance compared with the best DE-based algorithms at CEC 2013.

CICS'14 Session 2

Wednesday, December 10, 1:30PM-3:10PM, Room: Bonaire 5, Chair: Nur Zincir-heywood and Dipankar Dasgupta

1:30PM Automated testing for cyber threats to ad-hoc wireless networks [#14602]

Karel Bergmann and Joerg Denzinger, University of Calgary, Canada

Incremental Adaptive Corrective Learning is a method for testing ad-hoc wireless networks for vulnerabilities that adversaries can exploit. It is based on an evolutionary search for tests that define behaviors for adversary-controlled network nodes. The search incrementally increases the number of such nodes and first adapts each new node to the behaviors of the already existing attackers before improving the behavior of all attackers. Tests are evaluated in simulations and behaviors are corrected to fulfill all protocol induced obligations that are not explicitly targeted for an exploit. In this paper, we substantiate the claim that this is a general method by instantiating it for different vulnerability goals and by presenting an application for cooperative collision avoidance using VANETs. In all those instantiations, the method is able to produce concrete tests that demonstrate vulnerabilities.

1:50PM Automatic Attack Surface Reduction in Next-Generation Industrial Control Systems [#14575]

Sebastian Obermeier, Michael Wahler, Thanikesavan Sivanthi, Roman Schlegel and Aurelien Monot, ABB Corporate Research, Switzerland

Industrial control systems are often large and com- plex distributed systems and therefore expose a large potential attack surface. Effectively minimizing this attack surface requires security experts and significant manpower during engineering and maintenance of the system. This task, which is already difficult for today's control systems, will become significantly more complex for tomorrow's systems, which can reconfigure themselves dynamically, e.g., if hardware failures occur. In this article, we present a dynamic security system which can automatically minimize the attack surface of a control sys- tem's communication network. This security system is specifically designed for next-generation industrial control systems, but can also be applied in current generation systems. The presented security system adapts the necessary parameters of network and security controls according to the underlying changes in the control system environment. This ensures a better cyber security resilience against system compromise and reduces the attack surface because security controls will only allow data transfer that is required by the control application. Our evaluations for a next generation industrial control system and a current generation substation automation system show that the attack surface can be reduced by up to 90%, depending on the size and actual configuration of the control system.

2:10PM Supervised Learning to Detect DDoS Attacks [#14241]

Eray Balkanli, Jander Alves and A. Nur Zincir-heywood, Dalhousie university, Canada

In this research, we explore the performances of two machine learning classifiers and two open-source network intrusion detection systems (NIDS) on backscatter darknet traffic. We employ Bro and Corsaro open-source systems as well as the CART Decision Tree and Naive Bayes machine learning classifiers. While designing our machine learning classifiers, we used different sizes of training/test sets and different feature sets to understand the importance of data preprocessing. Our results show that a machine learning base approach can achieve very high performance on such backscatter darknet traffic without using IP addresses and port numbers employing a small training dataset.

2:30PM Benchmarking Two Techniques for Tor Classification: Flow Level and Circuit Level Classification [#14294]

Khalid Shahbar and A. Nur Zincir-heywood, Dalhousie University, Canada; Dalhousie university, Canada

Recently, many internet users, who seek anonymity, use Tor, which is one of the most popular anonymity software solutions. Tor provides this anonymity by hiding the identity of the user from the destination that the user aims to reach. It also hides the user activities into encrypted cells. In this work, we investigate up to what level we can define what the user in Tor is doing. To this end, we extended on the previous work to classify the user activities using information extracted from Tor circuits and cells. Moreover, we developed a classification system to identify user activities based on traffic flow features. Our results show that flow based classification can reach up to the accuracy of the cell level classification as well as being more flexible.

2:50PM Spark-based Anomaly Detection Over Multi-source VMware Performance Data In Real-time [#14945]

Mohiuddin Solaimani, Mohammed Iftekhar, Latifur Khan, Bhavani Thuraisingham and Joey Burton Ingram, The University of Texas at Dallas, United States; Sandia National Laboratories, United States

Anomaly detection refers to identifying the patterns in data that deviate from expected behavior. These nonconforming patterns are often termed as outliers, malwares, anomalies or exceptions in different application domains. This paper presents a novel, generic real-time distributed anomaly detection framework for multi-source stream data. As a case study, we have decided to detect anomaly for multi-source VMware-based cloud data center. The framework monitors VMware performance stream data (e.g., CPU load, memory usage, etc.) continuously. It collects these data simultaneously from all the VMwares connected to the network. It notifies the resource manager to reschedule its resources dynamically when it identifies any abnormal behavior of its collected data. We have used Apache Spark, a distributed framework for processing performance stream data and making prediction without any delay. Spark is chosen over a traditional distributed framework (e.g., Hadoop and MapReduce, Mahout, etc.) that is not ideal for stream data processing. We have implemented a flat incremental clustering algorithm to model the benign characteristics in our distributed Spark based framework. We have compared the average processing latency of a tuple during clustering and prediction in Spark with Storm, another distributed framework for stream data processing. We experimentally find that Spark processes a tuple much quicker than Storm on average.

CIEL'14 Session 2: Ensemble Predictors

Wednesday, December 10, 1:30PM-3:10PM, Room: Bonaire 6, Chair: Robi Polikar and Alok Kanti Deb

1:30PM Ensemble Deep Learning for Regression and Time Series Forecasting [#15028]

Xueheng Qiu, Le Zhang, Ye Ren, Ponnuthurai Nagaratnam Suganthan and Gehan Amaratunga, Nanyang Technological University, Singapore; Nanyang Technological Univeristy, Singapore; University of Cambridge, England

In this paper, for the first time, an ensemble of deep learning belief networks (DBN) is proposed for regression and time series forecasting. Another novel contribution is to aggregate the outputs from various DBNs by a support vector regression (SVR) model. We show the advantage of the proposed method on three electricity load demand datasets, one artificial time series dataset and three regression datasets over other benchmark methods.

1:50PM Building Predictive Models in Two Stages with Meta-Learning Templates [#15036]

Pavel Kordik and Jan Cerny, Czech Technical University in Prague, Czech Republic

The model selection stage is one of the most difficult in predictive modeling. To select a model with a highest generalization performance involves benchmarking huge number of candidate models or algorithms. Often, a final model is selected without considering potentially high quality candidates just because there are too many possibilities. Improper benchmarking methodology often leads to biased estimates of model generalization performance. Automation of the model selection stage is possible, however the computational complexity is huge especially when ensembles of models and optimization of input features should be also considered. In this paper we show, how to automate model selection process in a way that allows to search for complex hierarchies of ensemble models while maintaining computational tractability. We introduce

two-stage learning, meta-learning templates optimized by evolutionary programming with anytime properties to be able to deliver and maintain data-tailored algorithms and models in a reasonable time without human interaction. Co-evolution if inputs together with optimization of templates enabled to solve algorithm selection problem efficiently for a variety of datasets.

2:10PM Empirical Mode Decomposition based AdaBoost-Backpropagation Neural Network Method for Wind Speed Forecasting [#14700]

Ye Ren, Xueheng Qiu and Ponnuthurai Nagaratnam Suganthan, Nanyang Technological University, Singapore

Wind speed forecasting is a popular research direction in renewable energy and computational intelligence. Ensemble forecasting and hybrid forecasting models are widely used in wind speed forecasting. This paper proposes a novel ensemble forecasting model by combining Empirical mode decomposition (EMD), Adaptive boosting (AdaBoost) and Backpropagation Neural Network (BPNN) together. The proposed model is compared with six benchmark models: persistent, AdaBoost with regression tree, BPNN, AdaBoost-BPNN, EMD-BPNN and EMD-AdaBoost with regression tree. The comparisons undergoes several statistical tests and the tests show that the proposed EMD-AdaBoost-BPNN model outperformed the other models significantly. The forecasting error of the proposed model also shows significant randomness.

2:30PM TS Fuzzy Model Identification by a Novel Objective Function Based Fuzzy Clustering Algorithm [#15026]

Tanmoy Dam and Alok Kanti Deb, Department of Electrical Engineering, IIT Kharagpur, India

A Fuzzy C Regression Model (FCRM) distance metric has been used in Competitive Agglomeration (CA)algorithm to obtain optimal number rules or construct optimal fuzzy subspaces in whole input output space. To construct fuzzy partition matrix in data space, a new objective function has been proposed that can handle geometrical shape of input data distribution and linear functional relationship between input and output feature space variable. Premise and consequence parameters of Takagi-Sugeno (TS) fuzzy model are also obtained from the proposed objective function. Linear coefficients of consequence part have been determined using the Weighted Recursive Least Square (WRLS) framework. Effectiveness of the proposed algorithm has been validated using a nonlinear benchmark model.

CIR2AT'14 Session 2: Robotic Rehabilitation

Wednesday, December 10, 1:30PM-3:10PM, Room: Bonaire 7, Chair: Hermano Igo Krebs

1:30PM Spasticity Assessment System for Elbow Flexors/Extensors: Healthy Pilot Study [#14198]

Nitin Seth, Denise Johnson and Hussein Abdullah, University of Guelph, Canada; Hamilton Health Sciences Regional Rehabilitation Centre, Canada

This paper describes initial testing of a spasticity assessment system for passive elbow flexion/extension motions using a robotic manipulator. Quantitative force data was collected from healthy individuals. As repetition and speed were increased, significant differences in measured force were found in a study with a high speeds (n=48), but were not found in a study with a lower speeds (n=52). This result assists clinicians who now possess a baseline of healthy data to which quantitative patient data can be compared. Future developments include contrasting healthy baseline values to clinical trial data from individuals with stroke or acquired brain injury.

1:50PM Robotic Agents used to Help Teach Social Skills to Individuals with Autism: The Fourth Generation [#14324]

Matthew Tennyson, Deitra Kuester and Christos Nikolopoulos, Bradley University, United States

Robotic platforms have been developed and investigated as educationally useful interventions to improve social interactions among individuals with Autism Spectrum Disorders (ASD). In this paper, the development of a new generation of robotic agent is described, which uses economically available robotic platforms (Lego NXT) as Socially Assistive Robotics (SAR). In this generation, the robots were physically designed with maintainability, reliability, maneuverability, and aesthetics in mind; and the software architecture was designed for modularity, configurability, and reusability of the software.

2:10PM Encouraging Specific Intervention Motions via a Robotic System for Rehabilitation of Hand Function [#14651]

Brittney English and Ayanna Howard, Georgia Institute of Technology, United States

A knowledge gap exists for how to improve hand rehabilitation after stroke using robotic rehabilitation methods, and non-robotic hand rehabilitation methods show only small patient improvements. A proposed solution for this knowledge gap is to integrate the strengths of three of the most favorable rehabilitation strategies for post-stroke rehabilitation of hand function, which are constraint-induced movement therapy (CIMT), high-intensity therapy, and repetitive task training, with a robotic rehabilitation gaming system. To create a system that is composed of collaborative therapy efforts, we must first understand how to encourage rehabilitation intervention motions. An experiment was conducted in which healthy participants were asked to complete six levels of a rehabilitation game, each level designed to encourage a specific therapeutic intervention, and a control, where participants were asked to complete undefined exercise motions. The results showed that participants' motions were significantly different than the control while playing each of the levels. Upon comparing the actual paths of participants to the paths encouraged by the levels, it was discovered that the participants followed the intended path while encouragement was being provided for them to do so. When the encouraged motions required quick, hard motions, the participants would follow an aliased version of the intended path. This study suggests that robotic rehabilitation systems can not only change how a participant moves, but also encourage specific motions designed to mimic therapeutic interventions.

CIMSIVP'14 Session 2: Applications

Wednesday, December 10, 1:30PM-3:10PM, Room: Bonaire 8, Chair: Mohsen Dorodchi

1:30PM Endoscope Image Analysis Method for Evaluating the Extent of Early Gastric Cancer [#14736]

Tomoyuki Hiroyasu, Katsutoshi Hayashinuma, Hiroshi Ichikawa, Nobuyuki Yagi and Utako Yamamoto, Doshisha University, Japan; Murakami Memorial Hospital, Japan

In this study, a system is proposed to help physicians perform processing on images taken with a magnifying endoscopy with narrow band imaging. In our proposed system, the transition from lesion to normal zone is quantitatively analyzed and presented by texture analysis. Eleven feature values are calculated, i.e., six from a co-occurrence matrix and five from a run length matrix with a scanning window. Integrating these feature values formulates an effective and representative feature value, which is used to draw a color map, so the transition from lesion to normal zone can be visibly illustrated. In this paper, the proposed method is applied to images, and the efficacy is considered. This method is also applied to some rotated images to examine whether it could work effectively on such images.

1:50PM Fuzzy C-Means Clustering with Spatially Weighted Information for Medical Image Segmentation [#14809]

Myeongsu Kang and Jong-Myon Kim, University of Ulsan, Korea, Republic of

Image segmentation is an essential process in image analysis and is mainly used for automatic object recognition. Fuzzy c-means (FCM) is one of the most common methodologies used in clustering analysis for image segmentation. FCM clustering measures the common Euclidean distance between samples based on the assumption that each feature has equal importance. However, in most real-world problems, features are not considered equally important. To overcome this issue, we present a fuzzy c-means algorithm with spatially weighted information (FCM-SWI) that takes into account the influence of neighboring pixels on the center pixel by assigning weights to the neighbors. These weights are determined based on the distance between a corresponding pixel and the center pixel to indicate the importance of the memberships. Such a process leads to improved clustering performance. Experimental results show that the proposed FCM-SWI outperforms other FCM algorithms (FCM, modified FCM, and spatial FCM, FCM with spatial information, fast generation FCM) in both compactness and separation. Furthermore, the proposed FCM-SWI outperforms the classical algorithms in terms of quantitative comparison scores corresponding to a T1- weighted MR phantom for gray matter, white matter, and cerebrospinal fluid (CSF) slice regions.

2:10PM Improve Recognition Performance by Hybridizing Principal Component Analysis (PCA) and Elastic Bunch Graph Matching (EBGM) [#14240]

Xianming Chen, Zhang Chaoyang and Zhou Zhaoxian, University of Southern Mississippi, United States

In this paper, a new type of hybrid method that hybridizes PCA and EBGM as a two-stage procedure is presented to improve recognition performance in large- scale face recognition. Among various methods in face recognition, PCA is considered to identify human faces by holistic views, while EBGM is supposed to distinguish one face from another by details, but they are both excellent representative methods due to their respective advantages. However, when the size of gallery gets large, the recognition performance of both PCA and EBGM degrades severely. To improve recognition performance with large-scale gallery, we propose a hybrid method, which preprocesses the gallery images with PCA at first stage, and produces the final result with EBGM based on the preliminary result generated by PCA. Since the hybrid method combines the advantages of PCA and EBGM, the recognition performance with large-scale gallery has been improved greatly. Experimental result shows that the hybrid method has a remarkably better recognition accuracy than either PCA or EBGM. Moreover, it seems that the larger the gallery size, the better the improvement. On the other hand, the hybrid method brings no additional computational cost, even less than EBGM.

2:30PM Automatic Tumor Lesion Detection and Segmentation Using Histogram-Based Gravitational Optimization Algorithm [#14987]

Nooshin Nabizadeh and Mohsen Dorodchi, University Of Miami, United States; University of North Carolina at Charlotte, United States

In this paper, an automated and customized brain tumor segmentation method is presented and validated against ground truth applying simulated T1-weighted magnetic resonance images in 25 subjects. A new intensity-based segmentation technique called histogram based gravitational optimization algorithm is developed to segment the brain image into discriminative sections (segments) with high accuracy. While the mathematical foundation of this algorithm is presented in details, the application of the proposed algorithm in the segmentation of single T1-weighted images (T1-w) modality of healthy and lesion MR images is also presented. The results show that the tumor lesion is segmented from the detected lesion slice with 89.6% accuracy.

2:50PM Identification of Mature Grape Bunches using Image Processing and Computational Intelligence Methods [#14074]

Ashfaqur Rahman and Andrew Hellicar, CSIRO, Australia

Due to frost and insufficient exposure to sunlight, some grape bunches remain undeveloped during harvesting. For automation of harvesting, it is required to automatically identify the mature grape bunches. This paper presents a sequence of image processing and computational intelligence methods to identify mature grape bunches. It's a two-step process where in the first step the grape bunches are separated from the background of an image and in the second step the grape bunch is classified into mature and undeveloped group. We achieved 96.88% accuracy on the images obtained from a strip of vineyard in Cambridge, Tasmania.

ADPRL'14 Optimal Control 1: Fundamentals and Techniques

Wednesday, December 10, 1:30PM-3:10PM, Room: Curacao 1, Chair: Eugene Feinberg and Theodorou Evangelos

1:30PM Convergence of Value Iterations for Total-Cost MDPs and POMDPs with General State and Action Sets [#14747]

Eugene Feinberg, Pavlo Kasyanov and Michael Zgurovsky, Stony Brook University, United States; National Technical University of Ukraine, Ukraine

This paper describes conditions for convergence to optimal values of the dynamic programming algorithm applied to total-cost Markov Decision Processes (MDPSs) with Borel state and action sets and with possibly unbounded one-step cost functions. It also studies applications of these results to Partially Observable MDPs (POMDPs). It is well-known that POMDPs can be reduced to special MDPs, called Completely Observable MDPs (COMDPs), whose state spaces are sets of probabilities of the original states. This paper describes conditions on POMDPs under which optimal policies for COMDPs can be found by value iteration. In other words, this paper provides sufficient conditions for solving total-costs POMDPs with infinite state, observation and action sets by dynamic programming. Examples of applications to filtration, identification, and inventory control are provided.

1:50PM Theoretical Analysis of a Reinforcement Learning based Switching Scheme [#14832]

Ali Heydari, South Dakota School of Mines and Technology, United States

A reinforcement learning based scheme for optimal switching with an infinite- horizon cost function is briefly proposed in this paper. Several theoretical questions are shown to arise regarding its convergence, optimality of the result, and continuity of the limit function, to be uniformly approximated using parametric function approximators. The main contribution of the paper is providing rigorous answers for the questions, where, sufficient conditions for convergence, optimality, and continuity are provided.

2:10PM An analysis of optimistic, best-first search for minimax sequential decision making [#14381]

Lucian Busoniu, Remi Munos and Elod Pall, Department of Automation, Technical University of Cluj-Napoca, Romania; Team SequeL, INRIA Lille, France

We consider problems in which a maximizer and a minimizer agent take actions in turn, such as games or optimal control with uncertainty modeled as an opponent. We extend the ideas of optimistic optimization to this setting, obtaining a search algorithm that has been previously considered as the best-first search variant of the B* method. We provide a novel analysis of the algorithm relying on a certain structure for the values of action sequences, under which earlier actions are more important than later ones. An asymptotic branching factor is defined as a measure of problem complexity, and it is used to characterize the relationship between computation invested and near-optimality. In particular, when action importance decreases exponentially, convergence rates are obtained. Throughout, examples illustrate analytical concepts such as the branching factor. In an empirical study, we compare the optimistic best-first algorithm with two classical game tree search methods, and apply it to a challenging HIV infection control problem.

2:30PM Nonparametric Infinite Horizon Kullback-Leibler Stochastic Control [#14245]

Yunpeng Pan and Evangelos Theodorou, Georgia Institute of Technology, United States

We present two nonparametric approaches to Kullback-Leibler (KL) control, or linearly-solvable Markov de- cision problem (LMDP) based on Gaussian processes (GP) and Nystrom approximation. Compared to recently developed para- metric methods, the proposed data-driven frameworks feature accurate function approximation and efficient on-line operations. Theoretically, we derive the mathematical connection of KL control based on dynamic programming with earlier work in control theory which relies on information theoretic dualities for the infinite time horizon case. Algorithmically, we give explicit optimal control policies in nonparametric forms, and propose on-line update schemes with budgeted computational costs. Nu- merical results demonstrate the effectiveness and usefulness of the proposed frameworks.

2:50PM Information-Theoretic Stochastic Optimal Control via Incremental Sampling-based Algorithms [#14303]

Oktay Arslan, Evangelos Theodorou and Panagiotis Tsiotras, Georgia Institute of Technology, United States

This paper considers optimal control of dynamical systems which are represented by nonlinear stochastic differential equations. It is well-known that the optimal control policy for this problem can be obtained as a function of a value function that satisfies a nonlinear partial differential equation, namely, the Hamilton-Jacobi-Bellman equation. This nonlinear PDE must be solved backwards in time, and this computation is intractable for large scale systems. Under certain assumptions, and after applying a logarithmic transformation, an alternative characterization of the optimal policy can be given in terms of a path integral. Path Integral (PI) based control methods have recently been shown to provide elegant solutions to a broad class of stochastic optimal control problems. One of the implementation challenges with this formalism is the computation of the expectation of a cost functional over the trajectories of the unforced dynamics. Computing such expectation over trajectories that are sampled uniformly may induce numerical instabilities due to the exponentiation of the cost. Therefore, sampling of low-cost trajectories is essential for the practical implementation of PI-based methods. In this paper, we use incremental sampling-based algorithms to sample useful trajectories from the unforced system dynamics, and make a novel connection between Rapidly-exploring Random Trees (RRTs) and information-theoretic stochastic optimal control. We show the results from the numerical implementation of the proposed approach to several examples.

CIDM'14 Session 2: Multitask and Metalearning

Wednesday, December 10, 1:30PM-3:10PM, Room: Curacao 2, Chair: Rocco Langone

1:30PM New Bilinear Formulation to Semi-Supervised Classification Based on Kernel Spectral Clustering [#14221]

Vilen Jumutc and Johan Suykens, KU Leuven, Belgium

In this paper we present a novel semi-supervised classification approach which combines bilinear formulation for non-parallel binary classifiers based upon Kernel Spectral Clustering. The cornerstone of our approach is a bilinear term introduced into the primal formulation of semi-supervised classification problem. In addition we perform separate manifold regularization for each individual classifier. The latter relates to the Kernel Spectral Clustering unsupervised counterpart which helps to obtain more precise and generalizable classification boundaries. We derive the dual problem which can be effectively translated into a linear system of equations and then solved without introducing extra costs. In our experiments we show the usefulness and report considerable improvements in performance with respect to other semi-supervised approaches, like Laplacian SVMs and other KSC-based models.

1:50PM Batch Linear Least Squares-based Learning Algorithm for MLMVN with Soft Margins [#14263]

Evgeni Aizenberg and Igor Aizenberg, Delft University of Technology, Netherlands; Texas A and M University-Texarkana, United States

In this paper, we consider a batch learning algorithm for the multilayer neural network with multi-valued neurons (MLMVN) and its soft margins variant (MLMVN-SM). MLMVN is a neural network with a standard feedforward organization based on the multi-valued neuron (MVN). MVN is a neuron with complex-valued weights and inputs/output located on the unit circle. Standard MLMVN has a derivative-free learning algorithm based on the error-correction learning rule. Recently, this algorithm was modified for MLMVN with discrete outputs by using soft margins (MLMVN-SM). This modification improves classification results when MLMVN is used as a classifier. Another recent development in MLMVN is the use of batch acceleration step for MLMVN with a single output neuron. Complex QR-decomposition was used to adjust the output neuron weights for all learning samples simultaneously, while the hidden neuron weights were adjusted in a regular way. In this paper, we merge the soft margins approach with batch learning. We suggest a batch linear least squares (LLS) learning algorithm for MLMVN-SM. We also expand the batch technique to multiple output neurons and hidden neurons. This new learning technique drastically reduces the number of learning iterations and learning time when solving classification problems (compared to MLMVN-SM), while maintaining the classification accuracy of MLMVN-SM.

2:10PM Comparing Datasets by Attribute Alignment [#14629]

Jakub Smid and Roman Neruda, Charles University in Prague, Faculty of Mathematics and Physics, Czech Republic; Institute of Computer Science, Academy of Sciences of the Czech Republic, Czech Republic

Metalearning approach to the model selection problem -- exploiting the idea that algorithms perform similarly on similar datasets -- requires a suitable metric on the dataset space. One common approach compares the datasets based on fixed number of features describing the datasets as a whole. The information based on individual attributes is usually aggregated, taken for the most relevant attributes only, or omitted altogether. In this paper, we propose an approach that aligns complete sets of attributes of the datasets, allowing for different number of attributes. By supplying the distance between two attributes, one can find the alignment minimizing the sum of individual distances between aligned attributes. We present two methods that are able to find such an alignment. They differ in computational complexity and presumptions about the distance function between two attributes supplied. Experiments were performed using the proposed methods and the results were compared with the baseline algorithm.

2:30PM Convex Multi-task Relationship Learning using Hinge Loss [#14638]

Anveshi Charuvaka and Huzefa Rangwala, George Mason University, United States

Multi-task learning improves generalization performance by learning several related tasks jointly. Several methods have been proposed for multi-task learning in recent years. Many methods make strong assumptions about symmetric task relationships while some are able to utilize externally provided task relationships. However, in many real world tasks the degree of relatedness among tasks is not known a priori. Methods which are able to extract the task relationships and exploit them while simultaneously learning models with good generalization performance can address this limitation. In the current work, we have extended a recently proposed method for learning task relationships using smooth squared loss for regression to classification problems using non-smooth hinge loss due to the demonstrated effectiveness of SVM classifier in single task classification settings. We have also developed an efficient optimization procedure using bundle methods for the proposed multi-task learning formulation. We have validated our method on one simulated and two real world datasets and compared its performance to competitive baseline single-task and multi-task methods.

2:50PM Precision-Recall-Optimization in Learning Vector Quantization Classifiers for Improved Medical Classification Systems [#14845]

Thomas Villmann, Marika Kaden, Mandy Lange, Paul Stuermer and Wieland Hermann, University of Applied Sciences Mittweida, Germany; Paracelsus Hospital Zwickau, Germany

Classification and decision systems in data analysis are mostly based on accuracy optimization. This criterion is only a conditional informative value if the data are imbalanced or false positive/negative decisions cause different costs. Therefore more sophisticated statistical quality measures are favored in medicine, like precision, recall etc. . Otherwise, most classification approaches in machine learning are designed for accuracy optimization. In this paper we consider variants of learning vector quantizers (LVQs) explicitly optimizing those advanced statistical quality measures while keeping the basic intuitive ingredients of these classifiers, which are the prototype based principle and the Hebbian learning. In particular we focus in this contribution particularly to precision and recall as important measures for use in medical applications. We investigate these problems in terms of precision-recall curves as well as receiver-operating characteristic (ROC) curves well-known in statistical classification and test analysis. With the underlying more general framework, we provide a principled alternatives traditional classifiers, such that a closer connection to statistical classification analysis can be drawn.

SIS'14 Session 2: Particle Swarm Optimization - I

Wednesday, December 10, 1:30PM-3:10PM, Room: Curacao 3, Chair: Ivan Zelinka and Roman Senkerik

1:30PM Weight Regularisation in Particle Swarm Optimisation Neural Network Training [#14042]

Anna Rakitianskaia and Andries Engelbrecht, University of Pretoria, South Africa

Applying weight regularisation to gradient-descent based neural network training methods such as backpropagation was shown to improve the generalisation performance of a neural network. However, the existing applications of weight regularisation to particle swarm optimisation are very limited, despite being promising. This paper proposes adding a regularisation penalty term to the objective function of the particle swarm. The impact of different penalty terms on the resulting neural network performance as trained by both backpropagation and particle swarm optimisation is analysed. Swarm behaviour under weight regularisation is studied, showing that weight regularisation results in smaller neural network architectures and more convergent swarms.

1:50PM Gathering algorithm: A new concept of PSO based metaheuristic with dimensional mutation [#14815]

Michal Pluhacek, Roman Senkerik, Donald Davendra and Ivan Zelinka, Tomas Bata University, Faculty of Applied Informatics, Czech Republic; VSB-Technical University of Ostrava, Faculty of Electrical Engineering and Computer Science, Czech Republic

In this paper, a novel PSO based metaheuristic is proposed. This described approach is inspired by human gathering mechanisms. Each particle is given a possibility to follow a randomly selected particle from the swarm. When a promising search area is found by the particle, it remains stationary for a given number of iterations improving the chances of other particles following such a stationary particle into that search area. In this novel concept, the location of global best solution is not used as the attraction point for the particles. But the convergence into promising search areas is driven by the snowball effect of increasing number of stationary particles in the particular promising areas. Two different dimensional mutations are applied on stationary particles for the further improvement the performance of the algorithm. The key mechanism of the algorithm is described here in detail. The performance is tested on the CEC 2013 benchmark set with promising results. The results are compared with two current state-of-art PSO based optimization techniques.

2:10PM Comparison of Self-Adaptive Particle Swarm Optimizers [#14791]

Elre van Zyl and Andries Engelbrecht, University of Pretoria, South Africa

Particle swarm optimization (PSO) algorithms have a number of parameters to which their behaviour is sensitive. In order to avoid problem-specific parameter tuning, a number of self-adaptive PSO algorithms have been proposed over the past few years. This paper compares the behaviour and performance of a selection of self-adaptive PSO algorithms to that of time-variant algorithms on a suite of 22 boundary constrained benchmark functions of varying complexities. It was found that only two of the nine selected self-adaptive PSO algorithms performed comparably to similar time-variant PSO algorithms. Possible reasons for the poor behaviour of the other algorithms as well as an analysis of the more successful algorithms is performed in this paper.

2:30PM Confident but Weakly Informed: Tackling PSO's Momentum Conundrum [#14139]

Christopher Monson and Kevin Seppi, Google, Inc., United States; Brigham Young University, United States

Particle Swarm Optimization uses noisy historical information to select potentially optimal function samples. Though information-theoretic principles suggest that less noise indicates greater certainty, PSO's momentum term is usually both the least informed and the most deterministic. This dichotomy suggests that, while momentum has a profound impact on swarm diversity, it would benefit from a more principled approach. We demonstrate that momentum can be made both more effective and better behaved with informed feedback, and that it may even be completely eliminated with proper application of more straight- forward and well-behaved diversity injection strategies.

2:50PM Communication-Aware Distributed PSO for Dynamic Robotic Search [#14235]

Logan Perreault, Mike Wittie and John Sheppard, Montana State University, United States

The use of swarm robotics in search tasks is an active area of research. A variety of algorithms have been developed that effectively direct robots toward a desired target by leveraging their collaborative sensing capabilities. Unfortunately, these algorithms often neglect the task of communicating possible task solutions outside of the swarm. Many scenarios require a monitoring station that must receive updates from robots within the swarm. This task is trivial in constrained locations, but becomes difficult as the search area increases and communication between nodes is not always possible. A second shortcoming of existing algorithms is the inability to find and track mobile targets. We propose an extension to the distributed Particle Swarm Optimization algorithm that is both communication-aware and capable of tracking mobile targets within a search space. Simulated experiments show that our algorithm returns more accurate solutions to a monitoring station than existing algorithms, especially in scenarios, where the target value or location changes over time.

CIASG'14 Session 2: Micro-grids & Electric Vehicles

Wednesday, December 10, 1:30PM-3:10PM, Room: Curacao 4, Chair: Edgar Sanchez

1:30PM Performance of a Smart Microgrid with Battery Energy Storage System's Size and State of Charge [#14647]

Afshin Ahmadi, Ganesh Kumar Venayagamoorthy and Ratnesh Sharma, Clemson University, United States; NEC Laboratories America Inc., United States

A mini-grid with various distributed energy technologies such as micro-turbine, micro-hydro, wind, solar, and biomass is known as microgrid. A microgrid can either be connected to the main grid or operate stand-alone. Due to variable nature of renewable resources such wind and solar plants, energy storage becomes necessary to maintain reliability of power supply to critical loads if high level of wind and solar power penetration

is to be maximized. Moreover, advanced energy management systems are critical to make intelligent decisions that minimize power outage to critical loads, and maximize the utilization of renewable sources of energy. The primary contribution of this paper is to investigate the impact of size and state of charge (SOC) of a battery energy storage system (BESS) for a given microgrid with dynamic energy management systems (DEMS). Results are presented to show the relative performance of two types of DEMS for a microgrid with different BESS size and initial SOC. The performance of an intelligent DEMS developed using an adaptive critic designs approach is compared with of a DEMS developed using a decision tree based approach.

1:50PM A Simple Recurrent Neural Network for Solution of Linear Programming: Application to a Microgrid [#14910]

Juan Diego Sanchez-Torres, Martin J. Loza-Lopez, Riemann Ruiz-Cruz, Edgar Sanchez and Alexander G. Loukianov, CINVESTAV Guadalajara, Mexico; ITESO University, Mexico

The aim of this paper is to present a simple new class of recurrent neural networks, which solves linear programming. It is considered as a sliding mode control problem, where the network structure is based on the Karush-Kuhn-Tucker (KKT) optimality conditions, and the KKT multipliers are the control inputs to be implemented with finite time stabilizing terms based on the unit control, instead of common used activation functions. Thus, the main feature of the proposed network is the fixed number of parameters despite of the optimization problem dimension, which means, the network can be easily scaled from a small to a higher dimension problem. The applicability of the proposed scheme is tested on real- time optimization of an electrical Microgrid prototype.

2:10PM Parallel Tempering for Constrained Many Criteria Optimization in Dynamic Virtual Power Plants [#14147]

Joerg Bremer and Michael Sonnenschein, University of Oldenburg, Germany

The increasing pervasion of the distribution grid with renewable energy resources imposes fluctuating and hardly predictable feed-in and demands new management strategies. On the other hand, combined with controllable, shiftable loads and electrical storages, these energy units set up a new flexibility potential that may be used to full capacity when harnessing ICT-based control. Following the long-term goal of substituting conventional power generation, market oriented approaches will lead to interaction, competition but also collaboration between different units. Together with the huge number of actors, this in turn will lead to a need for self-organized and distributed control structures. Virtual power plants are an established idea for organizing distributed generation. A frequently arising task is solving the scheduling problem that assigns an operation schedule to each energy resource taking into account a bunch of objectives like accurate resemblance of the desired load profile, robustness of the schedule, costs, maximizing remaining flexibility for subsequent planning periods, and more. Nevertheless, also such dynamic approaches exhibit sub-problems demanding for centralized solutions for ahead of time scheduling of active power. In this paper we develop a hybrid approach combining the advantages of parallel tempering with a constraint handling technique based on a support vector decoder for systematically generating solutions; thus ensuring feasible overall solutions. We demonstrate the applicability with a set of simulation results comprising many-objective scheduling for different groups of energy resources.

2:30PM Non-convex Dynamic Economic/Environmental Dispatch with Plug-in Electric Vehicle Loads [#14710]

Zhile Yang, Kang Li, Qun Niu, Cheng Zhang and Aoife Foley, Queen's University Belfast, United Kingdom; Shanghai University, China

Electric vehicles are a key prospect for future transportation. A large penetration of electric vehicles has the potential to reduce the global fossil fuel consumption and hence the greenhouse gas emissions and air pollution. However, the additional stochastic loads imposed by plug-in electric vehicles will possibly introduce significant changes to existing load profiles. In this paper, electric vehicles loads are integrated into an 5-unit system using a non-convex dynamic dispatch model. The actual infrastructure characteristics including valve-point effects, load balance constraints and transmission loss have been included in the model. Multiple load profiles are comparatively studied and compared in terms of economic and environmental impacts in order to identify patterns to charge properly. The study as expected shows that off- peak charging is the best scenario with respect to using less fuels and producing less emissions.

2:50PM Coordinated Electric Vehicle Charging Solutions Using Renewable Energy Sources [#14801]

Kumarsinh Jhala, Balasubramaniam Natarajan, Anil Pahwa and Larry Erickson, Kansas State University, United States

Growing concerns about global warming, air pollution, and fossil fuel shortages have prompted the research and development of energy efficient electric vehicles (EVs). The United States government has a goal of putting 1 million EVs on the road by 2015. The anticipated increase in EV usage, along with the use of renewable energy sources for EV charging presents opportunities as well as technical hurdles. In this work, we propose coordinated EV charging strategies for commercial charging stations in parking lots. The focus of the research is on minimizing energy drawn from the grid while utilizing maximum energy from renewable energy resources in order to maximize benefits to parking lot owners. We propose an optimal control theory based strategy for EV charging. Specifically we derive a centralized iterative control approach in which the charging rates of EVs are optimized one at a time. Through analysis and simulations, we demonstrate that optimizing the charging rate of one vehicle at a time and repeating this process for all vehicles iteratively converges to the global optimum.

SSCI DC Session 2

Wednesday, December 10, 1:30PM-3:10PM, Room: Curacao 7, Chair: Xiaorong Zhang

1:30PM An Evolutionary Neural Network Model for Dynamic Channel Allocation in Mobile Communication Network [#14011]

Peter Ugege, Federal University of Agriculture, Nigeria

multimedia data and at the same time provides guaranteed quality of service (QoS) to all the applications. The challenge is to develop an efficient allocation scheme for assigning resources without compromising the QoS. In meeting this challenge,this research proposes an evolutionary neural network approach with dynamic allocation to utilize frequency spectrum efficiently and to reduce call blocking probabilities

1:50PM Computational Intelligence in Smart Grid Security Analysis Against Smart Attacks [#14225]

Jun Yan, University of Rhode Island, United States

The future Smart Grid is facing a growing risk from cyber-security issues while it is being integrated with the communication networks. A specific type of inherent structural vulnerability of power grids, the Cascading Failure, can be exploited by potential attackers. While the complex mechanism behind cascading failures has been challenging to traditional power system analysis, the methodologies and techniques from computational intelligence is shown to be helpful to better understand the risk and possible solutions. This doctoral study focuses on utilizing computational intelligence algorithms, e.g. the Self-organizing map, to explore implicit connections from the power system topology, states and other dynamics to the eventual impact of attacks that aimed at creating cascading failures. Preliminary results have demonstrated the power of these algorithms in bulk power system analysis.

2:10PM Doctoral Consortium [#14334]

Anne Marie Amja, University of Quebec at Montreal, Canada

The advancement of mobile wireless networks and mobile devices has permitted programmers to exert their imagination to create mobile applications. The interest and research for context-aware systems have substantially taken interest over the past years and has become the new era of several computing paradigms. Context-aware applications are found in everyday life such as recommending social events in a city. Several systems or architectures where proposed in the literature with their own specific strengths and weaknesses. These types of applications must go trough a cycle before providing the required service to the user. Among the steps found to design a context-aware application, modelling, reasoning and adaptation are the crucial ones. Our research consists of designing the context from modelling to self- adaptation. So far, we have proposed a modeling and reasoning approach that works hand in hand based on Relational Concept Analysis (RCA), an extension of Formal Concept Analysis (FCA), and Description Logic (DL) respectively. We are currently working on a semantic approach to self-adapt the application based on components and theirs connectors, architecture model transformation as well as autonomic control loop. This document contains the required aspects for the doctoral consortium running in conjunction with the IEEE SSCI 2014 conference.

2:30PM Predicting the Terminal Ballistics of Kinetic Energy Projectiles Using Artificial Neural Networks [#14610]

John Auten, Towson University, United States

The U.S. Army requires the evaluation of new weapon and vehicle systems through the use of experimental testing and Vulnerability/Lethality (V/L) modeling and simulation. The current modeling and simulation methods being utilized often require significant amounts of time and subject matter expertise. This typically means that quick results cannot be provided when needed to address new threats encountered in theater. Recently there has been an increased focus on rapid results for modeling and simulation efforts that can also provide accurate results. Accurately modeling the penetration and residual properties of a ballistic threat as it progresses through a target is an extremely important part of determining the effectiveness of the threat against that target. This research concentrates on improving the accuracy and speed of modeling the physical interaction of Kinetic Energy Projectiles (KEPs).

2:50PM Pruning Algorithm for Multi-objective Optimization using Specific Bias Intensity Parameter [#15005]

Sufian Sudeng and Naruemon Wattanapongsakorn, Department of Computer Engineering King Mongkut's University of Technology Thonburi Bangkok, 10140, Thailand., Thailand

Multi-objective optimization algorithms have been developed over many years. The Pareto-optimal solutions are evaluated based on convergence, diversity and computational performance of the algorithms. However, there is still a need to employ an additional approach to discover the preferred solutions among all available solutions. Concentrating on the search toward preferred regions is likely to yield a better approximation of the Pareto-optimal solutions.

Special Session: CIBD'14 Session 3: Big Data Analytics in Traditional Chinese Medicine

Wednesday, December 10, 3:30PM-5:10PM, Room: Antigua 2, Chair: Josiah Poon, Xuezhong Zhou and Runshun Zhang

3:30PM Mining the Prescription-Symptom Regularity of TCM for HIV/AIDS Based on Complex Network [#14397]

Zhang Xiaoping, Wang Jian, Liang Biyan, Qi Haixun and Zhao Yufeng, China Academy of Chinese Medical Sciences, Beijing, China; School of Computer and Information Technology Beijing Jiaotong University, China; Institute of Basic Research in Clinical Medicine, China Academy of Chinese Medical Sciences Beijing, China

Purpose: According to the theory of symptomatic treatment, to explore the characteristics of symptoms and the principles of TCM herbal treatment in HIV/AIDS population. Method: Extracting clinical case of HIV/AIDS for TCM herbal treatment gathered by pilot projects named the "National Free Treating HIV/AIDS with TCM Program" including 1695 patients with total 12,985 attendances from August 2004 to December 2010. Using complex network methods to explore the features of symptomatic treatment and using multi-layer network to show the relationship between symptoms and TCM herbs of prescription. Result: The main symptoms of HIV/AIDS are fatigue, anorexia, shortness of breath, chest tightness, pruritus, headache, muscle pain, abdominal distension, etc. And the main herbs are radix paeoniae alba, radix codonopsis, astragalus, atractylodes, tuckahoe, liquorice, rhizoma chuanxiong, dried tangerine peel, etc. Conclusion: From the relationship of prescription-symptom, it indicates that the treatment of HIV/AIDS starts from blood tonic, combined with spleen and stomach, digestion dredge, lung and focusing on modulating spleen.

3:50PM Regularity of Herbal Formulae for HIV/AIDS Patients with Syndromes Based on Complex Networks [#14398]

Jian Wang, Xiaoping Zhang, Biyan Liang, Xuezhong Zhou, Jiaming Lu, Liran Xu, Xin Deng, Xiuhui Li, Li Wang, Xinghua Tan, Yuxiang Mao, Guoliang Zhang, Junwen Wang, Xiaodong Li and Yuguang Wang, Academy of Chinese Medical Sciences, China; School of Computer and Information Technology, Beijing Jiaotong University, China; The First Affiliated of Hennan University of TCM, China; Ruikang Hospital Affiliated to Guangxi University of Chinese Medicine, China; Beijing You'an Hospital, China; Yunnan Academy of TCM, China; Guangzhou Eighth People's Hospital, China; Hebei Hospital of TCM, China; Anhui Hospital of TCM, China; Hunan Provincial Hospital of TCM, China; Hubei Provincial Hospital of TCM, China; Beijing Ditan Hospital, China

This study aimed to explore the primary Chinese herbs and their combination regularity in treating human immunodeficiency virus (HIV)/ acquired immunodeficiency syndrome (AIDS) patients with different syndromes. Methods: Data of first visit of 1,788 HIV/AIDS patients from August 2004 to December 2010 in 11 pilot projects are extracted. The medication law is analysed with frequency analysis and complex network method. Results are visually presented with complex network. Results: Atractylodes rhizome, Poria cocos, Angelica, Codonopsis pilosula, Ligusticum wallichii, Radix Paeoniae Alba, Liquorice and Astragalus are core herbals for deficiency of both qi and blood. Liquorice, Radix Paeoniae Alba, Liriope, Radix Scrophulariae, Radix Rehmanniae, prepared Radix Rehmanniae, Balloon flower, Fritillaria and Schisandra chinensis are core herbals for deficiency of both qi and yin, deficiency of lung and kidney. Poria cocos, Atractylodes rhizome, Codonopsis pilosula, Tangerine peel, Chinese yam, Semen Coicis, Amomum, white hyacinth bean and Balloon flower are core herbals for deficiency in the spleen and kidney and dampness blockage. Conclusion: The regularity of herbal formulae for HIV/AIDS patients with different syndromes may provide useful information for guiding clinical treatment and related research in the future.

4:10PM Development of large-scale TCM corpus using hybrid named entity recognition methods for clinical phenotype detection: an initial study [#14963]

Lizhi Feng, Xuezhong Zhou, Haixun Qi, Runshun Zhang, Yinghui Wang and Baoyan Liu, Beijing Jiaotong University, China; Guang'anmen Hospital, China; China Academy of Chinese Medicine Sciences, China

Clinical data is one of the core data repositories in traditional Chinese medicine (TCM) because TCM is a clinically based medicine. However, most clinical data like electronic medical record in TCM is still in free text. Due to the lack of large- scale annotation corpus in TCM field, in this paper, we aim to develop an annotation system for TCM clinical text corpus. To reduce the manual labors, we implement three named entity recognition methods like supervised machine learning method, unsupervised method and structured data comparison, to assist the batch annotations of clinical records before manual checking. We developed the system using Java and have curated more than 2,000 records of chief complaint in effective approach.

4:30PM Methods and technologies of traditional Chinese medicine clinical information datamation in real world [#14355]

Guanli Song, Guanbo Song, Baoyan Liu, Yinghui Wang, Runshun Zhang, Xuezhong Zhou, Liang Xie and Xinghuan Huang, Guang'anmen Hospital of China Academy of Chinese Medical Sciences, China; Jining Traditional Chinese Medicine Hospital, China; China Academy of Chinese Medical Sciences, China; School of Computer and Information Technology, Beijing Jiaotong University, China; Beijing Upway technology development CO., Ltd., China

Under the guidance of clinical research paradigm of traditional Chinese medicine (TCM) in real world, the research group developed the clinical research information sharing system, in which structured electronic medical record system of traditional Chinese medicine is the technology platform of datamation of clinical diagnosis and treatment information. The clinical diagnosis and treatment information can be activated and used effectively only after datamation and truly become the treasures of knowledge of TCM. This paper discusses the implementation process and technologies and methods of TCM clinical information datamation, and take admission records as an example to demonstrate the contents and realization way of datamation, and a brief introduction of the effect of implementation and application of datamation. By making full use of technologies and methods of datamation, strengthening data quality control in the datamation process, greatly improving the quality of TCM clinical research data, to lay a good foundation for establishment of knowledge base through further statistical analysis or data mining of TCM clinical data.

4:50PM TCM Syndrome Classification of AIDS based on Manifold Ranking [#14394]

Yufeng Zhao, Lin Luo, Liyun He, Baoyan Liu, Qi Xie, Xiaoping Zhang, Jian Wang, Guanli Song and Xianghong Jing, Institute of Basic Research in Clinical Medicine, China Academy of Chinese Medical Sciences, China; China Academy of Chinese Medical Sciences, China; Guang An Men Hospital, China Academy of Chinese Medical Sciences, China; Institute of acupuncture and moxibustion China Academy of Chinese Medical Sciences, China

Treatment based on the syndrome differentiation is the key of Traditional Chinese Medicine (TCM) treating the disease of acquired immune deficiency syndrome (AIDS). Therefore, a feasible way of improving the clinical therapy effectiveness is to correctly explore the syndrome classifications. Recently, more and more AIDS researchers are focused on exploring the syndrome classifications. In this paper, a novel data mining method based on Manifold Ranking (MR) is proposed to analyze the syndrome classifications for the disease of AIDS. Compared with the previous methods, three weaknesses, which are linear relation of the clinical data, mutually exclusive symptoms among different syndromes, confused application of expert knowledge, are avoided so as to effectively exploit the latent relation between syndromes and symptoms. Better performance of syndrome classifications is able to be achieved according to the experimental results and the clinical experts.

IES'14 Session 3

Wednesday, December 10, 3:30PM-5:10PM, Room: Antigua 3, Chair: Manuel Roveri

3:30PM High precision FPGA implementation of neural network activation functions [#14156]

Francisco Ortega, Jose Jerez, Gustavo Juarez, Jorge Perez and Leonardo Franco, Malaga University, Spain; Tucuman National University, Argentina

The efficient implementation of artificial neural networks in FPGA boards requires tackling several issues that strongly affect the final result. One of these issues is the computation of the neuron's activation function. In this work, an analysis of the implementation of the sigmoid and the exponential functions are carried out, using a lookup table approach combined with a linear interpolation procedure. Also a time division multiplexing of the multiplier attached to the neurons was used, with the aim of saving board resources. The results are evaluated in terms of the absolute and relative error values obtained and also through a quality factor, showing a clear improvement in relationship to previously published works.

3:50PM An Intelligent Embedded System for Real-Time Adaptive Extreme Learning Machine [#14432]

Raul Finker, Ines del Campo, Javier Echanobe and Victoria Martinez, University of the Basque Country, Spain

Extreme learning machine (ELM) is an emerging approach that has attracted the attention of the research community because it outperforms conventional back-propagation feed-forward neural networks and support vector machines (SVM) in some aspects. ELM provides a robust learning algorithm, free of local minima, suitable for high speed computation, and less dependant on human intervention than the above methods. ELM is appropriate for the implementation of intelligent embedded systems with real-time learning capability. Moreover, a number of cutting-edge applications demanding a high performance solution could benefit from this approach. In this work, a scalable hardware/software architecture for ELM is presented, and the details of its implementation on a field programmable gate array (FPGA) are analyzed. The proposed solution provides high speed, small size, low power consumption, autonomy, and true capability for real-time adaptation (i.e. the learning stage is performed on-chip). The developed system is able to deal with highly demanding multiclass classification problems. Two real-world applications are presented, a benchmark problem, the Landsat images classifier, and a novel driver identification system for smart car applications. Experimental results that validate the proposal are provided.

4:10PM A differential flatness theory approach to adaptive fuzzy control of chaotic dynamical systems [#14626]

Gerasimos Rigatos, Industrial Systems Institute / Unit of Industrial Automation, Greece

A solution to the problem of control of nonlinear chaotic dynamical systems, is proposed with the use of differential flatness theory and of adaptive fuzzy control theory. Considering that the dynamical model of chaotic systems is unknown, an adaptive fuzzy controller is designed. By applying differential flatness theory the chaotic system's model is written in a linear form, and the resulting control inputs are shown to contain nonlinear elements which depend on the system's parameters. The nonlinear terms which appear in the control inputs of the transformed dynamical model are approximated with the use of neuro-fuzzy networks. It is proven that a suitable learning law can be defined for the aforementioned neuro-fuzzy approximators so as to preserve the closed-loop system stability. Moreover, with the use of Lyapunov stability analysis it is proven that the proposed adaptive fuzzy control scheme results in H-infinity tracking performance, which means that the influence of the modeling errors and the external disturbances on the tracking error is attenuated to an arbitrary desirable level. Simulation experiments confirm the efficiency of the proposed adaptive fuzzy control method, using as a case study the model of the Lorenz chaotic oscillator.

CIHLI'14 Session 3: Applications

Wednesday, December 10, 3:30PM-5:10PM, Room: Antigua 4, Chair: Jacek Mandziuk and Janusz Starzyk

3:30PM The Leaning Intelligent Distribution Agent (LIDA) and Medical Agent X (MAX): Computational Intelligence for Medical Diagnosis [#14934]

Steve Strain, Sean Kugele and Stan Franklin, University of Memphis, United States

The complexity of medical problem solving presents a formidable challenge to current theories of cognition. Building on earlier work, we claim that the systems-level cognitive model LIDA (for "Learning Intelligent Distribution Agent") offers a number of specific advantages for modeling diagnostic thinking. The LIDA Model employs a consciousness mechanism in an iterative cognitive cycle of understanding, attention, and action, endowing it with the ability to integrate multiple sensory modalities into flexible, dynamic, multimodal representations according to strategies that support specific task demands. These representations enable diverse, asynchronous cognitive processes to be dynamically activated according to rapidly changing contexts, much like in biological cognition. The recent completion of the LIDA Framework, a software API supporting the

domain-independent LIDA Model, allows the construction of domain-specific agents that test the Model and/or enhance traditional machine learning algorithms with human-style problem solving. Medical Agent X (MAX) is a medical diagnosis agent under development using the LIDA Model and Framework. We review LIDA's approach to exploring cognition, assert its appropriateness for problem solving in complex domains such as diagnosis, and outline the design of an initial implementation for MAX.

3:50PM Two-Phase Multi-Swarm PSO and the Dynamic Vehicle Routing Problem [#15076]

Michal Okulewicz and Jacek Mandziuk, Warsaw University of Technology, Poland

In this paper a new 2-phase multi-swarm Particle Swarm Optimization approach to solving Dynamic Vehicle Routing Problem is proposed and compared with our previous single-swarm approach and with the PSO-based method proposed by other authors. Furthermore, several evaluation functions and problem encodings are proposed and experimentally verified on a set of standard benchmark sets. For the cut-off time set in the middle of a day our method found new best- literature results for 17 out of 21 tested problem instances.

4:10PM Proactive and Reactive Risk-Aware Project Scheduling [#14605]

Karol Waledzik, Jacek Mandziuk and Slawomir Zadrozny, Warsaw University of Technology, Poland; Polish Academy of Science, Poland

In order to create a test-bed for Computational Intelligence (CI) methods dealing with complex, non-deterministic and dynamic environments we propose a definition of a new class of problems, based on the real-world task of project scheduling and executing with risk management. Therefore, we define Risk-Aware Project Scheduling Problem (RAPSP) as a (significant) modification of the Resource-Constrained Project Scheduling Problem (RCPSP). We argue that this task is, considering its daunting complexity, sometimes surprisingly well solved by experienced humans, relying both on tools and their intuition. We speculate that a CI-based solver for RAPSP should also employ multiple cognitively-inspired approaches to the problem and we propose three such solvers of varying complexity and inspiration. Their efficacy comparison is in line with our expectations and supports our claims.

4:30PM Towards Intelligent Caring Agents for Aging-In-Place: Issues and Challenges [#15089]

Di Wang, Budhitama Subagdja, Yilin Kang, Ah-Hwee Tan and Daqing Zhang, Nanyang Technological University, Singapore; Institut Mines-Telecom/Telecom SudParis, France

The aging of the world's population presents vast societal and individual challenges. The relatively shrinking workforce to support the growing population of the elderly leads to a rapidly increasing amount of technological innovations in the field of elderly care. In this paper, we present an integrated framework consisting of various intelligent agents with their own expertise and responsibilities working in a holistic manner to assist, care, and accompany the elderly around the clock in the home environment. To support the independence of the elderly for Aging-In-Place (AIP), the intelligent agents must well understand the elderly, be fully aware of the home environment, possess high-level reasoning and learning capabilities, and provide appropriate tender care in the physical, cognitive, emotional, and social aspects. The intelligent agents sense in non-intrusive ways from different sources and provide wellness monitoring, recommendations, and services across diverse platforms and locations. They collaborate together and interact with the elderly in a natural and holistic manner to provide all-around tender care reactively and proactively. We present our implementation of the collaboration framework with a number of realized functionalities of the intelligent agents, highlighting its feasibility and importance in addressing various challenges in AIP.

4:50PM A Rapid Learning and Problem Solving Method: Application to the Starcraft Game Environment [#14153]

Seng-Beng Ho and Fiona Liausvia, National University of Singapore, Singapore

Building on a paradigm of rapid causal learning and problem solving for the purpose of creating adaptive general intelligent systems and autonomous agents that we have reported previously, we report in this paper improved methods of rapid learning of causal rules that are robust and applicable to a wide variety of general situations. The robust rapid causal learning mechanism is also applied to the rapid learning of scripts - knowledge structures that encode extended sequences of actions with certain intended outcomes and goals. Our method requires only a small number of training instances for the learning of basic causal rules and scripts. We demonstrate, using the Starcraft game environment, how scripts can vastly accelerate problem solving processes and obviate the need for computationally expensive and relatively blind search processes. Our system exhibits human-like intelligence in terms of the rapid learning of causality and learning and packaging of knowledge in increasingly larger chunks in the form of scripts for accelerated problem solving.

CCMB'14 Session 3: Cognitive, Mind, and Brain

Wednesday, December 10, 3:30PM-5:10PM, Room: Bonaire 1, Chair: Robert Kozma

3:30PM Limit Cycle Representation of Spatial Locations Using Self-Organizing Maps [#14520]

Di-Wei Huang, Rodolphe Gentili and James Reggia, Department of Computer Science, University of Maryland, College Park, United States; Department of Kinesiology, University of Maryland, College Park, United States

We use the term ``neurocognitive architecture'' here to refer to any artificially intelligent agent where cognitive functions are implemented using brain-inspired neurocomputational methods. Creating and studying neurocognitive architectures is a very active and increasing focus of research efforts. We have recently been exploring the use of neural activity limit cycles as representations of perceived external information in self-organizing maps (SOMs). Specifically, we have been examining limit cycle representations in terms of their compatibility with self-organizing map formation and as working memory encodings for cognitively-relevant stimuli (e.g., for images of objects and their corresponding names expressed as phoneme sequences \cite{huang14}). Here we evaluate the use of limit cycle representations in a new context of relevance to any cognitive agent: representing a spatial location. We find that, following repeated exposure to external 2D coordinate input values, robust limit cycles occur in a network's map region, the limit cycles representing nearby locations in external space are close to one another in activity state space, and the limit cycles representing widely separated external locations are very different from one another. Further, and in spite of the continually varying activity patterns in the network (instead of the fixed activity patterns used in most SOM work), map formation based on the learned limit cycles still occurs. We believe that these results, along with those in our earlier work, make limit cycle representations potentially useful for encoding information in the working memory of neurocognitive architectures.

3:50PM Self Organizing Neuro-Glial Network, SONG-NET [#14347]

Hajer Landolsi and Kirmene Marzouki, Faculty of Sciences of Tunis, Tunisia; Higher Institute of applied Science and Technology of Sousse, ISSATSO, Tunisia

More convincing evidence has proven the existence of a bidirectional relationship between neurons and astrocytes. Assume now that astrocytes, a new type of glial cells previously considered as passive cells of support, constitute a system of non-synaptic transmission plays a major role in modulating the activity of neurons. In this context, we proposed to model the effect of these cells to develop a new type of artificial neural network operating on new mechanisms to improve the information processing and reduce learning time, very expensive in traditional networks. The obtained results indicate that the implementation of bio-inspired functions such as of astrocytes, improve very considerably learning speed. The developed model achieves learning up to twelve times faster than traditional artificial neural networks.

4:10PM Joint decision-making on two visual perception systems [#14366]

Henrique Valim, Molly Clemens and D. Frank Hsu, Fordham University, United States

Decision-making is an interdisciplinary problem that has been the focus of many studies, particularly by interactive pairs of visual cognition systems. In a series of experiments, Bahrami et al. (2010) showed that dyadic interaction is beneficial only if participants communicate with each other about their confidence in making a judgment. Aside from data combination using both simple and weighted average, Hsu et al. (2006) first described the use of combinatorial fusion to combine multiple scoring systems (MSS). In this experiment, sixteen trials were conducted using pairs of individuals as visual cognition systems. Participants observed a target being thrown in a grassy field which could not be seen once it had landed, allowing them to then independently perceive the position of the target and determine their confidence level. The results of these trials were analyzed for performance of score and rank combinations relative to both the original cognition systems of the individuals and to simple and weighted averages of their systems. We demonstrated, using combinatorial fusion, that the combination of two visual perception systems is better than each of the individual systems only if they perform relatively well and they are diverse.

4:30PM Statistical Analysis and Classification of EEG-based Attention Network Task Using Optimized Feature Selection [#15027]

Hua-Chin Lee, Li-Wei Ko, Hui-Ling Huang, Jui-Yun Wu, Ya-Ting Chuang and Shinn-Ying Ho, National Chiao Tung University, Taiwan

This research incorporates optimized feature selection using an inheritable bi- objective combinatorial genetic algorithm (IBCGA) and mathematic modeling for classification and analysis of electroencephalography (EEG) based attention network. It consists of two parts. 1) We first design the attention network experiments, record the EEG signals of subjects from NeuronScan instrument, and filter noise from the EEG data. We use alerting scores, orienting scores, and conflict scores to serve as the efficiency evaluation of the attention network. 2) Based on an intelligent evolutionary algorithm as the core technique, we analyze the large-scale EEG data, identify a set of important frequency-channel factors, and establish mathematical models for within-subject, across-subject and leave-one-subject-out evaluation using a global optimization approach. The results of using 10 subjects show that the average classification accuracy of independent test in the within-subject case is 86.51%, the accuracy of the across-subject case is 68.44%, and the accuracy of the leave-one-subject-out case is 54.33%.

4:50PM The Effect of tDCS on ERD Potentials: A Randomized, Double-Blind Placebo Controlled Study [#15024]

Ahmed Izzidien, Sriharsha Ramaraju, Mohammed Ali Roula, Jenny Ogeh and Peter McCarthy, University Of South Wales, United Kingdom

In this paper, we report the results of a study on the post-intervention effects of applying anodal transcranial Direct Current Stimulation (tDCS) on the intensity of motor Event Related Desynchronization. Ten subjects were given 15 minutes of sham and 1.5 mA tDCS on two separate occasions in randomized order in a double blind setting. Post-intervention EEG was then recorded while subjects were asked to perform imagined motor imagery. Results show that the intensity of 8-13Hz Mu rhythms exhibited significant difference between the sham and tDCS groups, with an average of 24.13 Micro-Volts-Square for sham and 32.57 Micro-Volts-Squared for tDCS with a measured t-test p value of 0.03.

Special Session: CIPLS'14 Session 3: Supply Chain Design, Optimization, and Management

Wednesday, December 10, 3:30PM-5:10PM, Room: Bonaire 2, Chair: Hernan Chavez and Krystel Castillo

3:30PM Managing Inventories in Multi-echelon On-line Retail Fulfillment System with Different Response Lead Time Demands [#14261]

Juan Li and John Muckstadt, Palo Alto Research Center, United States; Cornell University, United States

When designing and operating an order fulfillment system for an on-line retailer, many factors must be taken into account. In this paper, we study a multi-echlon on-line fulfillment system with different response lead time demands. We present a delayed allocation system, which is called the primary warehouse system (PWS). In this system, inventories to satisfy different response lead time demands are managed differently. Since there are many millions of items managed in the system, determining stock levels quickly is a necessity. The focus of this paper is on planning inventory levels. Specifically, our goals are to describe a model for setting stock levels for each item, to present a computationally tractable method for determining their values, and to provide numerical results that illustrate the applications of the model to the on-line retailer's environment.

3:50PM A bi-objective model for local and Global Green Supply Chain [#14522]

Neale Smith, Mario Manzano, Krystel Castillo-Villar and Luis Rivera-Morales, ITESM, Mexico; UTSA, United States

In this paper, we develop a bi-objective mathematical model to build a Pareto front of efficient solutions for a Green Supply Chain considering profit maximization and carbon emissions minimization. The model is based on an integer programming formulation. Epsilon-constraint is used as the exact solution method for the model. A numerical study is performed to provide insight into the behavior of the model. The results of a case study from practice show that for local supply chains, both objectives can be solved simultaneously; while in global supply chain is contradictory.

4:10PM A bi-objective inventory routing problem by considering customer satisfaction level in context of perishable product [#14986]

Mohammad Rahimi, Armand Baboli and Yacine Rekik, Universite de Lyon, INSA-Lyon, DISP Laboratory EA4570, France; EMLYON Business School, DISP Laboratory EA4570, France

In this paper, we study a joint inventory and routing problem (IRP) for the food supply chain and we investigate the impact of customer satisfaction level under the optimization of the total expected cost. We propose a new bi- objective mathematical model by taking into account multi capacitated vehicles for perishable products from one supplier to many customers by considering total traveling time. The first objective in our optimization minimizes the different inventory and distribution costs (holding cost, shortage cost, ordering cost, fixed, variable transportation cost and recycling cost) while the second objective considers the customer satisfaction level, which is measured based on delays of vehicles. We consider perishable items and we also manage in this framework their shelf life (expiration date). The proposed framework is modelled as a mixed-integer linear program and is solved by using the software GAMS.

4:30PM A Preliminary Simulated Annealing for Resilience Supply Chains [#15061]

Krystel Castillo-Villar and Hernan Chavez, Department of Mechanical Engineering University of Texas at San Antonio San Antonio, Texas, 78249, U.S., United States

Most of the products imported from Mexico to U.S. can be classified as perishable. The United States Trade Representative, U.S. has reported that the overall importations from Mexico to U.S. were equivalent to $16.4 billion during 2012. Due to the geographical location of both countries most of the transportation of products across the U.S. - Mexico border is road modal transportation. The inspection of trucks at the border entry points can take long and unpredictable time. For perishable products, these inspection times have a very important effect on the shelf life of products once they arrive to their destination. This paper presents a tool that helps in the selection of the amount of products that will be sent through each of the available routes. Random length of disruptive inspection time and availability of servers at the entry points is very important for the Supply Chain (SC) that includes the transportation system of perishables from Mexico to U.S. This paper presents a Simulation-based Optimization Model (SimOpt) for minimizing transportation time and cost of agriculture products traded across the U.S. - Mexico border in order to build a resilient supply chain. This SimOpt model considers realistic continuous probability distributions for inspection time. This variability also accounts for the availability of inspection servers and lanes in the points of entry. The solution procedure finds solutions for a weighted (time and freight cost) objective function. The results of a case study are presented.

Special Session: CIComms'14 Session 3: Intelligent Applications in Communication and Computation

Wednesday, December 10, 3:30PM-5:10PM, Room: Bonaire 3, Chair: Paolo Rocca and Maode Ma

3:30PM Interference Suppression using CPP Adaptive Notch Filters for UWB Synchronization in Stochastic Non-Linear Channels [#14296]

Farhana Begum, Manash Pratim Sarma, Kandarpa Kumar Sarma, Nikos Mastorakis and Aida Bulucea, Gauhati University, India; Technical University - Sofia, Sofia 1000, "Kl. Ohridski" 8, Bulgaria; University of Craiova, Craiova,, Romania

For precise synchronization of ultra wide band (UWB) signals in wireless channels, narrow band interference (NBI) suppression is a challenging issue. This is more relevant for real time channels which are non-linear in nature and are co-existed by narrow band wireless systems. An interference suppression scheme coupled to an energy detection based synchronization approach designed using second-order complex adaptive notch filter (ANF) is reported in this paper. This ANF uses a gradient descent algorithm for tracking the filter coefficients. The use of the same exploits the correlation difference property of signals received and suppresses NBIs in UWB signals. Consequently, it significantly reduces the computational complexity compared to the existing adaptive filters and requires lower power for an efficient hardware implementation. The data rate of UWB is usually high, so a combined pipelined-parallelism (CPP) approach is proposed which effectively simplifies the hardware design unlike direct and cascade forms. Detailed analysis suggest that the proposed scheme provides better performance in terms of power, speed, convergence and stability. Moreover, this scheme when used in conjunction with energy detection receivers significantly improves the interference tolerance margin, thereby raising the performance levels of synchronization with energy detection approach in non-coherent energy detection receivers.

3:50PM Computation of transfer function of unknown networks for indoor power line communication [#14452]

Banty Tiru, Gauhati University, India

Obtaining the characteristics of a channel plays an important role in communication. Power lines are very different from other channels available and characterized by time variant notches that make it a harsh media for data transfer. Pre-determination of the transfer function is required in many mitigation schemes of communication. In this work, a novel method is described to estimate the transfer function of power line between two power outlets using the pre knowledge of the input impedance of the network. Using this methodology, the transmission, chain or ABCD matrices of unknown networks can be obtained which can be used to estimate the salient features of the transfer function of the same.

4:10PM Efficient Synthesis of Complex Antenna Devices Through System-by-Design [#14369]

Giacomo Oliveri, Marco Salucci, Paolo Rocca and Andrea Massa, ELEDIA Research Center, University of Trento, Italy

The design of complex antenna devices is addressed in this work through an instance of the System-by-Design (SbD) paradigm. Towards this end, an approach combining different functional blocks that enable the exploration of the search space, the antenna modeling from the physical viewpoint, and the evaluation of the quality of each trial design is introduced. An innovative algorithm that combines the properties of Orthogonal Arrays (OAs) and of Learning-by-Example tools is proposed to guarantee a reliable modeling of the physical features of the complex antennas of interest. A preliminary numerical validation is presented to assess the advantages and drawbacks of the arising SbD Synthesis strategy.

4:30PM Optimal Observations Transmission for Distributed Estimation under Energy Constraint [#14051]

Marwan Alkhweldi, West Virginia University, United States

This paper studies the problem of distributed parameter estimation in wireless sensor network under energy constraints. Optimization formulas that find the optimal sensors' observations transmission that guarantee the best estimation performance from the available energy are derived. The network consists of sensors that are deployed over an area at random. Sensors' observations are noisy measurements of an underlying field. Sensors have limited energy for the transmission process. Each sensor processes its observation prior to transmitting it to a fusion center, where a field parameter vector is estimated. Transmission channels between the sensors and the fusion center are assumed to be noisy parallel channels. The sensors' locations, the noise probability density function, and the field characteristic function are assumed to be known at the fusion center. Simulation results which support the optimization formulas are shown.

SDE'14 Session 3: Applications

Wednesday, December 10, 3:30PM-5:10PM, Room: Bonaire 4, Chair: Janez Brest

3:30PM Differential Evolution Schemes for Speech Segmentation: A Comparative Study [#14401]

Sunday Iliya, Ferrante Neri, Dylan Menzies, Pip Cornelius and Lorenzo Picinali, De Montfort University, United Kingdom

This paper presents a signal processing technique for segmenting short speech utterances into unvoiced and voiced sections and identifying points where the spectrum becomes steady. The segmentation process is part of a system for deriving musculoskeletal articulation data from disordered utterances, in order to provide training feedback. The functioning of the signal processing technique has been optimized by selecting the parameters of the model. The optimization has been carried out by testing and comparing multiple Differential Evolution implementations, including a standard one, a memetic one, and a controlled randomized one. Numerical results have also been compared with a famous and efficient swarm intelligence algorithm. For the given problem, Differential Evolution schemes appear to display a very good performance as they can quickly reach a high quality solution. The binomial crossover appears, for the given problem, beneficial with respect to the exponential one. The controlled randomization appears to be the best choice in this case. The overall optimized system proved to segment well the speech utterances and efficiently detect its uninteresting parts.

3:50PM The Usage of Differential Evolution in a Statistical Machine Translation [#15072]

Jani Dugonik, Borko Boskovic, Mirjam Sepesy Maucec and Janez Brest, University of Maribor, FEECS, Slovenia

Translations in statistical machine translation (SMT) are generated on the basis of statistical models, the parameters of which are derived from the analysis of aligned bilingual text corpora. Different models' parameters provide various translations, which can be evaluated by the BiLingual Evaluation Understudy (BLEU) metric. The problem of finding a suitable translation can be regarded as an optimization problem and some optimization can be done using the decoder itself - the optimization of models parameters. The main goal of this paper was to build SMT systems for the language pair English-Slovenian, and improve their translation quality using a global optimization algorithm - Differential Evolution (DE) algorithm. Experiments were performed using English and Slovenian JRC-ACQUIS Multilingual Parallel Corpora. The results show improvement in the translation quality.

4:10PM An Improved Differential Evolution Algorithm with Novel Mutation Strategy [#14118]

Yujiao Shi, Hao Gao and Dongmei Wu, Nanjing University of Posts and Telecommunicates, China; City University of Hong Kong, Hong Kong

As a modern Evolutionary Algorithm, Differential Evolution (DE) is usually criticized for its slow convergence when compared to Particle Swarm Optimization (PSO) on the PSO's benchmark functions. In this paper, by combing the merits of PSO and DE, we first present a new hybrid DE algorithm to accelerate its convergence speed. Then a novel mutation strategy with local and global search operators is proposed for balancing the exploration ability and the convergence rate of the improved DE. The new algorithm is applied to a set of benchmark test problems and compared with basic PSO and DE algorithms and their variants. The experimental results show the new algorithm shows better achievements on most test problems.

CICS'14 Session 3

Wednesday, December 10, 3:30PM-5:10PM, Room: Bonaire 5, Chair: Robert Abercrombie and Dipankar Dasgupta

3:30PM A Theoretical Q-Learning Temporary Security Repair [#14260]

Arisoa S. Randrianasolo and Larry D. Pyeatt, School of Computing and Informatics, Lipscomb University, United States; Department of Mathematics and Computer Science , South Dakota School of Mines and Technology, United States

This research summarizes a work in progress attempt to incorporate Q-learning algorithm in software security. The Q-learning method is embedded as part of the software itself to provide a security mechanism that has ability to learn by itself to develop a temporary repair mechanism. The results of the experiment express that given the right parameters and the right setting the Q-learning approach rapidly learns to block all malicious actions. Data analysis on the Q-values produced by the software can provide security diagnostic as well. A larger scale experiment with extended parameter testing is expected to be seen in the future work.

3:50PM The Analysis of Feature Selection Methods and Classification Algorithms in Permission Based Android Malware Detection [#14803]

Ugur Pehlivan, Nuray Baltaci, Cengiz Acarturk and Nazife Baykal, CyDeS, Cyber Defense and Security Laboratory of METU-COMODO, Turkey

Android mobile devices have reached a widespread use since the past decade, thus leading to an increase in the number and variety of applications on the market. However, from the perspective of information security, the user control of sensitive information has been shadowed by the fast development and rich variety of the applications. In the recent state of the art, users are subject to responding numerous requests for permission about using their private data to be able run an application. The awareness of the user about data protection and its relationship to permission requests is crucial for protecting the user against malicious software. Nevertheless, the slow adaptation of users to novel technologies suggests the need for developing automatic tools for detecting malicious software. In the present study, we analyze two major aspects of permission-based malware detection in Android applications: Feature selection methods and classification algorithms. Within the framework of the assumptions specified for the analysis and the data used for the analysis, our findings reveal a higher performance for the Random Forest and J48 decision tree classification algorithms for most of the selected feature selection methods.

4:10PM A Novel Bio-Inspired Predictive Model for Spam Filtering Based on Dendritic Cell Algorithm [#14395]

El-Sayed El-Alfy and Ali Al-Hasan, KFUPM, Saudi Arabia; Saudi Aramco, Saudi Arabia

Electronic mail has become the most popular, frequently-used and powerful medium for quicker personal and business communications. However, one of the common security issues and annoying problems faced by email users and organizations is receiving a large number of unsolicited email messages, known as spam emails, every day. A traditional countermeasure in most email systems nowadays is simple filtering mechanisms that can block or quarantine unwanted emails based on some keywords defined by the user. These filters require continual effort to keep them relevant and current with some extensions proposed to improve their performance. However, due to the gigantic volumes of received emails and the continual change in spamming techniques to bypass the implemented solutions, novel automated ideas and countermeasures need to be investigated. This paper explores a novel algorithm inspired by the immune system called dendritic cell algorithm (DCA). This algorithm is evaluated on a number of benchmark datasets to detect spam emails. The results demonstrate that this approach can be a promising solution for email classification and spam filtering.

4:30PM A Genetic Programming Approach for Fraud Detection in Electronic Transactions [#14466]

Carlos Assis, Adriano Pereira, Marconi Arruda and Eduardo Carrano, CEFET-MG, Brazil; UFMG, Brazil; UFSJ, Brazil

The volume of online transactions has increased considerably in the recent years. Consequently, the number of fraud cases has also increased, causing billion dollar losses each year worldwide. Therefore, it is mandatory to employ mechanisms that are able to assist in fraud detection. In this work, it is proposed the use of Genetic Programming (GP) to identify frauds (charge back) in electronic transactions, more specifically in online credit card operations. A case study, using a real dataset from one of the largest Latin America electronic payment systems, has been conducted in order to evaluate the proposed algorithm. The presented algorithm achieves good performance in fraud detection, obtaining gains up to 17\% with regard to the actual company baseline. Moreover, several classification problems, with considerably different datasets and domains, have been used to evaluate the performance of the algorithm. The effectiveness of the algorithm has been compared with other methods, widely employed for classification. The results show that the proposed algorithm achieved good classification effectiveness in all tested instances.

CIEL'14 Session 3: Ensemble Optimization

Wednesday, December 10, 3:30PM-5:10PM, Room: Bonaire 6, Chair: Andries P. Engelbrecht and Nikhil R Pal

3:30PM Hyper-heuristic approach for solving Nurse Rostering Problem [#14222]

Khairul Anwar, Mohammed A. Awadallah, Ahamad Tajudin Khader and Mohammed Azmi Al-Betar, Universiti Sains Malaysia, Malaysia

Hyper-heuristic (HH) is a higher level heuristic to choose from a set of heuristics applicable for the problem on hand. In this paper, a Harmony Search-based Hyper-heuristic (HSHH) approach is tested in solving nurse rostering problems (NRP). NRP is a complex scheduling problem of assigning given shifts to a given nurses. We test the proposed method by using the First International Nurse Rostering Competition 2010 (INRC2010) dataset. Experimentally, the HSHH approach achieved comparable results with the comparative methods in the literature.

3:50PM The Entity-to-Algorithm Allocation Problem: Extending the Analysis [#14480]

Jacomine Grobler, Andries P. Engelbrecht, Graham Kendall and V.S.S. Yadavalli, University of Pretoria and Council for Scientific and Industrial Research, South Africa; University of Pretoria, South Africa; University of Nottingham, United Kingdom

This paper extends the investigation into the algorithm selection problem in hyper-heuristics, otherwise referred to as the entity-to-algorithm allocation problem, introduced by Grobler et al. Two newly developed population-based portfolio algorithms (the evolutionary algorithm based on self- adaptive learning population search techniques (EEA-SLPS) and the Multi-EA algorithm) are compared to two meta- hyper-heuristic algorithms. The algorithms are evaluated under similar conditions and the same set of constituent algorithms on a diverse set of floating-point benchmark problems. One of the meta-hyper-heuristics are shown to outperform the other algorithms, with EEA-SLPS coming in a close second.

4:10PM Genetic Algorithm-Based Neural Error Correcting Output Classifier [#14336]

Mahdi Amina, Francesco Masulli and Stefano Rovetta, University of Genoa, Italy

The present study elaborates a probabilistic framework of ECOC technique, via replacement of pre-designed ECOC matrix by sufficiently large random codes. Further mathematical grounds of deploying random codes through probability formulations are part of novelty of this study. Random variants of ECOC techniques were applied in previous literatures, however, often failing to deliver sufficient theoretical proof of

efficiency of random coding matrix. In this paper a Genetic Algorithm-based neural encoder with redefined operators is designed and trained. A variant of heuristic trimming of ECOC codewords is also deployed to acquire more satisfactory results. The efficacy of proposed approach was validated over a wide set of datasets of UCI Machine Learning Repository and compared against two conventional methods.

CIMSIVP'14 Session 3: Features and Detections

Wednesday, December 10, 3:30PM-5:10PM, Room: Bonaire 8, Chair: Khan M. Iftekharuddin and Bonny Banerjee

3:30PM Change Detection using Dual Ratio and False Color [#14108]

Patrick Hytla, Eric Balster, Juan Vasquez and Robert Neuroth, University of Dayton Research Institute, United States; University of Dayton, United States; Air Force Research Laboratory, United States

In this paper a Dual Ratio change detection method is proposed. This method involves taking two ratios for both real color and false color imagery in order to maximize detected changes and minimize false alarms. The proposed Dual Ratio method outperforms other methods tested in terms of Area Under the Curve (AUC) performance by an average of 18 percent at low false alarm rates and an average of 10.5 percent across the entire false alarm rate sweep.

3:50PM Real-time Shape Classification Using Biologically Inspired Invariant Features [#14551]

Bharath Ramesh, Cheng Xiang and Tong Heng Lee, National University of Singapore, Singapore

Over the past few decades, a considerable amount of literature has been published on shape classification. Since classification of well-segmented shapes has become easy to achieve, a number of recent studies have emphasized the importance of robustness to noise and deformations. So in this paper, we undertake the task of classifying similar and noisy binary shape images, using a biologically inspired technique called log-polar transform (LPT). The LPT mapping technique achieves scale and rotation invariance by simulating the foveal mechanism of the human vision system. In order to ensure optimal shape representation in the log-polar space, an iterative method is presented for the LPT lattice design. In addition to optimal shape representation, the use of linear discriminant analysis is proposed for dimensionality reduction and elimination of noisy features. Besides eliminating noisy features, discriminant analysis plays a crucial role in differentiating between similar shape categories. The proposed shape classification framework is tested on five publicly available databases, and substantial boost in classification accuracy is reported compared to state-of-the-art methods. In addition to superior classification accuracy, real time performance is demonstrated using an efficient PC-based implementation.

4:10PM An Improved Evolution-COnstructed (iECO) Features Framework [#14142]

Stanton Price, Derek Anderson and Robert Luke, Mississippi State University, United States; Night Vision and Electronic Sensors Directorate, United States

In image processing and computer vision, significant progress has been made in feature learning for exploiting important cues in data that elude non-learned features. While the field of deep learning has demonstrated state-of-the-art performance, the Evolution-COnstructed (ECO) work of Lillywhite et. al has the advantage of interpretability, and it does not pre-dispose the solution to one of convolution. This paper presents a novel approach for extending the ECO framework. We achieve this through two overarching ideas. First, we address a potential major shortcoming of ECO features-- the ``features'' themselves. The so-called ECO features are simply a transformed image that has been unrolled into a large one dimensional vector. We propose employing feature descriptors to extract pertinent information from the ECO imagery. Furthermore, it is our hypothesis that there exists a unique set of transforms for each feature descriptor used on a given problem domain that leads to the descriptors extracting maximal discriminative information. Second, we introduce constraints on each individual's chromosome to promote population diversity and prevent infeasible solutions. We show through experiments that our proposed iECO framework results in, and benefits from, a unique series of transforms for each descriptor being learned and maintaining population diversity.

4:30PM Unsupervised Learning of Spatial Transformations in the Absence of Temporal Continuity [#14901]

Bonny Banerjee and Kamran Ghasedi Dizaji, University of Memphis, United States

Learning features invariant to arbitrary transformations in the data is a requirement for any recognition system, biological or artificial. Such transformations may be learned using label information or from temporal data in an unsupervised manner by exploiting continuity. This paper presents a dynamical system for learning invariances from real-world spatial patterns in an unsupervised manner and in the absence of temporal continuity. The model consists of a simple and a complex layers. Given an input, the simple layer imagines all of its variations, each with a degree of consistency, and eventually settles for the most consistent reconstruction. During this imagination, the complex layer learns the consistent variations of the same pattern as a transformation in each spatial region. Experimental results are comparable to those from supervised learning. The conditions for stability of the system are analyzed.

4:50PM Multiresolution superpixels for visual saliency detection [#14933]

Henry Chu, Anurag Singh and Michael Pratt, University of Louisiana at Lafayette, United States

Salient regions are those that stand out from others in an image. We present an algorithm to detect salient regions in an image that is represented as superpixels at a number of resolutions. Superpixels are segments generated by oversegmenting an image and they form a perceptually meaningful representation that preserves the underlying image structure. The novelty of our method is the ranking of a superpixel by its dissimilarities with respect to other superpixels and highlighting the statistically salient region proportional to their rank. This is based on the premise that salient region group together and they stand out. We tested our method using standard data sets containing images of varied complexity and compared the results to ground truth data. Our results show that our saliency detection algorithm is robust to changes in color, object size, object location in image, and background type.

Special Session: ADPRL'14 Reinforcement Learning and Optimization in Stochastic Multi-objective Environments

Wednesday, December 10, 3:30PM-5:10PM, Room: Curacao 1, Chair: Madalina Drugan and Yann-Michael De Hauwere

3:30PM Policy Gradient Approaches for Multi-Objective Sequential Decision Making: A Comparison [#14323]

Simone Parisi, Matteo Pirotta, Nicola Smacchia, Luca Bascetta and Marcello Restelli, Politecnico di Milano, Italy

This paper investigates the use of policy gradient techniques to approximate the Pareto frontier in Multi-Objective Markov Decision Processes (MOMDPs). Despite the popularity of policy-gradient algorithms and the fact that gradient- ascent algorithms have been already proposed to numerically solve multi- objective optimization problems, especially in combination with multi-objective evolutionary algorithms, so far little attention has been paid to the use of gradient information to face multi-objective sequential decision problems. Three different Multi-Objective Reinforcement-Learning (MORL) approaches are here presented. The first two, called radial and Pareto following, start from an initial policy and perform gradient-based policy-search procedures aimed at finding a set of non-dominated policies. Differently, the third approach performs a single gradient-ascent run that, at each step, generates an improved continuous approximation of the Pareto frontier. The parameters of a function that defines a manifold in the policy parameter space are updated following the gradient of some performance criterion so that the sequence of candidate solutions gets as close as possible to the Pareto front. Besides reviewing the three different approaches and discussing their main properties, we empirically compare them with other state-of-the-art MORL algorithms on two interesting MOMDPs.

3:50PM Annealing-Pareto Multi-Objective Multi-Armed Bandit Algorithm [#14053]

Saba Yahyaa, Madalina Drugan and Bernard Manderick, Vrije Universiteit Brussel, Belgium

In the stochastic multi-objective multi-armed bandit (or MOMAB), arms generate a vector of stochastic rewards, one per objective, instead of a single scalar reward. As a result, there is not only one optimal arm, but there is a set of optimal arms (Pareto front) of reward vectors using the Pareto dominance relation and there is a trade-off between finding the optimal arm set (exploration) and selecting fairly or evenly the optimal arms (exploitation). We propose Pareto Thompson sampling that uses Pareto dominance relation to find the Pareto front. We propose annealing-Pareto algorithm that trades-off between the exploration and exploitation by using a decaying parameter epsilon in combination with Pareto dominance relation. The annealing-Pareto algorithm uses the decaying parameter to explore the Pareto optimal arms and uses Pareto dominance relation to exploit the Pareto front. We experimentally compare Pareto-KG, Pareto- UCB1, Pareto Thompson sampling and the annealing-Pareto algorithms on multi-objective Bernoulli distribution problems and we conclude that the annealing-Pareto is the best performing algorithm.

4:10PM Pareto Upper Confidence Bounds algorithms: an empirical study [#14105]

Madalina Drugan, Ann Nowe and Bernard Manderick, Vrije Universiteit Brussel, Belgium

Many real-world stochastic environments are inherently multi-objective environments with conflicting objectives. The multi-objective multi-armed bandits (MOMAB) are extensions of the classical, i.e. single objective, multi-armed bandits to reward vectors and often are required techniques from multi-objective optimisation to design mechanisms for an efficient exploration / exploitation trade-off. In this paper, we propose the improved Pareto Upper Confidence Bound (iPUCB) algorithm that straightforwardly extends the improved UCB algorithm to reward vectors by deleting the suboptimal arms. The goal of the improved Pareto UCB algorithm, i.e. iPUCB, is to identify the set of best arms, or the Pareto front, in a fixed budget of arm pulls. We experimentally compare the performance of the proposed Pareto upper confidence bound algorithm with the Pareto UCB1 algorithm and the Hoeffding race on a bi-objective example coming from an industrial control applications, i.e. the engagement of wet clutches. We propose a new regret metric based on the Kullback-Leibler divergence to measure the performance of a multi-objective multi-armed bandit algorithm. We show that the proposed iPUCB algorithm outperforms the other two tested algorithms on the given multi-objective environment.

4:30PM Multi-Objective Reinforcement Learning for AUV Thruster Failure Recovery [#14353]

Seyed Reza Ahmadzadeh, Petar Kormushev and Darwin G. Caldwell, Department of Advanced Robotics, (Fondazione) Istituto Italiano di Tecnologia, Italy

This paper investigates learning approaches for discovering fault-tolerant control policies to overcome thruster failures in Autonomous Underwater Vehicles (AUV). The proposed approach is a model-based direct policy search that learns on an on-board simulated model of the vehicle. When a fault is detected and isolated the model of the AUV is reconfigured according to the new condition. To discover a set of optimal solutions a multi-objective reinforcement learning approach is employed which can deal with multiple conflicting objectives. Each optimal solution can be used to generate a trajectory that is able to navigate the AUV towards a specified target while satisfying multiple objectives. The discovered policies are executed on the robot in a closed-loop using AUV's state feedback. Unlike most existing methods which disregard the faulty thruster, our approach can also deal with partially broken thrusters to increase the persistent autonomy of the AUV. In addition, the proposed approach is applicable when the AUV either becomes under-actuated or remains redundant in the presence of a fault. We validate the proposed approach on the model of the Girona500 AUV.

4:50PM Model-Based Multi-Objective Reinforcement Learning [#14759]

Marco Wiering, Maikel Withagen and Madalina Drugan, University of Groningen, Netherlands; Vrije Universiteit Brussel, Belgium

This paper describes a novel multi-objective reinforcement learning algorithm. The proposed algorithm first learns a model of the multi-objective sequential decision making problem, after which this learned model is used by a multi-objective dynamic programming method to compute Pareto optimal policies. The advantage of this model-based multi-objective reinforcement learning method is that once an accurate model has been estimated from the experiences of an agent in some environment, the dynamic programming method will compute all Pareto optimal policies. Therefore it is important that the agent explores the environment in an intelligent way by using a good exploration strategy. In this paper we have supplied the agent with two different exploration strategies and compare their effectiveness in estimating accurate models within a reasonable amount of time. The experimental results show that our method with the best exploration strategy is able to quickly learn all Pareto optimal policies for the Deep Sea Treasure problem.

Special Session: CIDM'14 Session 3: Computational Intelligence for Health and Wellbeing

Wednesday, December 10, 3:30PM-5:10PM, Room: Curacao 2, Chair: Paulo Lisboa

3:30PM BioHCDP: A Hybrid Constituency-Dependency Parser for Biological NLP Information Extraction [#14034]

Kamal Taha and Mohammed Al Zaabi, Khalifa University, United Arab Emirates

One of the key goals of biological Natural Language Processing (NLP) is the automatic information extraction from biomedical publications. Most current constituency and dependency parsers overlook the semantic relationships between the constituents comprising a sentence and may not be well suited for capturing complex long-distance dependencies. We propose in this paper a hybrid constituency-dependency parser for biological NLP information extraction called BioHCDP. BioHCDP aims at enhancing the state of the art of biological text mining by applying novel linguistic computational techniques that overcome the limitations of current constituency and dependency parsers outlined above, as follows: (1) it determines the semantic relationship between each pair of constituents in a sentence using novel semantic rules, and (2) it applies semantic relationship extraction models that represent the relationships of different patterns of usage in different contexts. BioHCDP can be used to extract various classes of data from biological texts, including protein function assignments, genetic networks, and protein-protein interactions. We evaluated the quality of BioHCDP by comparing it experimentally with three systems. Results showed marked improvement.

3:50PM Classification of iPSC Colony Images Using Hierarchical Strategies with Support Vector Machines [#14125]

Henry Joutsijoki, Jyrki Rasku, Markus Haponen, Ivan Baldin, Yulia Gizatdinova, Michelangelo Paci, Jyri Saarikoski, Kirsi Varpa, Harri Siirtola, Jorge Avalos-Salguero, Kati Iltanen, Jorma Laurikkala, Kirsi Penttinen, Jari Hyttinen, Katriina Aalto-Setala and Martti Juhola, University of Tampere, Finland; University of Tampere, Russian Federation; Tampere University of Technology, Italy; University of Tampere, Spain; Tampere University of Technology, Finland

In this preliminary research we examine the suitability of hierarchical strategies of multi-class support vector machines for classification of induced pluripotent stem cell (iPSC) colony images. The iPSC technology gives incredible possibilities for safe and patient specific drug therapy without any ethical problems. However, growing of iPSCs is a sensitive process and abnormalities may occur during the growing process. These abnormalities need to be recognized and the problem returns to image classification. We have a collection of 80 iPSC colony images where each one of the images is prelabeled by an expert to class bad, good or semigood. We use intensity histograms as features for classification and we evaluate histograms from the whole image and the colony area only having two datasets. We perform two feature reduction procedures for both datasets. In classification we examine how different hierarchical constructions effect the classification. We perform thorough evaluation and the best accuracy was around 54% obtained with the linear kernel function. Between different hierarchical structures, in many cases there are no significant changes in results. As a result, intensity histograms are a good baseline for the classification of iPSC colony images but more sophisticated feature extraction and reduction methods together with other classification methods need to be researched in future.

4:10PM Semi-supervised source extraction methodology for the nosological imaging of glioblastoma response to therapy [#14155]

Sandra Ortega-Martorell, Ivan Olier, Teresa Delgado-Goni, Magdalena Ciezka, Margarida Julia-Sape, Paulo Lisboa and Carles Arus, Liverpool John Moores University, Great Britain; The University of Manchester, Great Britain; The Institute of Cancer Research, Great Britain; Universitat Autonoma de Barcelona, Spain

Glioblastomas are one the most aggressive brain tumors. Their usual bad prognosis is due to the heterogeneity of their response to treatment and the lack of early and robust biomarkers to decide whether the tumor is responding to therapy. In this work, we propose the use of a semi-supervised methodology for source extraction to identify the sources representing tumor response to therapy, untreated/unresponsive tumor, and normal brain; and create nosological images of the response to therapy based on those sources. Fourteen mice were used to calculate the sources, and an independent test set of eight mice was used to further evaluate the proposed approach. The preliminary results obtained indicate that was possible to discriminate response and untreated/unresponsive areas of the tumor, and that the color-coded images allowed convenient tracking of response, especially throughout the course of therapy.

4:30PM Automatic relevance source determination in human brain tumors using Bayesian NMF [#14158]

Sandra Ortega-Martorell, Ivan Olier, Margarida Julia-Sape, Carles Arus and Paulo Lisboa, Liverpool John Moores University, Great Britain; The University of Manchester, Great Britain; Universitat Autonoma de Barcelona, Spain

The clinical management of brain tumors is very sensitive; thus, their non-invasive characterization is often preferred. Non-negative Matrix Factorization techniques have been successfully applied in the context of neuro-oncology to extract the underlying source signals that explain different tissue tumor types, for which knowing the number of sources to calculate was always required. In the current study we estimate the number of relevant sources for a set of discrimination problems involving brain tumors and normal brain. For this, we propose to start by calculating a high number of sources using Bayesian NMF and automatically discarding the irrelevant ones during the iterative process of matrices decomposition, hence obtaining a reduced range of interpretable solutions. The real data used in this study come from a widely tested human brain tumor database. Simulated data that resembled the real data was also generated to validate the hypothesis against ground truth. The results obtained suggest that the proposed approach is able to provide a small range of meaningful solutions to the problem of source extraction in human brain tumors.

4:50PM Alzheimer's disease patients classification through EEG signals processing [#14172]

Giulia Fiscon, Emanuel Weitschek, Giovanni Felici, Paola Bertolazzi, Simona De Salvo, Placido Bramanti and Maria Cristina De Cola, Department of Computer, Control and Management Engineering, Sapienza University, Rome, Italy; Department of Engineering Roma Tre University, Rome, Italy; Institute of Systems Analysis and Computer Science National Research Council, Rome, Italy; IRCCS Centro Neurolesi "Bonino-Pulejo", Messina, Italy

Alzheimer's Disease (AD) and its preliminary stage - Mild Cognitive Impairment (MCI) - are the most widespread neurodegenerative disorders, and their investigation remains an open challenge. ElectroEncephalography (EEG) appears as a non-invasive and repeatable technique to diagnose brain abnormalities. Despite technical advances, the analysis of EEG spectra is usually carried out by experts that must manually

perform laborious interpretations. Computational methods may lead to a quantitative analysis of these signals and hence to characterize EEG time series. The aim of this work is to achieve an automatic patients classification from the EEG biomedical signals involved in AD and MCI in order to support medical doctors in the right diagnosis formulation. The analysis of the biological EEG signals requires effective and efficient computer science methods to extract relevant information. Data mining, which guides the automated knowledge discovery process, is a natural way to approach EEG data analysis. Specifically, in our work we apply the following analysis steps: (i) pre- processing of EEG data; (ii) processing of the EEG-signals by the application of time-frequency transforms; and (iii) classification by means of machine learning methods. We obtain promising results from the classification of AD, MCI, and control samples that can assist the medical doctors in identifying the pathology.

Special Session: SIS'14 Session 3: Biologically-inspired Intelligence for Robotics

Wednesday, December 10, 3:30PM-5:10PM, Room: Curacao 3, Chair: Chaomin Luo and Simon X. Yang

3:30PM A Bio-inspired Approach to Task Assignment of Multi-robots [#14076]

Yi Xin, Anmin Zhu and Zhong Ming, Shenzhen University, China

In this paper, a SOM (self organizing map)-based approach to task assignment of multi-robots in 3-D dynamic environments is proposed. This approach intends to mimic the operating mechanism of biological neural systems, and integrates the advantages and characteristics of biological neural systems. It is capable of dynamically planning the paths of multi-robots in 3-D environments under uncertain situations, such as when some robots are added in or broken down or when more than one robot is needed for some special task locations. The effectiveness and efficiency of the proposed approach are demonstrated by simulation studies.

3:50PM Naturally Inspired Optimization Algorithms as Applied to Mobile Robotic Path Planning [#14229]

Steven Muldoon, Chaomin Luo, Furao Shen and Hongwei Mo, University of Detroit-Mercy, United States; Nanjing University, China; Harbin Engineering University, China

Global path planning as applied to mobile robotics can be approached in a similar fashion as classic optimization problems involving combinational constraints (e.g. the Traveling Salesman Problem). A single, exact optimal solution for the shortest path may not exist, and obtaining near-optimal solutions selected and ranked by criteria, or deemed "good-enough", can satisfy the problem. A general overview is provided on a select subset of naturally inspired iterative search algorithms; Simulated Annealing (SA), Genetic Algorithm (GA), and Ant Colony Optimization (ACO). These algorithms have all been studied and applied to the task of mobile robotic path planning. These three algorithms (respectively) represent a broader range of naturally inspired physical processes, evolutionary or biological processes, and animal kingdom behavioral examples. It has been demonstrated that these algorithms have been utilized on their own, or as part of a collaborative hybridization of iterative algorithms and heuristic modifiers, to effectively balance the constraints, strengths and weaknesses in a given path planning approach. A contextual survey of current literature provides insight regarding Naturally Inspired Optimization algorithms, and suggests directions for future research in their application to mobile robotic path planning.

4:10PM A fuzzy system for parameter adaptation in Ant Colony Optimization [#14643]

Frumen Olivas, Fevrier Valdez and Oscar Castillo, Tijuana Institute of Technology, Mexico

In this paper we propose a fuzzy system for parameter adaptation in ant colony optimization (ACO). ACO is a method inspired in the behavior of ant colonies to find food and its objective are discrete optimization problems. We developed various fuzzy systems and in this paper a comparison was made between them. The use of a fuzzy system is to control the diversity of the solutions, this is, control the ability of exploration and exploitation of the ant colony.

4:30PM OCbotics: An Organic Computing Approach to Collaborative Robotic Swarms [#14905]

Sebastian von Mammen, Sven Tomforde, Joerg Haehner, Patrick Lehner, Lukas Foerschner, Andreas Hiemer, Mirela Nicola and Patrick Blickling, University of Augsburg, Germany

In this paper we present an approach to designing swarms of autonomous, adaptive robots. An observer/controller framework that has been developed as part of the Organic Computing initiative provides the architectural foundation for the individuals' adaptivity. Relying on an extended Learning Classifier System (XCS) in combination with adequate simulation techniques, it empowers the individuals to improve their collaborative performance and to adapt to changing goals and changing conditions. We elaborate on the conceptual details, and we provide first results addressing different aspects of our multi-layered approach. Not only for the sake of generalisability, but also because of its enormous transformative potential, we stage our research design in the domain of quad-copter swarms that organise to collaboratively fulfil spatial tasks such as maintenance of building facades. Our elaborations detail the architectural concept, provide examples of individual self-optimisation as well as of the optimisation of collaborative efforts, and we show how the user can control the swarm at multiple levels of abstraction. We conclude with a summary of our approach and an outlook on possible future steps.

4:50PM Sensor-based Autonomous Robot Navigation Under Unknown Environments with Grid Map Representation [#14304]

Chaomin Luo, Jiyong Gao, Xinde Li, Hongwei Mo and Qimi Jiang, Department of Electrical and Computer Engineering, University of Detroit Mercy, United States; School of Automation, Southeast University, China; Automation College, Harbin Engineering University, China; Comau Inc, North America, Michigan, United States

Real-time navigation and mapping of an autonomous robot is one of the major challenges in intelligent robot systems. In this paper, a novel sensor-based biologically inspired neural network algorithm to real-time collision-free navigation and mapping of an autonomous mobile robot in a completely unknown environment is proposed. A local map composed of square grids is built up through the proposed neural dynamics for robot navigation with restricted incoming sensory information. With equipped sensors, the robot can only sense a limited reading range of surroundings with grid map representation. According to the measured sensory information, an accurate map with grid representation of the robot with local environment is dynamically built for the robot navigation. The real-time robot motion is planned through the varying neural activity landscape, which represents the dynamic environment. The proposed model for autonomous robot navigation and mapping is capable of planning a real-time reasonable trajectory of an autonomous robot. Simulation and comparison studies are presented to demonstrate the effectiveness and efficiency of the proposed methodology that concurrently performs collision-free navigation and mapping of an intelligent robot.

CIASG'14 Session 3: Markets

Wednesday, December 10, 3:30PM-5:10PM, Room: Curacao 4, Chair: Hiroyuki Mori

3:30PM A Kalman Filtering approach to the detection of option mispricing in electric power markets [#36]

Gerasimos Rigatos, Industrial Systems Institute / Unit of Industrial Automation, Greece

Option pricing models are usually described with the use of stochastic differential equations and diffusion-type partial differential equations (e.g. Black-Scholes models). In case of electric power markets these models are complemented with integral terms which describe the effects of jumps and changes in the diffusion process and which are associated with variations in the production rates, condition of the transmission and distribution system, pay-off capability, etc. Considering the latter case, that is a partial integrodifferential equation for the option's price, a new filtering method is developed for estimating option prices variations without knowledge of initial conditions. The proposed filtering method is the so-called Derivative-free nonlinear Kalman Filter and is based on a transformation of the initial option price dynamics into a state-space model of the linear canonical form. The transformation is shown to be in accordance to differential flatness theory and finally provides a model of the option price dynamics for which state estimation is possible by applying the standard Kalman Filter recursion. Based on the provided state estimate, validation of the Black-Scholes partial integrodifferential equation can be performed and the existence of inconsistent parameters in the electricity market pricing model can be concluded.

3:50PM LMP Forecasting with Prefiltered Gaussian Process [#15040]

Hiroyuki Mori and Kaoru Nakano, Meiji University, Japan

In this paper, a new method is proposed for Locational Marginal Pricing (LMP) forecasting in Smart Grid. The marginal cost is required to supply electricity to incremental loads in case where a certain node increases power demands in a balanced power system. LMP plays an important role to maintain economic efficiency in power markets in a way that electricity flows from a low-cost area to high-cost one and the transmission network congestion in alleviated. The power market players are interested in maximizing the profits and minimizing the risks through selling and buying electricity. As a result, it is of importance to obtain accurate information on electricity pricing forecasting in advance so that their desire is reflected. This paper presents the Gaussian Process (GP) technique that comes from the extension of Support Vector Machine (SVM) that hierarchical Bayesian estimation is introduced to express the model parameters as the probabilistic variables. The advantage is that the model accuracy of GP is better than others. In this paper, GP is integrated with the k-means method of clustering to improve the performance of GP. Also, this paper makes use of the Mahalanobis kernel in GP rather than the Gaussian one so that GP is generalized to approximate nonlinear systems. The proposed method is successfully applied to real data of ISO New England in USA.

4:10PM An Efficient Iterative Double Auction for Energy Trading in Microgrids [#14959]

Bodhisattwa Majumder Prasad, Mohammad Faqiry, Sanjoy Das and Anil Pahwa, Jadavpur University, India; Kansas State University, United States

This paper proposes a double auction mechanism for energy trade between buying and selling agents. The framework is general enough, requiring neither the agents' preferences nor the energy pricing to be fixed values across the spatially distributed agents. A microgrid controller implements a distributed algorithm to maximize individual participating agents' utilities as well as the social welfare. This is accomplished by the controller in an iterative manner, such that the need to obtain private information pertaining to individual agents' preferences is obviated. Simulation results with a set of seven buyers and an equal number of sellers indicate that the proposed iterative double auction can establish social welfare maximization, requiring only a reasonable amount of computational overhead.

4:30PM Smart Grid Energy Fraud Detection Using Artificial Neural Networks [#14339]

Vitaly Ford, Ambareen Siraj and William Eberle, Tennessee Tech University, United States

Energy fraud detection is a critical aspect of smart grid security and privacy preservation. Machine learning and data mining have been widely used by researchers for extensive intelligent analysis of data to recognize normal patterns of behavior such that deviations can be detected as anomalies. This paper discusses a novel application of a machine learning technique for examining the energy consumption data to report energy fraud using artificial neural networks and smart meter fine-grained data. Our approach achieves a higher energy fraud detection rate than similar works in this field. The proposed technique successfully identifies diverse forms of fraudulent activities resulting from unauthorized energy usage.

SSCI DC Session 3

Wednesday, December 10, 3:30PM-5:10PM, Room: Curacao 7, Chair: Xiaorong Zhang

3:30PM Universal Task Model for Simulating Human System Integration Processes [#14255]

Anastasia Angelopoulou and Waldemar Karwowski, University of Central Florida, United States

The growing interest in modeling human performance increases the need to create a model to simulate human decision-making related to Human System Integration processes to study team human performance in more detail. The main aim of this research is to examine the factors that affect team performance and analyze team human performance data about proposed system design concepts in HSI processes. To achieve this goal, a model named UTSM was developed for simulating Human System Integration processes. In addition, the Unified Modeling Language was used to describe the conceptual model and illustrate the different constructs and concepts included in the model. A preliminary model has been also designed in AnyLogic.

3:50PM Transfer learning in a sequence of Reinforcement Learning tasks with continuous state spaces [#14283]

Edwin Torres, University of Los Andes, Colombia

The objective of this thesis proposal is to devise new strategies to facilitate knowledge transfer when a computer agent is learning to solve a sequence of reinforcement learning tasks of increasing difficulty. The key assumption we make is the following: the knowledge acquired in a task can be useful in future tasks if they are ordered according to their difficulty. We claim that the transfer of knowledge can improve the learning rate of the whole sequence. As a consequence of the task arrangement, the last task will be learned with the contribution from all the preceding tasks

Wednesday, December 10, 3:30PM-5:10PM

in the sequence. Furthermore, we claim that the transfer of knowledge must be done in a specific time during the agent's learning with an appropriate knowledge storage to allow a more efficient usage of it.

4:10PM Scaling Up Subset Selection and the Microbiome [#14969]

Gregory Ditzler, Drexel Univerity, United States

The amount of data that is being generated by todays applications is stupendous compared to just a decade ago. Hence, the success of the future of machine learning lies in the ability of algorithms that can scale to such massive data and run in a reasonable amount of time, while being able to provide vital statistics about the data. This research focuses on scaling up feature subset selection (FSS) to the the growth of massive datasets using statistics and sequential learning to handle the large growth of data. We briefly present two frameworks for scaling subset selection to massive amounts of data and how they can be applied to problems in microbial ecology.

4:30PM Application for Doctoral Consortium in SSCI2014 [#14297]

Naoki Masuyama, University of Malaya, Malaysia

Associative memory is one of the significant and effective models in human-robot communication. Conventionally, we have been succeeded to improve the abilities of associative memory model applying the concept of quantum mechanics, and developed its complex-valued model. In the field of psychology, it is known that human memory and emotion are closely related each other. Thus, for further implementation, we apply the mood-congruency effects to associative memory model. The results of interactive communication experiment show the possibility of proposed system that can be provided the suitable information for the atmosphere of interactive space.

4:50PM A Study on Adaptive Dynamic Programming [#14182]

Xiangnan Zhong, University of Rhode Island, United States

Taking the advantage of solving the problem without the knowledge of system function, adaptive dynamic programming (ADP) has attracted significantly increasing attention from both theoretical research and real-world applications over the past decades by attempting to obtain the approximate solutions of the Hamilton-Jacobi-Bellman (HJB) equations. It has been widely recognized that ADP could be one of the "core methodologies" to achieve optimal control in stochastic process in a general case to achieve brain-like intelligent control.

Thursday, December 11, 8:00AM-9:00AM

Plenary Talk: Single Frame Super Resolution: Gaussian Mixture Regression and Fuzzy Rule-Based Approaches

Thursday, December 11, 8:00AM-9:00AM, Room: Grand Sierra D, Speaker: Nikhil R. Pal, Chair: Bernadette Bouchon-Meunier

Thursday, December 11, 9:20AM-10:00AM

CICA'14 Keynote Talk: Fuzzy and Fuzzy-Polynomial Systems for Nonlinear Control: Overview and Discussion

Thursday, December 11, 9:20AM-10:00AM, Room: Antigua 2, Speaker: Antonio Sala

ICES'14 Keynote Talk: Robot Bodies and How to Evolve Them

Thursday, December 11, 9:20AM-10:00AM, Room: Antigua 3, Speaker: Alan Winfield

CIBIM'14 Keynote Talk: Computational Intelligence and Biometric Technologies: Application-driven development

Thursday, December 11, 9:20AM-10:00AM, Room: Antigua 4, Speaker: Qinghan Xiao

MCDM'14 Keynote Talk: Combining Interactive and Evolutionary Approaches when Solving Multiobjective Optimization Problems

Thursday, December 11, 9:20AM-10:00AM, Room: Bonaire 1, Speaker: Kaisa Miettinen

Thursday, December 11, 9:20AM-10:00AM

RiiSS'14 Keynote Talk: Informationally Structured Space for Cognitive Robotics
Thursday, December 11, 9:20AM-10:00AM, Room: Bonaire 2, Speaker: Naoyuki Kubota

CIVTS'14 Keynote Talk: Multiagent Reinforcement Learning in Traffic and Transportation
Thursday, December 11, 9:20AM-10:00AM, Room: Bonaire 3, Speaker: Ana Bazzan

CIES'14 Keynote Talk: Verified Computation with Uncertain Numbers: How to Avoid Pretending We Know More Than We Do
Thursday, December 11, 9:20AM-10:00AM, Room: Bonaire 4, Speaker: Scott Ferson

ISIC'14 Keynote Talk: Computational Intelligence and Independent Computing: A Biological Systems Perspective
Thursday, December 11, 9:20AM-10:00AM, Room: Bonaire 5, Speaker: Gary B. Fogel

FOCI'14 Keynote Talk: Interactive Memetic Algorithms: New Possibilities for Social Learning
Thursday, December 11, 9:20AM-10:00AM, Room: Bonaire 6, Speaker: Jim Smith

EALS'14 Keynote Talk: Toward Association Rules in Data Streams: New Approaches with Potential Real-Word Applications
Thursday, December 11, 9:20AM-10:00AM, Room: Bonaire 7, Speaker: Jorge Casillas

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Special Lecture: ADPRL'14 Talk: Cognitive Control in Cognitive Dynamic Systems: A New Way of Thinking Inspired by the Brain
Thursday, December 11, 9:20AM-10:00AM, Room: Curacao 1, Speaker: Simon Haykin

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9:20AM Cognitive Control in Cognitive Dynamic Systems: A New Way of Thinking Inspired by The Brain [#14510]

Simon Haykin, Ashkan Amiri and Mehdi Fatemi, University Professor, Canada; PhD Candidate, Canada

Briefly, main purpose of the paper is fourfold: a) Cognitive perception, which consists of two functional blocks: improved sparse-coding under the influence of perceptual attention for extracting relevant information from the observables and ignoring irrelevant information, followed by a Bayesian algorithm for state estimation. b)Entropic state of the perceptor, which provides feedback information to the controller. c) Cognitive control, which also consists of two functional blocks: executive learning algorithm computed by processing the entropic state, followed by predictive planning to set the stage for policy to act on the environment, thereby establishing the global perception-action cycle. d) Experimental results for exploiting the perceptual as well as executive attention in a co-operative manner, which is aimed at the first demonstration of risk control in the presence of a severe disturbance in the environment.

Competition: Ghosts Competition Session
Thursday, December 11, 9:20AM-10:00AM, Room: Curacao 2, Chair: Alessandro Sperduti

Special Lecture: SIS'14 Talk: Uncovering Lost Civilizations Using Cultural Algorithms
Thursday, December 11, 9:20AM-10:00AM, Room: Curacao 3, Speaker: Robert G. Reynolds

Thursday, December 11, 10:20AM-12:00PM

Panel Session: Computational Intelligence in Big Data Panel

Thursday, December 11, 9:20AM-10:00AM, Room: Curacao 4, Chair: Yonghong Peng and Marios M. Polycarpou

Thursday, December 11, 10:20AM-12:00PM

CICA'14 Session 1: System Identification and Learning with Applications

Thursday, December 11, 10:20AM-12:00PM, Room: Antigua 2, Chair: G. N. Pillai and Eduardo M. A. M. Mendes

10:20AM One-Class LS-SVM with Zero Leave-One-Out Error [#14359]

Geritt Kampmann and Oliver Nelles, University of Siegen, Germany

This paper extends the closed form calculation of the leave-one-out (LOO) error for least-squares support vector machines (LS-SVMs) from the two-class to the one-class case. Furthermore, it proposes a new algorithm for determining the hyperparameters of a one-class LS-SVM with Gaussian kernels which exploits the efficient LOO error calculation. The standard deviations are selected by prior knowledge while the regularization parameter is optimized in order to obtain a tight decision boundary under the constraint of a zero LOO error.

10:40AM Extreme Learning ANFIS for Control Applications [#14849]

G. N. Pillai, Jagtap Pushpak and Germin Nisha, Indian Institute of Technology Roorkee, India

This paper proposes a new neuro -fuzzy learning machine called extreme learning adaptive neuro-fuzzy inference system (ELANFIS) which can be applied to control of nonlinear systems. The new learning machine combines the learning capabilities of neural networks and the explicit knowledge of the fuzzy systems as in the case of conventional adaptive neuro-fuzzy inference system (ANFIS). The parameters of the fuzzy layer of ELANFIS are not tuned to achieve faster learning speed without sacrificing the generalization capability. The proposed learning machine is used for inverse control and model predictive control of nonlinear systems. Simulation results show improved performance with very less computation time which is much essential for real time control.

11:00AM Collaborative Fuzzy Rule Learning for Mamdani Type Fuzzy Inference System with Mapping of Cluster Centers [#14903]

Mukesh Prasad, Kuang-pen Chou, Amit Saxena, Om Prakash Kawrtiya, Dong-Lin Li and Chin-Teng Lin, National Chiao Tung University, Taiwan; Guru Ghasidas Vishwavidyalaya, India; Jawaharlal Nehru University, India

This paper demonstrates a novel model for Mamdani type fuzzy inference system by using the knowledge learning ability of collaborative fuzzy clustering and rule learning capability of FCM. The collaboration process finds consistency between different datasets, these datasets can be generated at various places or same place with diverse environment containing common features space and bring together to find common features within them. For any kind of collaboration or integration of datasets, there is a need of keeping privacy and security at some level. By using collaboration process, it helps fuzzy inference system to define the accurate numbers of rules for structure learning and keeps the performance of system at satisfactory level while preserving the privacy and security of given datasets.

11:20AM An Input-Output Clustering Approach for Structure Identification of T-S Fuzzy Neural Networks [#14533]

Wei Li, Honggui Han and Junfei Qiao, Beijing University of Technology, China

This paper proposes a novel input-output clustering approach for structure identification of T-S fuzzy neural networks. This approach consists of two phases. Firstly, k-means clustering method is applied to the input data to provide the initial clusters of the input space. Secondly, check whether the sub-clustering is needed for each input cluster by considering the corresponding output variation and then apply the k-means method to further partition those input clusters needed sub-clustering. Applying the above process recursively leads to the structure identification of a T-S fuzzy neural network and then the parameter identification is completed by using the gradient learning algorithm. The experiments by applying the proposed method to several benchmark problems show better performance compared with many existing methods and then verify the effectiveness and usefulness of the proposed method.

11:40AM Real-Time Nonlinear Modeling of a Twin Rotor MIMO System Using Evolving Neuro-Fuzzy Network [#14920]

Alisson Silva, Walmir Caminhas, Andre Lemos and Fernando Gomide, Federal University of Minas Gerais, Brazil; University of Campinas, Brazil

This paper presents an evolving neuro-fuzzy network approach (eNFN) to model a twin rotor MIMO system (TRMS) with two degrees of freedom in real-time. The TRMS is a fast, nonlinear, open loop unstable time-varying dynamic system, with cross coupling between the rotors. Modeling and control of TRMS require high sampling rates, typically in the order of milliseconds. Actual laboratory implementation shows that eNFN is fast, effective, and accurately models the TRMS in real-time. The eNFN captures the TRMS system dynamics quickly, and develops precise low cost models from the point of view of time and space complexity. The results suggest eNFN as a potential candidate to model complex, fast time-varying dynamic systems in real-time.

Special Session: ICES'14 Session 1: Evolutionary Systems for Semiconductor Design, Simulation and Fabrication

Thursday, December 11, 10:20AM-12:00PM, Room: Antigua 3, Chair: Andy Tyrrell

10:20AM Circuit Design Optimisation Using a Modified Genetic Algorithm and Device Layout Motifs [#14306]

Yang Xiao, James Walker, Simon Bale, Martin Trefzer and Andy Tyrrell, University of York, United Kingdom

Circuit performance optimization such as increasing speed and minimizing power consumption is the most important design goal for circuit designers next to correct functionality. This is generally also a very complex problem where, in order to solve it, several factors such as device characteristics, circuit topology, and circuit functionality must be considered. Particularly, as technology has scaled to the atomistic level, the resulting uncertainty factors further affect circuit performance. In this paper, we propose combining a modified genetic algorithm with dynamic gene mutation and device layout motif selection for circuit performance improvement. We explore novel device layout motifs (O shape device) to exploit effects of device layout at the atomistic level in order to improve characteristics of circuits and combine them with a modified GA for automatic circuit optimization. Additionally, in order to overcome local optima and premature convergence, a dynamic gene mutation rate is performed within the GA. The experimental results show that this methodology can achieve more than 30% delay reduction through mixed combinations of O shape devices and regular devices in a circuit, compared to circuits built of only regular devices. At the same time, the local optima are also reliably avoided due to the dynamic gene mutation.

10:40AM Acceleration of Transistor-Level Evolution using Xilinx Zynq Platform [#14503]

Vojtech Mrazek and Zdenek Vasicek, Brno University of Technology, Czech Republic

The aim of this paper is to introduce a new accelerator developed to address the problem of evolutionary synthesis of digital circuits at transistor level. The proposed accelerator, based on recently introduced Xilinx Zynq platform, consists of a discrete simulator implemented in programmable logic and an evolutionary algorithm running on a tightly coupled embedded ARM processor. The discrete simulator was introduced in order to achieve a good trade-off between the precision and performance of the simulation of transistor-level circuits. The simulator is implemented using the concept of virtual reconfigurable circuit and operates on multiple logic levels which enables to evaluate the behavior of candidate transistor-level circuits at a reasonable level of detail. In this work, the concept of virtual reconfigurable circuit was extended to enable bidirectional data flow which represents the basic feature of transistor level circuits. According to the experimental evaluation, the proposed architecture speeds up the evolution in one order of magnitude compared to an optimized software implementation. The developed accelerator is utilized in the evolution of basic logic circuits having up to 5 inputs. It is shown that solutions competitive to the circuits obtained by conventional design methods can be discovered.

11:00AM Sustainability Assurance Modeling for SRAM-based FPGA Evolutionary Self-Repair [#14043]

Rashad S. Oreifej, Rawad Al-Haddad, Rizwan A. Ashraf and Ronald F. DeMara, University of Central Florida, United States

A quantitative stochastic design technique is developed for evolvable hardware systems with self-repairing, replaceable, or amorphous spare components. The model develops a metric of sustainability which is defined in terms of residual functionality achieved from pools of amorphous spares of dynamically configurable logic elements, after repeated failure and recovery cycles. At design-time the quantity of additional resources needed to meet mission availability and lifetime requirements given the fault-susceptibility and recovery capabilities are assured within specified constraints. By applying this model to MCNC benchmark circuits mapped onto Xilinx Virtex-4 Field Programmable Gate Array (FPGA) with reconfigurable logic resources, we depict the effect of fault rates for aging-induced degradation under Time Dependent Dielectric Breakdown (TDDB) and interconnect failure under Electromigration (EM). The model considers a population-based genetic algorithm to refurbish hardware resources which realize repair policy parameters and decaying reparability as a complete case-study using published component failure rates.

11:20AM Segmental Transmission Line: Its Practical Applicaion -The Optimized PCB Trace Design Using a Genetic Algorithm- [#14532]

Moritoshi Yasunaga, Hiroki Shimada, Katsuyuki Seki and Ikuo Yoshihara, Graduate School of Systems and Information Engineering, University of Tsukuba, Japan; Faculty of Engineering, Miyazaki University, Japan

The deterioration of signal integrity (SI) is one of the most serious problems in the design of printed circuit boards (PCBs) for very-large-scale integration (VLSI) packaging in the GHz era, and conventional characteristic impedance matching designs, however, do not work in the GHz domain. In order to overcome this difficulty, we have previously proposed a novel transmission line, the segmental transmission line (STL) , which is based on genetic algorithms (GAs). A fundamental prototype of the STL has been presented in ICES 2008, and the paper received the best paper award. Since that fundamental prototype, we have improved the GAs used in the design of the STL in terms of gene structure and crossover operation, and have put it into practical use. In the first part of this paper, we describe the improved STL design using GAs, and in the latter part, we show three representative practical applications of the STL. In the first example, the STL is applied to a double data rate (DDR) memory bus system, which is used currently in almost all information and communication equipment to connect the central processing unit (CPU) with the main memory module. In the second example, the STL is applied to a backplane PCB bus systems, which are indispensable structures in high-end server computers. In the third example, we apply the STL to high-density trace bus systems, where the SI deterioration results not due to the mismatching of the characteristic impedance but due to crosstalk noise. And high SI performance of the STL are demonstrated by the use of prototypes of these practical applications.

11:40AM Towards Self-Adaptive Caches: a Run-Time Reconfigurable Multi-Core Infrastructure [#14258]

Nam Ho, Paul Kaufmann and Marco Platzner, University of Paderborn, Germany

This paper presents the first steps towards the implementation of an evolvable and self-adaptable processor cache. The implemented system consists of a run-time reconfigurable memory-to-cache address mapping engine embedded into the split level one cache of a Leon3 SPARC processor as well as of an measurement infrastructure able to profile microarchitectural and custom logic events based on the standard Linux performance measurement interface perf_event. The implementation shows, how reconfiguration of the very basic processor properties, and fine granular profiling of custom logic and integer unit events can be realized and meaningfully used to create an adaptable multicore embedded system.

Special Session: CIBIM'14 Session 1: Adaptive Biometric Systems - Recent Advances and Challenges

Thursday, December 11, 10:20AM-12:00PM, Room: Antigua 4, Chair: Eric Granger and Ajita Rattani

10:20AM A New Efficient and Adaptive Sclera Recognition System [#14167]

Abhijit Das, Umapada Pal, Miguel Ferrer Ballaster and Michael Blumenstein, GRIFFITH UNIVERSITY, Australia; ISI, India; Universidad de Las Palmas de Gran Canaria, Spain

In this paper an efficient and adaptive biometric sclera recognition and verification system is proposed. Here sclera segmentation was performed by Fuzzy C-means clustering. Since the sclera vessels are not prominent so, in order to make them clearly visible image enhancement was required. Adaptive histogram equalization, followed by a bank of Discrete Meyer Wavelet was used to enhance the sclera vessel patterns. Feature extraction was performed by, Dense Local Directional Pattern (D-LDP). D-LDP patch descriptors of each training image are used to form a bag of features; further Spatial Pyramid Matching was used to produce the final training model. Support Vector Machines (SVMs) are used for classification. The UBIRIS version 1 dataset was used here for experimentation of the proposed system. To investigate regarding sclera patterns adaptively with respect to change in environmental condition, population, data accruing technique and time span two different session of the mention dataset are utilized. The images in two sessions are different in acquiring technique, representation, number of individual and theye were captured in a gap of two weeks. An encouraging Equal Error Rate (EER) of 3.95% was achieved in the above mention investigation.

10:40AM Biometric Template Update under Facial Aging [#14315]

Zahid Akhtar, Amr Ahmed, Cigdem Eroglu Erdem and Gian Luca Foresti, University of Udine, Italy; University of Lincoln, United Kingdom; Bahcesehir University, Turkey

Being biological tissues in nature, all biometric traits undergo aging. Aging has profound effects on facial biometrics as it causes shape and texture changes. However aging remain an under-studied problem in comparison to facial variations due to pose, illumination and expression changes. A commonly adopted solution in the state-of-the-art is the virtual template synthesis for aging and de-aging transformations involving complex 3D modelling techniques. These methods are also prone to estimation errors in the synthesis. Another viable solution is to continuously adapt the template to the temporal variation (aging) of the query data. Though efficacy of template update procedures has been proven for expression, lightning and pose variations, the use of template update for facial aging has not received much attention so far. This paper investigates the use of template update procedures for temporal variance due to the facial aging process. Experimental evaluations on FGNET and MORPH aging database using commercial VeriLook face recognition engine demonstrate that continuous template updating is an effective and simple way to adapt to variations due to the aging process.

11:00AM An Automated Multi-modal Biometric System and Fusion [#14742]

Yogesh Kumar, Aditya Nigam, Phalguni Gupta and Kamlesh Tiwari, Department of Computer Science and Engg., Indian Institute of Technology Kanpur, INDIA, India

This paper proposed an automated multimodal biometric system and fusion technique to eliminates the unimodal limitations. Unimodal biometric system has many problems like occlusion, illumination, pose variation. This proposed multimodal biometric system use face, left ear, left palm, right palmprint, left knuckleprint, right knuckleprint as biometric traits. This multimodal biometric system has auto positioning device for face and ear image acquisition. An another device is created for palmprint and knuckleprint acquisition. This proposed biometric system use an efficient image enhancement, SURF based feature extraction and SURF based feature matching techniques for all used biometric trait images. This system use two level fusion strategy. Feature level fusion is used to make more discriminative feature template for each biometric trait and score level fusion is used to make final fused score from all used biometric traits.

11:20AM Multi-angle Based Lively Sclera Biometrics at a Distance [#14825]

Abhijit Das, Umapada Pal, Miguel Ferrer Ballaster and Michael Blumenstein, GRIFFITH UNIVERSITY, Australia; ISI, India; Universidad de Las Palmas de Gran Canaria, Spain

This piece of work proposes a liveliness sclera-based eye biometric validation and recognition technique at a distance. The images in this work are acquired by a digital camera in the visible spectrum at varying distance of about 1 meter from the individual. Each individual during registration as well as validation is asked to look straight and move their eye ball up, left and right keeping their face straight to incorporate liveliness of the data. At first the image is divided vertically into two halves and the eyes are detected in each half of the face image that is captured, by locating the eye ball by a Circular Hough Transform. Then the eye image is cropped out automatically using the radius of the iris. Next a C-means-based segmentation is used for sclera segmentation followed by vessel enhancement by the Haar filter. The feature extraction was performed by patch-based Dense-LDP (Linear Directive Pattern). Furthermore each training image is used to form a bag of features, which is used to produce the training model. Each of the images of the different poses is combined at the feature level and the image level. The fusion that produces the best result is considered. Support Vector Machines (SVMs) are used for classification. Here images from 82 individuals are used and an appreciable Equal Error Rate of 0.52% is achieved in this work.

11:40AM Adaptive ECG Biometric Recognition: a Study on Re-Enrollment Methods for QRS Signals [#14911]

Ruggero Donida Labati, Vincenzo Piuri, Roberto Sassi, Fabio Scotti and Gianluca Sforza, Universita' degli Studi di Milano, Italy

The diffusion of wearable and mobile devices for the acquisition and analysis of cardiac signals drastically increased the possible applicative scenarios of biometric systems based on electrocardiography (ECG). Moreover, such devices allow for comfortable and unconstrained acquisitions of ECG signals for relevant time spans of tens of hours, thus making these physiological signals particularly attractive biometric traits for continuous authentication applications. In this context, recent studies showed that the QRS complex is the most stable component of the ECG signal, but the accuracy of the authentication degrades over time, due to significant variations in the patterns for each individual. Adaptive techniques for automatic template update can therefore become enabling technologies for continuous authentication systems based on ECG characteristics. In this work, we propose an approach for unsupervised periodical re-enrollment for continuous authentication, based on ECG signals. During the enrollment phase, a "super" template obtained from a fixed number of samples is stored in the gallery. In continuous authentication, an update condition is periodically verified. If the condition is satisfied, confirming that the fresh data pertain to the stored identity,

an update strategy is applied to fuse the fresh data with the "super" template. Different update conditions and update strategies are presented and evaluated. Tests have been performed on a significantly large public dataset of 24h Holter signals acquired in uncontrolled conditions, proving that the proposed approach obtains a relevant accuracy, which increases with respect to traditional biometric approaches based on a single enrolled template for each individual.

MCDM'14 Session 1: Algorithms I

Thursday, December 11, 10:20AM-12:00PM, Room: Bonaire 1, Chair: Piero Bonissone and Yaochu Jin

10:20AM Robustness Threshold Methodology for Multicriteria based Ranking using Imprecise Data [#14026]

Bastien Rizzon, Sylvie Galichet and Vincent Cliville, Universite de Savoie - LISTIC, France

It is well established that making decisions from defined data according to various criteria requires the use of MultiCriteria Decision Aiding or Analysis (MCDA) methods. However the necessary input data for these approaches are often ill-known especially when the data are a priori estimated. The common MCDA approaches consider these data as singular/scalar values. This paper deals with the consideration of more realistic, values by studying the impact of imprecision on a classical "precise" ranking established with ACUTA, a method based on additive utilities. We propose a generic approach to establish the concordance of pairwise relations of preference despite interval-based imprecision by complementing ACUTA with a computation of Kendall's index of concordance and of a threshold for maintaining this concordance. The methodology is applied to an industrial case subjected to Sustainable Development problems.

10:40AM Generating Diverse and Accurate Classifier Ensembles Using Multi-Objective Optimization [#15078]

Shenkai Gu and Yaochu Jin, University of Surrey, United Kingdom

Accuracy and diversity are two vital requirements for constructing classifier ensembles. Previous work has achieved this by sequentially selecting accurate ensemble members while maximizing the diversity. As a result, the final diversity of the members in the ensemble will change. In addition, little work has been reported on discussing the trade-off between accuracy and diversity of classifier ensembles. This paper proposes a method for generating ensembles by explicitly maximizing classification accuracy and diversity of the ensemble together using a multi-objective evolutionary algorithm. We analyze the Pareto optimal solutions achieved by the proposed algorithm and compare them with the accuracy of single classifiers. Our results show that by explicitly maximizing diversity together with accuracy, we can find multiple classifier ensembles that outperform single classifiers. Our results also indicate that a combination of proper methods for creating and measuring diversity may be critical for generating ensembles that reliably outperform single classifiers.

11:00AM Selection of Solutions in Multi-Objective Optimization: Decision Making and Robustness [#14390]

Antonio Gaspar-Cunha, Jose Ferreira, Jose Covas and Gustavo Reccio, Institute of Polymers and Composites/I3N, University of Minho, Portugal; Department of Computer Science Universidad Carlos III de Madrid, Spain

A multidisciplinary design an optimization framework based on the use of multi- objective evolutionary algorithms, together with decision making and robustness strategies, was used to optimize the polymer extrusion process. This methodology was applied with the aim to select the best solutions from the Pareto set in a multi-objective environment. The application to a complex polymer extrusion case study demonstrated the validity and usefulness of the approach.

11:20AM A Multiobjective Genetic Algorithm based on NSGA II for Deriving Final Ranking from a Medium-Sized Fuzzy Outranking Relation [#14403]

Juan Carlos Leyva Lopez, Diego Alonso Gastelum Chavira and Jesus Jaime Solano Noriega, Universidad de Occidente, Mexico; Universidad Autonoma de Ciudad Juarez, Mexico

In this paper, a heuristic, based on the nondominated sorting genetic algorithm II (NSGA II), is developed to exploit a known fuzzy outranking relation, with the purpose of constructing a recommendation for a medium-sized multicriteria ranking problem. The performance of the proposed evolutionary algorithm is evaluated on a real medium-sized problem. The results indicate that the proposed evolutionary algorithm can effectively be used to solve medium-sized multicriteria ranking problems.

11:40AM A Hybrid Multi-objective GRASP+SA Algorithm with Incorporation of Preferences [#14944]

Eunice Oliveira, Carlos Henggeler Antunes and Alvaro Gomes, School of Technology and Management, Polytechnic Institute of Leiria and Research and Development Unit INESC Coimbra, Portugal; Dept. of Electrical Engineering and Computers, University of Coimbra and Research and Development Unit INESC Coimbra, Portugal

A hybrid multi-objective approach based on GRASP (Greedy Randomized Adaptive Search Procedure) and SA (Simulated Annealing) meta-heuristics is proposed to provide decision support in a direct load control problem in electricity distribution networks. The main contributions of this paper are new techniques for the incorporation of preferences in these meta-heuristics and their hybridization. Preferences are included in the construction phase of multi- objective GRASP, in SA, as well as in the selection of solutions that go to the next generation, with the aim to obtain solutions more in accordance with the preferences elicited from a decision maker. The incorporation of preferences is made operational using the principles of the ELECTRE TRI method, which is based on the exploitation of an outranking relation in the framework of the sorting problem.

Special Session: RiiSS'14 Session 1: Computational Intelligence for Cognitive Robotics I

Thursday, December 11, 10:20AM-12:00PM, Room: Bonaire 2, Chair: Naoyuki Kubota

10:20AM Average Edit Distance Bacterial Mutation Algorithm for Effective Optimisation [#14517]

Tiong Yew Tang, Simon Egerton, Janos Botzheim and Naoyuki Kubota, Monash University Malaysia, Malaysia; Tokyo Metropolitan University, Japan

In the field of Evolutionary Computation (EC), many algorithms have been proposed to enhance the optimisation search performance in NP-Hard problems. Recently, EC research trends have focused on memetic algorithms that combine local and global optimisation search. One of the state-of-the-art memetic EC methods named Bacterial Memetic Algorithm (BMA) has given good optimisation results. In this paper, the objective is to improve the existing BMA optimisation performance without significant impact to its processing cost. Therefore, we propose a novel algorithm called Average Edit Distance Bacterial Mutation (AEDBM) algorithm that improves the bacterial mutation operator in BMA. The AEDBM algorithm performs edit distance similarity comparisons for each selected mutation elements with other bacterial clones before assigning the selected elements to the clones. In this way, AEDBM will minimise bad (similar elements) bacterial mutation to other bacterial clones and thus improve the overall optimisation performance. We investigate the proposed AEDBM algorithm on commonly used datasets in fuzzy logic system analysis. We also apply the proposed method to train a robotic learning agent's perception-action mapping dataset. Experimental results show that the proposed AEDBM approach in most cases gains consistent mean square error optimisation performance improvements over the benchmark approach with only minimal impact to processing cost.

10:40AM Robust face recognition via transfer learning for robot partner [#14653]

Noel Nuo Wi Tay, Janos Botzheim, Chu Kiong Loo and Naoyuki Kubota, Graduate School of System Design, Tokyo Metropolitan University, Japan; Faculty of Computer Science and Information Technology University of Malaya, Malaysia

Face recognition is crucial for human-robot interaction. Robot partners are required to work in real-time under unconstrained condition and do not restrict the personal freedom of human occupants. On the other hand, due to its limited computational capability, a tradeoff between accuracy and computational load needs to be made. This tradeoff can be alleviated via the introduction of informationally structured space. In this work, transfer learning is employed to perform unconstraint face recognition, where templates are constructed from domains acquired from various image-capturing devices, which is a subset of sensors from the informationally structured space. Given the conditions, appropriate templates are used for recognition. The templates can be easily learned and merged, which reduces significantly the processing load. Tested on standard databases, experimental studies show that specific and small target domain samples can boost the recognition performance without imposing strain on computation.

11:00AM Combining Pose Control and Angular Velocity Control for Motion Balance of Humanoid Robot Soccer EROS [#14683]

Azhar Aulia Saputra, Indra Adji Sulistijono, Achmad Subhan Khalilullah, Takahiro Takeda and Naoyuki Kubota, Tokyo Metropolitan University, Japan; Politeknik Elektronika Negeri Surabaya (PENS), Indonesia

This paper proposes a research about the humanoid robot system stability to the basic movements in playing football (walking, running, and kicking a ball). The system controls the stability of the robot body angle in order to remain in an ideal position, using the hand as a function of the feedback that has been controlled the actuator separately with leg function on the robot. The hand has a function as robot body tilt actuator controller and the foot has a function as gait motion control system that controls the robot to walk. This system has deficiency to disorders the high impulse, resulting in added angular velocity control system functions, which can reduce the foot force moment generated when stopping suddenly and unexpectedly ran. System control used PID control while in motion pattern and kinematic control system using Fuzzy algorithm. We applied the combination between the control and speed control angle pose at EROS (EEPIS RoboSoccer).

11:20AM Spiking Neural Network based Emotional Model for Robot Partner [#15056]

Janos Botzheim and Naoyuki Kubota, Tokyo Metropolitan University, Japan

In this paper, a spiking neural network based emotional model is proposed for a smart phone based robot partner. Since smart phone has limited computational power compared to personal computers, a simple spike response model is applied for the neurons in the neural network. The network has three layers following the concept of emotion, feeling, and mood. The perceptual input stimulates the neurons in the first, emotion layer. Weights adjustment is also proposed for the interconnected neurons in the feeling layer and between the feeling and mood layer based on Hebbian learning. Experiments are presented to validate the proposed method. Based on the emotional model, the output action such as gestural and facial expressions for the robot is calculated.

11:40AM GNG Based Conversation Selection Model for Robot Partner and Human Communication System [#15066]

Shogo Yoshida and Naoyuki Kubota, Tokyo Metropolitan University, Japan

Elderly people with socially isolated has become an important problem in Japan. Therefore, the introduction robot partner for supporting socially isolated elderly people's life become of the solutions. This paper discusses conversation selection model using GNG(:Growing Neural Gas). The robot partner is composed of a smart device used as a face module and the robot body module with two arms. First we discuss the necessity of robot partner in conjunction with elderly people life support, while we also discuss the connection between conversation selection model and robot partner's communication ability performance. Next, we propose conversation selection model using GNG for determining robot partner's utterance from voice recognition result. We conduct experiments to discuss the effectiveness of the proposed method based on GNG and JS divergence. Finally, we show the robot partner's capability in selecting words while performing conversation using the proposed method.

CIVTS'14 Session 1

Thursday, December 11, 10:20AM-12:00PM, Room: Bonaire 3, Chair: Justin Dauwels, Dipti Srinivasan and Ana Bazzan

10:20AM A GPU-Based Real-Time Traffic Sign Detection and Recognition System [#14841]

Zhilu Chen, Xinming Huang, Ni Zhen and Haibo He, Worcester Polytechnic Institute, United States; University of Rhode Island, United States

This paper presents a GPU-based system for real-time traffic sign detection and recognition which can classify 48 different traffic signs included in the library. The proposed design implementation has three stages: pre-processing, feature extraction and classification. For high-speed processing, we propose a window-based histogram of gradient algorithm that is highly optimized for parallel processing on a GPU. For detecting signs in various sizes, the processing was applied at 32 scale levels. For more accurate recognition, multiple levels of supported vector machines are employed to classify the traffic signs. The proposed system can process 27.9 frames per second video with active pixels of 1,628 x 1,236 resolution. Evaluating using the BelgiumTS dataset, the experimental results show the detection rate is about 91.69% with false positives per window of 3.39e-5 and the recognition rate is about 93.77%.

10:40AM Traffic Information Extraction from a Blogging Platform using Knowledge-based Approaches and Bootstrapping [#14501]

Jorge Aching, Thiago de Oliveira and Ana Bazzan, Instituto de Informatica, Universidade Federal do Rio Grande do Sul, Brazil

In this paper we propose a strategy to use messages posted in a blogging platform for real-time sensing of traffic-related information. Specifically, we use the data that appear in a blog, in Portuguese language, which is managed by a Brazilian daily newspaper on its online edition. We propose a framework based on two modules to infer the location and traffic condition from unstructured, non georeferenced short post in Portuguese. The first module relates to name-entity recognition (NER). It automatically recognizes three classes of named-entities (NEs) from the input post (Location, Status and Date). Here, a bootstrapping approach is used to expand the initially given list of locations, identifying new locations as well as locations corresponding to spelling variants and typographical errors of the known locations. The second module relates to relation extraction (RE). It extracts binary and ternary relations between such entities to obtain relevant traffic information. In our experiments, the NER module has yielded a F-measure of 96%, while the RE module resulted in 87%. Also, results show that our bootstrapping approach identifies 1,058 new locations when 10,000 short posts are analysed.

11:00AM Multiobjective Selection of Input Sensors for Travel Times Forecasting Using Support Vector Regression [#14707]

Jiri Petrlik, Otto Fucik and Lukas Sekanina, Brno University of Technology, Czech Republic

In this paper we propose a new method for travel time prediction using a support vector regression model (SVR). The inputs of the method are data from license plate detection systems and traffic sensors such as induction loops or radars placed in the area. This method is mainly designed to be capable of dealing with missing values in the traffic data. It is able to create many different SVR models with different input variables. These models are dynamically switched according to which traffic variables are currently available. The proposed method was compared with a basic license plate based prediction approach. The results showed that the proposed method provides the prediction of better quality. Moreover, it is available for a longer period of time.

11:20AM Predicting Bikeshare System Usage Up to One Day Ahead [#14351]

Romain Giot and Raphael Cherrier, Univ. Bordeaux, France; QUCIT, France

Bike sharing systems are present in several modern cities. They provide citizens with an alternative and ecological mode of transportation, allowing them to avoid the use of personal car and all the problems associated with it in big cities (i.e., traffic jam, roads reserved for public transport, ...). However, they also suffer from other problems due to their success: some stations can be full or empty (i.e., impossibility to drop off or take a bike). Thus, to predict the use of such system can be interesting for the user in order to help him/her to plan his/her use of the system and to reduce the probability of suffering of the previously presented issues. This paper presents an analysis of various regressors from the state of the art on an existing public dataset acquired during two years in order to predict the global use of a bike sharing system. The prediction is done for the next twenty-four hours at a frequency of one hour. Results show that even if most regressors are sensitive to over-fitting, the best performing one clearly beats the baselines.

11:40AM Battery-supercapacitor electric vehicles energy management using DP based predictive control algorithm [#14082]

Xiaofeng Lin, Meipin Hu, Shaojian Song and Yimin Yang, College of Electrical Engineering,Guangxi University, China

To achieve a reasonable power split scheme of Li battery pack and supercapacitor hybrid electric vehicles, we propose dynamic programming (DP) based predictive control algorithm (PCA) in this paper. First, the model of the vehicle plant is established consisting of mathematical models of supercapacitor and Li battery pack. Then, the PCA based control system is designed in order to make full use of future road information. Thirdly, a DP-based-controller is proposed to minimize the cost function which consists of power loss and constrains of output. The simulation suggests that the proposed strategy can generate reasonable power split by taking the power loss, constraints of two sources and flatness of power output of Li battery pack into account.

CIES'14 Session 1: Theories and Designs

Thursday, December 11, 10:20AM-12:00PM, Room: Bonaire 4, Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse

10:20AM If We Take Into Account that Constraints Are Soft, Then Processing Constraints Becomes Algorithmically Solvable [#14060]

Quentin Brefort, Luc Jaulin, Martine Ceberio and Vladik Kreinovich, ENSTA-Bretagne, France; University of Texas at El Paso, United States

Constraints are ubiquitous in science and engineering. Constraints describe the available information about the state of the system, constraints describe possible relation between current and future states of the system, constraints describe which future states we would like to obtain. To solve problems from engineering and science, it is therefore necessary to process constraints. We show that if we treat constraints as hard (crisp), with all the threshold values exactly known, then in the general case, all the corresponding computational problems become algorithmically unsolvable. However, these problems become algorithmically solvable if we take into account that in reality, constraints are soft: we do not know the exact values of the corresponding thresholds, we do not know the exact dependence between the present and future states, etc.

10:40AM Why Ricker Wavelets Are Successful in Processing Seismic Data: Towards a Theoretical Explanation [#14341]

Afshin Gholamy and Vladik Kreinovich, University of Texas at El Paso, United States

In many engineering applications ranging from engineering seismology to petroleum engineering and civil engineering, it is important to process seismic data. In processing seismic data, it turns out to be very efficient to describe the signal's spectrum as a linear combination of Ricker wavelet spectra. In this paper, we provide a possible theoretical explanation for this empirical efficiency. Specifically, signal propagation through several layers is discussed, and it is shown that the Ricker wavelet is the simplest non-trivial solution for the corresponding data processing problem, under the condition that the described properties of the approximation family are satisfied.

11:00AM Fuzzy Local Linear Approximation-based Sequential Design [#14588]

Joachim van der Herten, Dirk Deschrijver and Tom Dhaene, Ghent University - iMinds, Belgium

When approximating complex high-fidelity black box simulators with surrogate models, the experimental design is often created sequentially. LOLA-Voronoi, a powerful state of the art method for sequential design combines an Exploitation and Exploration algorithm and adapts the sampling distribution to provide extra samples in non-linear regions. The LOLA algorithm estimates gradients to identify interesting regions, but has a bad complexity which results in long computation time when simulators are high-dimensional. In this paper, a new gradient estimation approach for the LOLA algorithm is proposed based on Fuzzy Logic. Experiments show the new method is a lot faster and results in experimental designs of comparable quality.

11:20AM Incorporating Decision Maker Preference in Multi-objective Evolutionary Algorithm [#14762]

Sufian Sudeng and Naruemon Wattanapongsakorn, Department of Computer Engineering King Mongkut's University of Technology Thonburi Bangkok, 10140, Thailand., Thailand

There is no existence of single best trade-off solution in multi-objective optimization frameworks with many competing objectives, as a decision maker's (DM) opinion is concerned. In this paper, we propose a preference-based multi-objective optimization evolutionary algorithm (MOEA) to help the decision maker (DM) choosing the final best solution(s). Our algorithm is called ASA-NSGA-II. The approach is accomplished by replacing the crowding estimator technique in NSGA-II algorithm by applying an extended angle-based dominance technique. The contribution of ASA-NSGA-II can be illustrated by the geometric angle between a pair of solutions by using an arctangent function and compare the angle with a threshold angle. The specific bias intensity parameter is then introduced to the threshold angle in order to approximate the portions of desirable solutions based on the DM's preference. We consider two and three-objective benchmark problems. In addition, we also provide an application problem to observe the usefulness of our algorithm in practical context.

11:40AM Visualizing Uncertainty with Fuzzy Rose Diagrams [#14627]

Andrew Buck and James Keller, University of Missouri, United States

This paper presents a novel method for visualizing vectors of fuzzy numbers. The proposed approach is an extension of the standard polar area diagram and can be applied to a single uncertain vector or a fuzzy weighted graph with vectors of fuzzy attributes on the vertices and/or edges. The resulting diagrams are intuitive to understand and do not require an extensive background in fuzzy set theory. By visualizing uncertain vectors in this way, the viewer can easily compare and contrast sets of fuzzy numbers. This can be useful in the context of decision support systems, particularly those involving multi-criteria decision making. We demonstrate our approach on the problem of finding a least-cost path through an uncertain environment.

ISIC'14 Session 1: Independent Computing I

Thursday, December 11, 10:20AM-12:00PM, Room: Bonaire 5, Chair: Neil Y. Yen

10:20AM Meta-Framework for Semantic TRIZ [#14975]

K.R.C. Koswatte, Incheon Paik and B.T.G.S. Kumara, University of Aizu, Japan

In the manufacturing industry, SCM (Supply Chain Management) is playing an important role which gives profit to enterprise. Extracting innovative design considerations for a product from the information infrastructure requires large knowledge base and solutions to technical and physical contradictions. Construction of information infrastructure with the integration of four designs attributes: component cost, quality, function and technology, innovation can be enhanced. Information which is useful to improve the existing products and development of a new product can be acquired from the database and from the ontology. The TRIZ (Theory of Inventive Problem Solving) supports designers for innovative product

design by searching from a knowledge base. The existing TRIZ ontology support innovative design of a product. But it is considering about a specific product (flashlight) for TRIZ ontology. Our final goal is to construct meta-TRIZ ontology that can be applied to multiple products. To achieve this goal, we try to apply the semantic TRIZ to another product; multifunction fan (Smart Fan), as an interim stage towards meta-ontology. This may open up new possibilities to innovative product designs with multifunction.

10:40AM A Model for Estimating SCM Audit Effort with Key Characteristic Sensitivity Analysis [#14047]

John Medellin, Southern Methodist University Lyle School of Engineering, United States

Software Configuration Management auditing is the fourth of four sub processes recommended by the IEEE and the ACM in the area of SCM. Little guidance is offered in the area of estimation. This paper proposes an initial model for estimating overall system Configuration Items size and effort that might be required to execute the audit. The model is built from formulae and other input from other studies of Empirical Software Engineering and is therefore theoretical. A second part of the study tests the sensitivity to the parameters of white box/structural testing, organizational competence in CMMi level 3 and above and usage of automation in SCM auditing. It is an initial study aimed at discovering the extent of potential impact of certain environment characteristics on the level of effort required to execute the audit.

11:00AM Signboard Design System through Social Voting Technique [#14563]

Hiroshi Takenouchi, Hiroyuki Inoue and Masataka Tokumaru, Fukuoka Institute of Technology, Japan; University of Fukui, Japan; Kansai University, Japan

We propose a signboard design system with votes by multiple people. When determining a signboard design with many people, it is important that local residents agree on a single signboard design. Therefore, we created a signboard design system that determines the design by popularity using an evolutionary computation algorithm to finalize the design. We have proposed a paired comparison voting method (PCV) that allows several thousand unspecified users to participate in the evaluation of candidate solutions. Specifically, the PCV method considers multiple opinion from the Internet votes to evaluate candidate solutions, accepting votes made during a defined time parameter. In our previous study, we confirmed the effectiveness of the PCV method by numerical simulations using evaluation agents that imitate human sensitivity. In this paper, we demonstrate its effectiveness for real users using a signboard design system. The system helps users to create a signboard design by considering the suitability of the grain pattern, background and character colors, and the signboard's environment. The experimental results showed that the PCV method can reduce the load on users and produce a suitable and satisfactory design, verifying the effectiveness of the PCV method for real users.

11:20AM Social Network based Smart Grids Analysis [#14692]

Joseph C. Tsai, Neil Y. Yen and Takafumi Hayashi, The University of Aizu, Japan

Issues concerning renewable energy have drawn a dramatic attention from the publics, especially the government units. In order to well manage the energy (e.g., power, water, and etc.), concept of grid, i.e., the smart grid, is recognized one of most efficient approaches in the realm, and widely applied, as well, in many kinds of situations for renewable energy. One significant topic among all is power scheduling which makes it understandable to general users a better volume of power consumption and a finer province electricity plan. Based on this concept, renewable energy generation prediction is the approach to enhance the power scheduling and performance of power using. Thus in this work, we proposed an approach to make the prediction to the trend of power usage and its scheduling issues based on social network analysis and machine learning. The SVM (Support Vector Machine), which its kernel is RBF (Radial Basis Function), is applied to process the power generation prediction by weather forecasting. The social networking is used to improve the accuracy of the prediction. In the experimental result, the accuracy rate is showed with the excellent results.

11:40AM Design Support System with Votes from Multiple People using Digital Signage [#14676]

Masayuki Sakai, Hiroshi Takenouchi and Masataka Tokumaru, Department of Science and Engineering Graduate School of Kansai University, Japan; Fukuoka Institute of Technology, Japan; Kansai University, Japan

We propose a system to create designs that reflect multiple user preferences obtained by voting using digital signage. When creating such designs, it is important to collect a significant number of user opinions and adopt them in the designs. However, as the number of users increases, the collection of opinions becomes more difficult. We propose an interactive evolutionary computation system using digital signage. This system presents several designs. Each user evaluates the designs by voting. In other words, this system obtains the preferences of multiple users by voting and uses the preferences to evaluate designs. Therefore, the proposed system can create designs that please multiple users. In our previous research, we proposed a paired comparison voting (PCV) method that obtains preferences from multiple users by voting and confirmed the effectiveness of the method by simulation. Here, we construct a system using the PCV method and digital signage to demonstrate its effectiveness with real users. The proposed system uses the PCV method to create designs. The experimental results show that the designs generated by the proposed system converged visually and genetically. As a result, we verified that the proposed system creates designs reflecting the preferences of multiple people.

FOCI'14 Session 1: Fuzzy Logic

Thursday, December 11, 10:20AM-12:00PM, Room: Bonaire 6, Chair: Leonardo Franco

10:20AM Information Fusion with Uncertainty Modeled on Topological Event Spaces [#14616]

Roman Ilin and Jun Zhang, Air Force Research Laboratory, United States; University of Michigan, United States

We investigate probability and belief functions constructed on topological event spaces (without requiring complementation operation as in the definition of Borel sets). Anchored on the Lattice Theory, and making use of the correspondence of distributive lattice and topology, we propose a hierarchical scheme for modeling fusion of evidence based on constructing the lattice of topologies over a given sample space, where each topology encodes context for sensor measurement as specified by the basic probability assignment function. Our approach provides a rigorous mathematical grounding for modeling uncertainty and information fusion based on upper and lower probabilities (such as the Dempster-Shafer model).

10:40AM Ranking scientists from the field of quantum game theory using p-index [#14724]

Upul Senanayake, Mahendra Piraveenan and Albert Zomaya, The University of Sydney, Australia

The h-index is a very well known metric used to measure scientific throughput, but it also has well known limitations. In this paper we use a metric based on pagerank algorithm, which we call the p-index, to compare the performance of scientists. We use a real-world dataset to which we apply our analysis: a dataset of scientists from the field of quantum game theory. This dataset is cured by us for this study from google scholar. We show that where as the popularly used h-index rewards authors who collaborate extensively and publish in higher volumes, the p-index rewards hardworking authors who contribute more to each paper they write, as well as authors who publish in high impact and well cited journals. As such, it could be argued that the p-index is a `fairer' metric of the productivity and impact of scientists. Of particular note is that the p-index does not use the so called `impact factors' of journals, the utility of which is debated ins scientific community. Rather, the p-index relies on the actual underlying citation network to measure the real impact of each paper. Furthermore, the p-index relies not only on the number of citations but also on the quality of citations of each paper. Using p-index, we highlight and compare the impact of real world scientists on the field of quantum game theory.

11:00AM Quantum-inspired Genetic Algorithm with Two Search Supportive Schemes and Artificial Entanglement [#14560]

Chee Ken Choy, Kien Quang Nguyen and Ruck Thawonmas, Intelligent Computer Entertainment Laboratory, Ritsumeikan University, Japan

In this paper, we present an enhanced quantum-inspired genetic algorithm (eQiGA) with a combination of proposed mechanisms: two search supportive schemes and artificial entanglement. This combination is aimed at balancing exploration and exploitation. Two schemes, namely Explore and Exploit scheme are designed with aggressive specific roles reflecting its name. Entanglement is considered to be one of the significant strengths in quantum computing aside the probabilistic representation and superposition. Hence we attempt to apply its concept as part of our strategy for its potential. In addition, two new sub-strategies are proposed: fitness threshold, and quantum side-stepping. The algorithm is tested on multiple numerical optimization functions, and significant results of improved performance are obtained, studied, and discussed.

11:20AM The Performance of Page Rank Algorithm under Degree Preserving Perturbations [#14725]

Upul Senanayake, Peter Szot, Mahendra Piraveenan and Dharshana Kasthurirathna, The University of Sydney, Australia

Page rank is a ranking algorithm based on a random surfer model which is used in Google search engine and many other domains. Because of its initial success in Google search engine, page rank has become the de-facto choice when it comes to ranking nodes in a network structure. Despite the ubiquitous utility of the algorithm, little is known about the effect of topology on the performance of the page rank algorithm. Hence this paper discusses the performance of page rank algorithm under different topological conditions. We use scale-free networks and random networks along with a custom search engine we implemented in order to experimentally prove that the performance of page rank algorithm is deteriorated when the random network is perturbed. In contrast, scale-free topology is proven to be resilient against degree preserving perturbations which aids the page rank algorithm to deliver consistent results across multiple networks that are perturbed to varying proportions. Not only does the top ranking results emerge as stable nodes, but the overall performance of the algorithm is proven to be remarkably resilient which deepens our understanding about the risks in applying page rank algorithm without an initial analysis on the underlying network structure. The results conclusively suggests that while page rank algorithm can be applied to scale-free networks with relatively low risk, applying page rank algorithm to other topologies can be risky as well as misleading. Therefore, the success of the page rank algorithm in real world in search engines such as Google is at least partly due to the fact that the world wide web is a scale-free network.

11:40AM Fuzzy Networks: What Happens When Fuzzy People Are Connected through Social Networks [#14583]

Li-Xin Wang and Jerry M. Mendel, Xian Jiaotong University, China; University of Southern California, United States

A fuzzy node is a fuzzy set whose membership function contains some uncertain parameters. Two fuzzy nodes are connected if the uncertain parameter of one node is provided by the fuzzy set from the other node. A fuzzy network is a connection of a number of fuzzy nodes. We define Gaussian Fuzzy Networks and study a number of basic connections in details, including basic center, basic standard deviation (sdv), basic center-sdv, chain-in-center, chain-in-sdv, self- feedback and some other connections. We derive the membership functions resulting from these connections that reveal how the fuzziness is propagated through the networks, and we explain what the mathematical results mean with respect to human behaviors.

EALS'14 Session 1: Theory and Principles

Thursday, December 11, 10:20AM-12:00PM, Room: Bonaire 7, Chair: Fernando Gomide

10:20AM Anomaly Detection based on Eccentricity Analysis [#14604]

Plamen Angelov, Lancaster University, United Kingdom

In this paper, we propose a new eccentricity- based anomaly detection principle and algorithm. It is based on a further development of the recently introduced data analytics framework (TEDA - from typicality and eccentricity data analytics). We compare TEDA with the traditional statistical approach and prove that TEDA is a generalization of it in regards to the well-known "n sigma" analysis (TEDA gives exactly the same result as the traditional "n sigma;" analysis but it does not require the restrictive prior assumptions that are made for the traditional approach to be in place). Moreover, it offers a non-parametric, closed form analytical descriptions (models of the data distribution) to be extracted from the real data realizations, not to be pre-assumed. In addition to that, for several types of proximity/similarity measures (such as Euclidean, cosine, Mahalonobis) it can be calculated recursively, thus, computationally very efficiently and is suitable for real time and online algorithms. Building on the per data sample, exact information about the data distribution in a closed analytical form, in this paper we propose a new less conservative and more sensitive condition for anomaly detection. It is quite different from the traditional "n sigma;" type conditions. We demonstrate example where traditional conditions would lead to an increased amount of false negatives or false positives in comparison with the proposed condition. The new condition is intuitive and easy to check for arbitrary data distribution and arbitrary small (but not less than 3) amount of data samples/points.

10:40AM Recursive Possibilistic Fuzzy Modeling [#14652]

Leandro Maciel, Fernando Gomide and Rosangela Ballini, University of Campinas, Brazil

This paper suggests a recursive possibilistic approach for fuzzy modeling of time-varying processes. The approach is based on an extension of the possibilistic fuzzy c-means clustering and functional fuzzy rule- based modeling. Recursive possibilistic fuzzy modeling (rPFM) employs memberships and typicalities to cluster data. Functional fuzzy models uses affine functions in the fuzzy rule consequents. The parameters of the consequent functions are computed using the recursive least squares. Two classic benchmarks, Mackey-Glass time series and Box and Jenkins furnace data, are studied to illustrate the rPFM modeling and applicability. Data produced by a synthetic model with parameter drift is used to show the usefulness of rPFM to model time-varying processes. Performance of rPFM is compared with well established recursive fuzzy and neural fuzzy modeling and identification. The results show that recursive possibilistic fuzzy modeling produces parsimonious models with comparable or better accuracy than the alternative approaches.

11:00AM On Merging and Dividing of Barabasi-Albert-Graphs [#14208]

Pascal Held, Alexander Dockhorn and Rudolf Kruse, Otto von Guericke University Magdeburg, Germany

The Barabasi-Albert-model is commonly used to generate scale-free graphs, like social networks. To generate dynamics in these networks, methods for altering such graphs are needed. Growing and shrinking is done simply by doing further generation iterations or undo them. In our paper we present four methods to merge two graphs based on the Barabasi-Albert-model, and five strategies to reverse them. First we compared these algorithms by edge preservation, which describes the ratio of the inner structure kept after altering. To check if hubs in the initial graphs are hubs in the resulting graphs as well, we used the node-degree rank correlation. Finally we tested how well the node-degree distribution follows the power-law function from the Barabasi-Albert-model.

11:20AM Embodied Artificial Life at an Impasse: Can Evolutionary Robotics Methods Be Scaled? [#14851]

Andrew Nelson, Androtics LLC, United States

Evolutionary robotics (ER) investigates the application of artificial evolution toward the synthesis of robots capable of performing autonomous behaviors. Over the last 25 years, researchers have reported increasingly complex evolved behaviors, and have compiled a de facto set of benchmark tasks. Perhaps the best known of these is the obstacle avoidance and target homing task performed by differential drive robots. More complex tasks studied in recent ER work include augmented variants of the rodent T-maze and complex foraging tasks. But can proof-of-concept results such as these be extended to evolve complex autonomous behaviors in a general sense? In this topical analysis paper we survey relevant research and make the case that common tasks used to demonstrate the effectiveness of evolutionary robotics are not characteristic of more general cases and in fact do not fully prove the concept that artificial evolution can be used to evolve sophisticated autonomous agent behaviors. Robots capable of performing many of the tasks studied in ER have now been evolved using nearly aggregate binary success/fail fitness functions. However, arguments used to support the necessity of incremental methods for complex tasks are essentially sound. This raises the possibility that the tasks themselves allow for relatively simple solutions, or span a relatively small candidate solution set. This paper presents these arguments in detail and concludes with a discussion of current ER research.

11:40AM Topological stability of evolutionarily unstable strategies [#14203]

Dharshana Kasthurirathna and Mahendra Piraveenan, Centre for Complex Systems Research, Faculty of Engineering and IT, The University of Sydney, Australia

Evolutionary game theory is used to model the evolution of competing strategies in a population of players. Evolutionary stability of a strategy is a dynamic equilibrium, in which any competing mutated strategy would be wiped out from a population. If a strategy is weak evolutionarily stable, the competing strategy may manage to survive within the network. Understanding the network-related factors that affect the evolutionary stability of a strategy would be critical in making accurate predictions about the behaviour of a strategy in a real-world strategic decision making environment. In this work, we evaluate the effect of network topology on the evolutionary stability of a strategy. We focus on two well-known strategies known as the Zero-determinant strategy and the Pavlov strategy. Zero- determinant strategies have been shown to be evolutionarily unstable in a well-mixed population of players. We identify that the Zero-determinant strategy may survive, and may even dominate in a population of players connected through a non-homogeneous network. We introduce the concept of `topological stability' to denote this phenomenon. We argue that not only the network topology, but also the evolutionary process applied and the initial distribution of strategies are critical in determining the evolutionary stability of strategies. Further, we observe that topological stability could affect other well-known strategies as well, such as the general cooperator strategy and the cooperator strategy. Our observations suggest that the variation of evolutionary stability due to topological stability of strategies may be more prevalent in the social context of strategic evolution, in comparison to the biological context.

CIMSIVP'14 Session 4: Algorithms I

Thursday, December 11, 10:20AM-12:00PM, Room: Bonaire 8, Chair: Khan M. Iftekharuddin and Salim Bouzerdoum

10:20AM A Comparison of Genetic Programming Feature Extraction Languages for Image Classification [#14064]

Mehran Maghoumi and Brian Ross, Brock University, Canada

Visual pattern recognition and classification is a challenging computer vision problem. Genetic programming has been applied towards automatic visual pattern recognition. One of the main factors in evolving effective classifiers is the suitability of the GP language for defining expressions for feature extraction and classification. This research presents a comparative study of a variety of GP languages suitable for classification. Four different languages are examined, which use different selections of image processing operators. One of the languages does block classification, which means that an image is classified as a whole by examining many blocks of pixels within it. The other languages are pixel classifiers, which determine classification for a single pixel. Pixel classifiers are more common in the GP-vision literature. We tested the languages on different instances of Brodatz textures, as well as aerial and camera images. Our results show that the most effective languages are pixel-based ones with spatial operators. However, as is to be expected, the nature of the image will determine the effectiveness of the language used.

10:40AM Finding Optimal Transformation Function for Image Thresholding Using Genetic Programming [#14907]

Shaho Shahbazpanahi and Shahryar Rahnamayan, UOIT, Canada

In this paper, Genetic Programming (GP)is employed to obtain an optimum transformation function for bi-level image thresholding. The GP utilizes a user- prepared gold sample to learn from. A magnificent feature of this method is that it does not require neither a prior knowledge about the modality of the image nor a large training set to learn from. The performance of the proposed approach has been examined on 147 X-ray lung images. The transformed images are thresholded using Otsu's method and the results are highly promising. It performs successfully on 99% of the tested images. The proposed method can be utilized for other image processing tasks, such as, image enhancement or segmentation.

11:00AM PFBIK-Tracking: Particle Filter with Bio-Inspired Keypoints Tracking [#14192]

Silvio Filipe and Luis Alexandre, IT - Instituto de Telecomunicacoes, University of Beira Interior, Portugal

In this paper, we propose a robust detection and tracking method for 3D objects by using keypoint information in a particle filter. Our method consists of three distinct steps: Segmentation, Tracking Initialization and Tracking. The segmentation is made in order to remove all the background information, in order to reduce the number of points for further processing. In the initialization, we use a keypoint detector with biological inspiration. The information of the object that we want to follow is given by the extracted keypoints. The particle filter does the tracking of the keypoints, so with that we can predict where the keypoints will be in the next frame. In a recognition system, one of the problems is the computational cost of keypoint detectors with this we intend to solve this problem. The experiments with PFBIK-Tracking method are done indoors in an office/home environment, where personal robots are expected to operate. The Tracking Error evaluate the stability of the general tracking method. We also quantitatively evaluate this method using a "Tracking Error". Our evaluation is done by the computation of the keypoint and particle centroid. Comparing our system with the tracking method which exists in the Point Cloud Library, we archive better results, with a much smaller number of points and computational time. Our method is faster and more robust to occlusion when compared to the OpenniTracker.

11:20AM Unsupervised Multiobjective Design for Weighted Median Filters Using Genetic Algorithm [#14866]

Yoshiko Hanada and Yukiko Orito, Kansai University, Japan; Hiroshima University, Japan

In this paper, a new unsupervised design method of the weighted median filter (WMF) is proposed for recovering images from impulse noise. A design problem of WMFs is to determine a suitable window shape, and an appropriate weight for each element in the window. The purpose of the filter for the noise removal is generally to estimate the original values precisely for corrupted pixels while preserving the original values of non-corrupted pixels. WMF is required to output the image with higher preservation quality and higher restoration quality, however, these qualities often have a trade-off relation. Here, we formulate the design of WMF as a multi-objective optimization problem that treats the preservation performance and the restoration performance as trade-off functions. Through the experiments, we show our method obtains a wide variety of filters that have the high preservation performance or the high restoration performance at one search process. In addition, we also discuss how to select a good set of sophisticated filters from the designed filters.

11:40AM Analysis of Gray Scale Watermark in RGB Host using SVD and PSO [#14571]

Irshad Ahmad Ansari, Millie Pant and Ferrante Neri, Indian Institute of Technology - Roorkee, India; Centre for Computational Intelligence The Gateway, De Montfort University Leicester, United Kingdom

the present study is conducted in two phases. In the first phase we analyze the different aspects of gray image watermarking in a colored host. Robustness and imperceptibility are used as analysis parameters. The approaches explored and compared in this study are - watermark embedding with any one of the three RGB (Red-Green-Blue) components (single channel embedding), multichannel watermark embedding (same watermark with all channels) and multichannel embedding with equally segmented watermark. SVD (Singular Value Decomposition) is used to calculate the singular values of host image and then appropriate scaling factor isused to embed the watermark and the watermarked image is subjected to different attacks. To secure the watermark from an unauthorized access Arnold transform is implemented. From the simulation results it is observed that segmented watermark approach is better than the other two approaches in terms of both robustness and imperceptibility. In the second phase, change of robustness and imperceptibility is studied with the change of scaling factor for which PSO (Particle swarm optimization) is employed to determine the optimal values of scaling factor. The results here indicate that the use of different scaling factors (optimal) for each RGB component provides better result in comparison to a single (optimal) scaling factor in segmented multichannel approach. Overall, the experimental analysis shows that the equal distribution of gray watermark over RGB components with PSO optimized scaling factors provides significant improvement in the quality of watermarked image and the quality of retrieved watermark even from the distorted watermarked image.

Special Session: ADPRL'14 Approximate Dynamic Programming for Energy and Sustainability

Thursday, December 11, 10:20AM-12:00PM, Room: Curacao 1, Chair: Boris Defourny

10:20AM Using Approximate Dynamic Programming for Estimating the Revenues of a Hydrogen-based High-Capacity Storage Device [#14326]

Vincent Francois-Lavet, Raphael Fonteneau and Damien Ernst, ULg, Belgium

This paper proposes a methodology to estimate the maximum revenue that can be generated by a company that operates a high-capacity storage device to buy or sell electricity on the day-ahead electricity market. The methodology exploits the Dynamic Programming (DP) principle and is specified for hydrogen-based storage devices that use electrolysis to produce hydrogen and fuel cells to generate electricity from hydrogen. Experimental results are generated using historical data of energy prices on the Belgian market. They show how the storage capacity and other parameters of the storage device influence the optimal revenue. The main conclusion drawn from the experiments is that it may be interesting to invest in large storage tanks to exploit the inter-seasonal price fluctuations of electricity.

10:40AM Adaptive Aggregated Predictions for Renewable Energy Systems [#14702]

Balazs Csaji, Andras Kovacs and Jozsef Vancza, Institute for Computer Science and Control, Hungarian Academy of Sciences, Hungary

The paper addresses the problem of generating forecasts for energy production and consumption processes in a renewable energy system. The forecasts are made for a prototype public lighting microgrid, which includes photovoltaic panels and LED luminaries that regulate their lighting levels, as inputs for a receding horizon controller. Several stochastic models are fitted to historical times-series data and it is argued that side information, such as clear-sky predictions or the typical system behavior, can be used as exogenous inputs to increase their performance. The predictions can be further improved by combining the forecasts of several models using online learning, the framework of prediction with expert advice. The paper suggests an adaptive aggregation method which also takes side information into account, and makes a state-dependent aggregation. Numerical experiments are presented, as well, showing the efficiency of the estimated time-series models and the proposed aggregation approach.

11:00AM A Comparison of Approximate Dynamic Programming Techniques on Benchmark Energy Storage Problems: Does Anything Work? [#14067]

Daniel Jiang, Thuy Pham, Warren Powell, Daniel Salas and Warren Scott, Princeton University, United States

As more renewable, yet volatile, forms of energy like solar and wind are being incorporated into the grid, the problem of finding optimal control policies for energy storage is becoming increasingly important. These sequential decision problems are often modeled as stochastic dynamic programs, but when the state space becomes large, traditional (exact) techniques such as backward induction, policy iteration, or value iteration quickly become computationally intractable. Approximate dynamic programming (ADP) thus becomes a natural solution technique for solving these problems to near-optimality using significantly fewer computational resources. In this paper, we compare the performance of the following: various approximation architectures with approximate policy iteration (API), approximate value iteration (AVI) with structured lookup table, and direct policy search on an energy storage problem, for which optimal benchmarks exist.

11:20AM Near-Optimality Bounds for Greedy Periodic Policies with Application to Grid-Level Storage [#14433]

Yuhai Hu and Boris Defourny, Lehigh University, United States

This paper is concerned with periodic Markov Decision Processes, as a simplified but already rich model for nonstationary infinite-horizon problems involving seasonal effects. Considering the class of policies greedy for periodic approximate value functions, we establish improved near-optimality bounds for such policies, and derive a corresponding value-iteration algorithm suitable for periodic problems. The effectiveness of a parallel implementation of the algorithm is demonstrated on a grid-level storage control problem that involves stochastic electricity prices following a daily cycle.

CIDM'14 Session 4: Mining Relational and Networked data

Thursday, December 11, 10:20AM-12:00PM, Room: Curacao 2, Chair: John Lee

10:20AM Relational Data Partitioning using Evolutionary Game Theory [#14244]

Lawrence O. Hall and Alireza Chakeri, University of South Florida, United States

This paper presents a new approach for relational data partitioning using the notion of dominant sets. A dominant set is a subset of data points satisfying the constraints of internal homogeneity and external in-homogeneity, i.e. a cluster. However, since any subset of a dominant set cannot be a dominant set itself, dominant sets tend to be compact sets. Hence, in this paper, we present a novel approach to enumerate well distributed clusters where the number of clusters need not be known. When the number of clusters is known, in order to search the solution space appropriately, after finding each dominant set, data points are partitioned into two disjoint subsets of data points using spectral graph image segmentation methods to enumerate the other well distributed dominant sets. For the latter case, we introduce a new hierarchical approach for relational data partitioning using a new class of evolutionary game theory dynamics called InImDynamics which is very fast and linear, in computational time, with the number of data points. In this regard, at each level of the proposed hierarchy, Dunn's index is used to find the appropriate number of clusters. Then the objects are partitioned based on the projected number of clusters using game theoretic relations. The same method is applied to each partition to extract its underlying structure. Although the resulting clusters exist in their equivalent partitions, they may not be clusters of the entire data. Hence, they are checked for being an actual cluster and if they are not, they are extended to an existing cluster of the data. The approach can also be used to assign unseen data to existing clusters, as well.

10:40AM Aggregating Predictions vs. Aggregating Features for Relational Classification [#14282]

Oliver Schulte and Kurt Routley, Simon Fraser University, Canada

Relational data classification is the problem of predicting a class label of a target entity given information about features of the entity, of the related entities, or neighbors, and of the links. This paper compares two fundamental approaches to relational classification: aggregating the features of entities related to a target instance, or aggregating the probabilistic predictions based on the features of each entity related to the target instance. Our experiments compare different relational classifiers on sports, financial, and movie data. We examine the strengths and weaknesses of both score and feature aggregation, both conceptually and empirically. The performance of a single aggregate operator (e.g., average) can vary widely across datasets, for both feature and score aggregation. Aggregate features can be adapted to a dataset by learning with a set of aggregate features. Used adaptively, aggregate features outperformed learning with a single fixed score aggregation operator. Since score aggregation is usually applied with a single fixed operator, this finding raises the challenge of adapting score aggregation to specific datasets.

11:00AM Ontology Learning with Complex Data Type for Web Service Clustering [#14931]

B. T. G. S. Kumara, Incheon Paik, K. R. C. Koswatte and Wuhui Chen, University of Aizu, Japan

Clustering Web services into functionally similar clusters is a very efficient approach to service discovery. A principal issue for clustering is computing the semantic similarity between services. Current approaches use similarity- distance measurement methods such as keyword, information-retrieval or ontology based methods. These approaches have problems that include discovering semantic characteristics, loss of semantic information and a shortage of high-quality ontologies. Further, current clustering approaches are considered only have simple data types in services' input and output. However, services that published on the web have input/ output parameter of complex data type. In this

research, we propose clustering approach that considers the simple type as well as complex data type in measuring the service similarity. We use hybrid term similarity method which we proposed in our previous work to measure the similarity. We capture the semantic pattern exist in complex data types and simple data type to improve ontology learning method. Experimental results show our clustering approach which use complex data type in measuring similarity works efficiently.

11:20AM Semantic clustering-based cross-domain recommendation [#14070]

Anil Kumar, Nitesh Kumar, Muzammil Hussain, Santanu Chaudhury and Sumeet Agarwal, Samsung Research Insititute (SRI) - Delhi, Noida, India; Department of Electrical Engineering, IIT Delhi, Delhi, India

Cross-domain recommendation systems exploit tags, textual descriptions or ratings available for items in one domain to recommend items in multiple domains. Handling unstructured/ unannotated item information is, however, a challenge. Topic modeling offer a popular method for deducing structure in such data corpora. In this paper, we introduce the concept of a common latent semantic space, spanning multiple domains, using topic modeling of semantic clustered vocabularies of distinct domains. The intuition here is to use explicitly-determined semantic relationships between non-identical, but possibly semantically equivalent, words in multiple domain vocabularies, in order to capture relationships across information obtained in distinct domains. The popular WordNet based ontology is used to measure semantic relatedness between textual words. The experimental results shows that there is a marked improvement in the precision of predicting user preferences for items in one domain when given the preferences in another domain.

11:40AM Distributed Evolutionary Approach To Data Clustering and Modeling [#14694]

Mustafa Hajeer, Dasgupta Dipankar, Alexander Semenov and Jari Veijalainen, University of Memphis, United States; University of Jyvaskyla, Finland

In this article we describe a framework (DEGA-Gen) for application of distributed genetic algorithms for detection of communities in networks. The framework proposes efficient way of encoding the network in the chromosomes, greatly optimizing the memory use and computations, resulting in a scalable framework. Different objective functions may be used for producing division of network into communities. The framework is implemented using open source implementation of MapReduce paradigm, Hadoop. We validate the framework by developing community detection algorithm, which uses modularity as measure of the division. Result of the algorithm is the network, partitioned into non-overlapping communities, in such a way, that network modularity is maximized. We apply the algorithm to well-known data sets, such as Zachary Karate club, bottlenose Dolphins network, College football dataset, and US political books dataset. Framework shows comparable results in achieved modularity; however, much less space is used for network representation in memory. Further, the framework is scalable and can deal with large graphs

Special Session: SIS'14 Session 4: Applications of Swarm Intelligence for Industrial Processes

Thursday, December 11, 10:20AM-12:00PM, Room: Curacao 3, Chair: Wei-Chang Yeh

10:20AM MAX-SAT Problem using Evolutionary Algorithms [#14212]

Hafiz Munsub Ali, David Mitchell and Daniel C. Lee, Simon Fraser University, Canada

MAX-SAT is a classic NP-hard optimization problem. Optimal solutions of such problems using budgeted resources (i.e., computation, time, memory, etc.) are not feasible. Many problems can be easily represented in, or reduced to, MAX-SAT, which has many applications. Because, all known exact algorithms for the problem require worst-case exponential time, evolutionary algorithms are useful for good quality solutions. We present the results of experimentally comparing the performance of a number of recently proposed evolutionary algorithms on MAX-SAT instances. These algorithms include Artificial Bee Colony (ABC) algorithm, Quantum Inspired Evolutionary Algorithm (QEA), Immune Quantum Evolutionary Algorithm (IQEA) Estimation of Distribution Algorithm (EDA), and randomized Monte Carlo (MC). The MAX-SAT problem falls in the Boolean domain and the ABC algorithm requires a similarity measure to handle the Boolean domain problem. In addition to comparing these algorithms, we experiment with the ABC algorithm five different similarity measures to indicate the better choice for MAX-SAT problems. Our experiments show that the ABC algorithm has better performance.

10:40AM A Generic Archive Technique for Enhancing the Niching Performance of Evolutionary Computation [#14216]

Zhang Yu-Hui, Gong Yue-Jiao, Chen Wei-Neng, Zhan Zhi-Hui and Zhang Jun, Sun Yat-sen University, China

The performance of a multimodal evolutionary algorithm is highly sensitive to the setting of population size. This paper introduces a generic archive technique to reduce the importance of properly setting the population size parameter. The proposed archive technique contains two components: subpopulation identification and convergence detection. The first component is used to identify subpopulations in a number of individuals while the second one is used to determine whether a subpopulation is converged. By using the two components, converged subpopulations are identified, and then, individuals in the converged subpopulations are stored in an external archive and re-initialized to search for other optima. We integrate the archive technique with several state-of-the-art PSO-based multimodal algorithms. Experiments are carried out on a recently proposed multimodal problem set to investigate the effect of the archive technique. The experimental results show that the proposed method can reduce the influence of the population size parameter and improve the performance of multimodal algorithms.

11:00AM Solving the S-system Model-based Genetic Network Using The Novel Hybrid Swarm Intelligence [#14141]

Wei-Chang Yeh and Chia-Ling Huang, National Tsing Hua University, Taiwan; Kainan University, Taiwan

The importance of any inferences that can be taken from underlying genetic networks of observed time-series data of gene expression patterns should not be overlooked. They are one of the largest topics within bioinformatics. The S- system model is one good choice for analyzing such genetic networks due to the fact that it can capture various dynamics. One problem this model faces is the fact that the number of S-system parameters is in proportion with the square of the number of genes. This is also the reasoning as to why the S-system model tends to be used on smaller scales. Its parameters are optimized by hybrid soft computing. Furthermore, it also uses the problem decomposition strategy to deal with the vast amount of problems a system might face. First of all the original problem is split into several smaller parts, which are then separately solved by the SSO. Afterwards, all of these separate solutions are merged together and used to solve the original problem along with the ABC. This shows the effectiveness of the SSO in solving such sub problems. Lastly, the SSO also utilizes the hybrid soft computing system, which infers the possibility of having S-systems on a larger scale.

11:20AM Changing Factor based Food Sources in ABC [#14723]

Tarun Kumar Sharma, Millie Pant and Ferrante Neri, IIT Roorkee, India; Centre for Computational Intelligence, School of Computer Science and Informatics, De Montfort University, The Gateway, Leicester LE1 9BH England, United Kingdom, United Kingdom

The present study, proposes an optimization algorithm for solving the continuous global optimization problems. The basic framework selected for modeling the algorithm is Artificial Bee Colony (ABC). The proposed variant is called ABC with changing factor or CF-ABC. The proposed CF-ABC tries to maintain a tradeoff between exploration and exploitation so as to obtain reasonably good results. The proposed algorithm is implemented on the six benchmark functions and four engineering design problems. Simulated results illustrate the efficiency of the CF-ABC in terms of convergence speed and mean value

11:40AM A New K-Harmonic Means based Simplified Swarm Optimization for Data Mining [#15044]

Chia-Ling Huang and Wei-Chang Yeh, Kainan University, Taiwan; National Tsing Hua University, Taiwan

In this paper, we have developed an efficient hybrid data mining approach. The proposed data mining approach called gSSO is a modification introduced to simplified swarm optimization and based on K-harmonic means (KHM) algorithm to help the KHM algorithm escape from local optimum. To test its solution quality, the proposed gSSO is compared with other recently introduced KHM-based Algorithms in iris dataset in the UCI database. The experimental results conclude that the proposed gSSO outperforms other algorithms in the solution quality of all aspects (AVG, MIN, MAX, and STDEV) in space and stability.

CIASG'14 Session 4: Distribution Systems

Thursday, December 11, 10:20AM-12:00PM, Room: Curacao 4, Chair: Zita Vale

10:20AM Pulsed Power Network Based on Decentralized Intelligence for Reliable and Low Loss Electrical Power Distribution [#14770]

Hisayoshi Sugiyama, Osaka City University, Japan

Pulsed power network is proposed for reliable and low loss electrical power distribution among various type of power sources and consumers. The proposed scheme is a derivative of power packet network so far investigated that has affinity with dispersion type power sources and has manageability of energy coloring in the process of power distribution. In addition to these advantages, the proposed scheme has system reliability and low loss property because of its intelligent operation performed by individual nodes and direct relaying by power routers. In the proposed scheme, power transmission is decomposed into a series of pulses placed at specified power slots in continuous time frames that are synchronized over the network. The power slots are pre-reserved based on information exchanges among neighboring nodes following inherent protocol of the proposed scheme. Because of this power slot reservation based on decentralized intelligence, power pulses are directly transmitted from various power sources to consumers with low power dissipation even though a partial failure occurs in the network. The network performance of the proposed scheme is simulated to confirm the protocol for the power slot reservation.

10:40AM Distributed Volt/Var Control in Unbalanced Distribution Systems with Distributed Generation [#14641]

Ahmad Reza Malekpour, Anil Pahwa and Balasubramaniam Natarajan, Kansas State University, United States

Future power distribution systems are expected to have large number of scale smart measuring devices and distributed generation (DG) units which would require real- time network management. Integration of single-phase DG and advanced metering infrastructure (AMI) technologies will add further complexity to the power distribution system which is inherently unbalanced. In order to alleviate the negative impacts associated with the integration of DG, transformation from passive to active control methods is imperative. If properly regulated, DGs could provide voltage and reactive power support and mitigate the volt/var problem. This paper presents a distributed algorithm to provide voltage and reactive power support and minimize power losses in unbalanced power distribution systems. Three- phase volt/var control problem is formulated and active/reactive powers of DGs are determined in a distributed fashion by decomposing the overall power distribution system into zonal sub-systems. The performance is validated by applying the proposed method to the modified IEEE 37 node test feeder.

11:00AM A Uniform Implementation Scheme for Evolutionary Optimization Algorithms and the Experimental Implementation of an ACO Based MPPT for PV Systems under Partial Shading [#14062]

Lian lian Jiang and Douglas L. Maskell, School of Computer Engineering, Nanyang Technological University, Singapore

Partial shading is one of the important issues in maximum power point (MPP) tracking (MPPT) for photovoltaic (PV) systems. Multiple peaks on the power- voltage (P-V) curve under partial shading conditions can result in a conventional MPPT technique failing to track the global MPP, thus causing large power losses. Whereas, evolutionary optimization algorithms exhibit many advantages when applying them to MPPT, such as, the ability to track the global MPP, no requirement for irradiance or temperature sensors, system independence without knowledge of the PV system in advance, reduced current/voltage sensors compared to conventional methods when applied to PV systems with a distributed MPPT structure. This paper presents a uniform scheme for implementing evolutionary algorithms into the MPPT under various PV array structures. The effectiveness of the proposed method is verified both by simulations and experimental setup. The implementation of the ant colony optimization (ACO) based MPPT is conducted using this uniform scheme. In addition, a strategy to accelerate the convergence speed, which is important in systems with partial shading caused by rapid irradiance change, is also discussed.

Thursday, December 11, 10:20AM-12:00PM

SSCI DC Session 4

Thursday, December 11, 10:20AM-12:00PM, Room: Curacao 7, Chair: Xiaorong Zhang

10:20AM Safe and Secure Networked Control Systems [#14414]

Arman Sargolzaei, Department of Electrical and Computer Engineering, Florida International University, United States

This PhD dissertation will study and analyzes of different kind of attack on the control system and then aim to drive the general model of the system under attacks. We will improve current procedure for controllers to be more robust in front of specific attack called time-delay switch (TDS) attack. Furthermore for those applications that changing or upgrading the controllers are expensive or hard, we are going to detect attack and inform the control and monitoring center and divert the system to open loop control. Also we will use some sort of attack resistant hardware implementation to protect the systems. It should also be noted that if in the course of the research, we can find better idea that makes our system more robust and attack resistant; the study will be modernized accordingly.

10:40AM Neuroscience-Inspired Dynamic Architectures [#14114]

Catherine Schuman, University of Tennessee, Knoxville, United States

A framework for neuroscience-inspired dynamic architectures (NIDA) and an associated design method based on evolutionary optimization are described. Two major components are discussed: the recognition and reuse of useful substructures and the inclusion of affective systems. Potential impacts of the work on the fields of neuroscience-inspired computing and neuromorphic hardware are discussed.

11:00AM Active Fault Detection in Dynamic Systems [#14214]

Jan Skach, University of West Bohemia, Czech Republic

The goal of this summary is to inform the reader about the background of my Ph.D. thesis. First, the topic will be introduced together with literature survey. Then, the objectives of the research and the research questions will be defined. Finally, the research methodology will be proposed and preliminary results will be presented.

11:20AM Hybrid Approach of Clustered-SVM for Rational Clinical Features in Early Diagnosis of Heart Disease [#14646]

Noreen Kausar and Sellapan Palaniappan, Malaysia University of Science and Technology (MUST) Selangor, Malaysia, Malaysia

Enhancing the detection rate of heart anomalies for clinical diagnosis is essential yet complicated because of irrelevant patients' detail and slow systematic processing. In this research, our aim is to optimize classification process of abnormal and normal patients. For this purpose, we proposed a Clustered-SVM approach which can be tuned with help of associated parameters. Support Vector Machines (SVM) has good generalization ability which can even detect unseen data and K-means clustering groups the similar data in to different cluster which are separately classified and increased overall detection accuracy of the system. Results performed have outperformed earlier data mining approaches because of its optimization with parameters and selection of sensitive clinical attributes on the basis of weightage criteria using Fisher Score. Principal Component Analysis reduces the data dimension by extracting few attributes having maximum portion of total variance. In future, this approach can be used for multi-classification of different medical datasets.

11:40AM Adaptive Critic Designs Based Intelligent Controller for Power Systems [#14188]

Yufei Tang, University of Rhode Island, United States

In traditional power system stability controller design, such as power system stabilizers (PSSs), a linearized power system model near the operating point is used. However, we need to relax this assumption as modern power systems become more and more nonlinear, time-variant and uncertain with the continuously increased deployment of flexible alternating current transmission system (FACTS), renewable energy, and electric vehicles (EVs). As system state parameters and operating conditions are changing, power system modeling becomes a very complex and time-consuming task for the electrical engineers and operators.In such situation, two major drawbacks of the traditional control methods are the lack of robustness and online learning capability. Among many enabling technologies, the latest research results from both the power and energy community and the computational intelligence (CI) community have demonstrated that CI research could provide key technical innovations to solve this challenging problem.

Thursday, December 11, 1:30PM-3:10PM

CICA'14 Session 2: Fuzzy Systems and Control with Applications

Thursday, December 11, 1:30PM-3:10PM, Room: Antigua 2, Chair: Li-Xin Wang and Tadanari Taniguchi

1:30PM Speculative Dynamical Systems: How Technical Trading Rules Determine Price Dynamics [#14577]

Li-Xin Wang, Xian Jiaotong University, China

We use fuzzy systems theory to convert the technical trading rules commonly used by stock practitioners into excess demand functions which are then used to drive the price dynamics. First, we define fuzzy sets to represent the fuzzy terms in the technical trading rules; second, we translate each technical trading heuristic into a group of fuzzy IF-THEN rules; third, we combine the fuzzy IF-THEN rules in a group into a fuzzy system; and finally, the linear combination of these fuzzy systems is used as the excess demand function in the price dynamic equation. We transform moving average rules, support and resistance rules, and trend line rules into fuzzy systems. Simulation results show that the price dynamics driven by these technical trading rules are complex and chaotic, and some common phenomena in real stock prices such as jumps, trending and self-fulfilling appear naturally.

1:50PM Adaptive Dynamic Output Feedback Control of Takagi-Sugeno Fuzzy Systems with Immeasurable Premise Variables and Disturbance [#14898]

Balaje Thumati and Al Salour, The Boeing Company, United States

Unlike in the literature, premise variables of the Takagi-Sugeno (TS) fuzzy system is assumed to be not measurable, and an adaptive output feedback control law is designed for the given system. Additionally, the system under investigation is considered to be subjected with both parameteric uncertainty and disturbance. Unlike other control designs, the bound on parameter uncertainty term is relaxed. Further, the adaptive control law utilizes estimated premise variables and online approximator. Note only one approximator is used to estimate both the parameter uncertainty and disturbance. Therefore, the proposed control design is simplified. This control design is guaranteed to render a stable closed loop TS fuzzy system. Detailed analytical results using Lyapunov theory are presented to guarantee stability. Finally, a simulation example is used to illustrate the performance of the proposed adaptive output feedback control law.

2:10PM Optimal Robust Control for Generalized Fuzzy Dynamical Systems: A Novel Use on Fuzzy Uncertainties [#14613]

Jin Huang, Jiaguang Sun, Xibin Zhao and Ming Gu, Tsinghua University, China

A novel approach for optimal robust control of a class of generalized fuzzy dynamical systems is proposed. This is a novel use of fuzzy uncertainty in doing dynamical system control.The system may have nonlinear nominal terms and the other terms with uncertainty, including unknown parameters and input disturbances. The Fuzzy sets theory is creatively employed in presenting the system parameter and input uncertainty, and then the control structure is deterministic (versus IF-THEN rule-based as is typical in Mamdani-type fuzzy control). The desired controlled system performance is also deterministic, with guaranteed performances of uniform boundedness and uniform ultimate boundedness. Fuzzy informations on the uncertainties are used in searching optimal control gain under a proposed LQG-like quadratic cost index. The control gain design problem is formulated as a constrained optimization problem with the solution be proved to be always existed and unique. Systematic procedure is summarized for such control design.

2:30PM SOFC for TS fuzzy systems: Less Conservative and Local Stabilization Conditions [#14806]

Leonardo Mozelli, Fernando Souza and Eduardo Mendes, UFSJ, Brazil; UFMG, Brazil

The static output feedback control (SOFC) for TS fuzzy systems is addressed in this paper. Based on Lyapunov theory the proposed methods are formulated as linear matrix inequalities (LMIs). To obtain less conservative conditions the properties of the time-derivative of the membership functions are explored. This new methodology is able to design the SOFC with higher H-infinity attenuation level. Moreover, the method is extended to local stabilization using the concepts of invariant ellipsoids and regions of stability. This local conditions overcome some difficulties associated with the estimation of bounds for the time- derivative of the membership functions. Simulation and numeric examples are given to illustrate the merits of the proposed approaches.

2:50PM Quadrotor Control Using Dynamic Feedback Linearization Based on Piecewise Bilinear Models [#14542]

Tadanari Taniguchi, Luka Eciolaza and Michio Sugeno, Tokai University, Japan; European Centre for Soft Computing, Spain

This paper proposes a tracking controller for a four rotors helicopter robot using dynamic feedback linearization based on piecewise bilinear (PB) models. The approximated model is fully parametric. Input-output (I/O) dynamic feedback linearization is applied to stabilize PB control system. Although the controller is simpler than the conventional I/O feedback linearization controller, the control performance based on PB model is the same as the conventional one. Examples are shown to confirm the feasibility of our proposals by computer simulations.

Special Session: ICES'14 Session 2: Bio-inspired Computation for the Engineering of Materials and Physical Devices

Thursday, December 11, 1:30PM-3:10PM, Room: Antigua 3, Chair: Lukas Sekanina

1:30PM Evolution-In-Materio: Solving Bin Packing Problems Using Materials [#14021]

Maktuba Mohid, Julian Miller, Simon Harding, Gunnar Tufte, Odd Rune, Kieran Massey and Mike Petty, University of York, United Kingdom; Norwegian University of Science and Technology, Norway; Durham University, United Kingdom

Evolution-in-materio (EIM) is a form of intrinsic evolution in which evolutionary algorithms are allowed to manipulate physical variables that are applied to materials. This method aims to configure materials so that they solve computational problems without requiring a detailed understanding of the properties of the materials. The concept gained attention through the work of Adrian Thompson who in 1996 showed that evolution could be used to design circuits in FPGAS that exploited the physical properties of the underlying silicon [21]. In this paper, we show that using a purpose-built hardware platform called Mecobo, we can solve computational problems by evolving voltages, signals and the way they are applied to a microelectrode array with a chamber containing single-walled carbon nanotubes and a poly- mer. Here we demonstrate for the first time that this methodology can be applied to the well-known computational problem of bin packing. Results on benchmark problems show that the technique can obtain results reasonably close to the known global optima. This suggests that EIM is a promising method for configuring materials to carry out useful computation.

1:50PM Evolution-In-Materio: A Frequency Classifier Using Materials [#14035]

Maktuba Mohid, Julian Miller, Simon Harding, Gunnar Tufte, Odd Rune, Kieran Massey and Mike Petty, University of York, United Kingdom; Norwegian University of Science and Technology, Norway; Durham University, United Kingdom

Evolution-in-materio (EIM) is a method that uses artificial evolution to exploit properties of materials to solve computational problems without requiring a detailed understanding of such properties. In this paper, we describe experiments using a purpose-built EIM platform called Mecobo to classify whether an applied square wave signal is above or below a userdefined threshold. This is the first demonstration that electrical configurations of materials (carbon nanotubes and a polymer) can be evolved to act as frequency classifiers.

2:10PM Comparison and Evaluation of Signal Representations for a Carbon Nanotube Computational Device [#14872]

Odd Rune Lykkebo and Gunnar Tufte, Norwegian University of Science and Technology, Norway

Evolution in Materio (EIM) exploits properties of physical systems for computation. Evolution manipulates physical processes by stimulating materials by applying some sort of configuration signal. For materials such as liquid crystal and carbon nanotubes the properties of configuration data is rather open. In this work we investigate what kind of configuration data that most likely will be favourable for a carbon nanotube based device. An experimental approach targeting graph colouring is used to test three different types of signal representation: static voltages, square waves and a mixed signal representation. The results show that all signal representation was capable of producing a working device. In the experiments square wave representation produced the best result.

2:30PM Practical issues for configuring carbon nanotube composite materials for computation [#14584]

Kester Clegg, Julian Miller, Kieran Massey and Mike Petty, University of York, United Kingdom; Durham University, United Kingdom

We report our experiences of attempting to configure a single-walled carbon nanotube (SWCNT) / polymer composite material deposited on a micro-electrode array to carry out two classification tasks based on data sets from University of California, Irvine (UCI). The tasks are attempted using hybrid "in materio" computation: a technique that uses machine search to configure materials for computation. The SWCNT / polymer composite materials are configured using static voltages so that voltage output readings from the material predict which class the data samples belong to. Our initial results suggest that the configured SWCNT materials are able to achieve good levels of predictive accuracy. However, we are in no doubt that the time and effort required to configure the samples could be improved. The parameter space when dealing with physical systems is large, often unknown and slow to test, making progress in this field difficult. Our purpose is not demonstrate the accuracy of configured samples to perform a certain classification, but to showcase the potential of configuring very small material samples with analogue voltages to solve stand alone computation tasks. Such SWCNT devices would be cheap to manufacture and require only low precision assembly, yet if correctly configured would be able to function as multipurpose, single task computational devices.

2:50PM In-Situ Evolution of an Antenna Array with Hardware Fault Recovery [#14648]

Jonathan Becker, Jason Lohn and Derek Linden, Carnegie Mellon University, United States; X5 Systems Inc., United States

We present a system for performing evolution directly on an antenna array. The system is composed of three programmable antennas and runs in an antenna chamber under the control of an evolutionary algorithm. Fitness is measured in two ways. First, we assess how well the antenna array radiation pattern matches a desired null-steering pattern, which changes over time. Second, we measure how well the algorithms are able to reconfigure the array's hardware settings to recover from a localized hardware fault within the array. We describe the \textit{in-situ} evolution hardware system, the algorithms used, and the experimental setup. The results show that two types of genetic algorithms and the simulated annealing algorithm were able to adapt, \textit{in-situ}, the antenna array's output pattern to a target nulling pattern. We also show that the evolutionary algorithms were able to reconfigure the array to re-steer nulls correctly following the introduction of localized hardware faults into the array. This provides a proof-of-concept for the idea of self-healing antenna arrays.

CIBIM'14 Session 2: Adaptive Biometric Systems and Biometric Fusion

Thursday, December 11, 1:30PM-3:10PM, Room: Antigua 4, Chair: Eric Granger

1:30PM Differential Evolution Based Score Level Fusion For Multi-modal Biometric Systems [#14331]

Satrajit Mukherjee, Kunal Pal, Bodhisattwa Prasad Majumder, Chiranjib Saha, B. K. Panigrahi and Sanjoy Das, Electronics and Tele-communication Engineering, Jadavpur University, Kolkata-32, India; Dept. of Electrical Engineering, Indian Institute of Technology, Delhi, India; Kansas State University, United States

The purpose of a multimodal biometric system is to construct a robust classifier of genuine and imposter candidates by extracting useful information from several biometric sources which fail to perform well in identification or verification as individual biometric systems. Amongst different levels of information fusion, very few approaches exist in literature exploring score level fusion. In this paper, we propose a novel adaptive weight and exponent based function mapping the matching scores from different biometric sources into a single amalgamated matching score to be used by a classifier for further decision making. Differential Evolution (DE) has been employed to adjust these tunable parameters with the objective being the minimization of the overlapping area of the frequency distributions of genuine and imposter scores in the fused score space, which are estimated by Gaussian kernel density method to achieve higher level of accuracy. Experimental results show that, the proposed method outperforms the conventional score-level fusion rules (sum, product, tanh, exponential) when tested on two databases of 4 modalities (fingerprint, iris, left ear and right ear) of 200 and 516 users and thus confirms the effectiveness of score level fusion. The preliminary results provide adequate motivation towards future research in the line of the application of meta-heuristics in score level fusion.

1:50PM Offline Signature-Based Fuzzy Vault: A Review and New Results [#14528]

George Eskander, Robert Sabourin and Eric Granger, ETS, Quebec university, Canada

An offline signature-based fuzzy vault (OSFV) is a bio-cryptographic implementation that uses handwritten signature images as biometrics instead of traditional passwords to secure private cryptographic keys. Having a reliable OSFV implementation is the first step towards automating financial and legal authentication processes, as it provides greater security of sensitive documents by means of the embedded handwritten signatures. The authors have recently proposed the first OSFV implementation, where a machine learning approach based on the dissimilarity representation concept is employed to select a reliable feature representation adapted for the fuzzy vault scheme. In this paper, some variants of this system are proposed for enhanced accuracy and security. In particular, a new method that adapts user key size is presented. Performance of proposed methods are compared using the Brazilian PUCPR and GPDS signature databases and results indicate that the key-size adap- tation method achieves a good compromise between security and accuracy. As the average system entropy is increased from 45-bits to about 51-bits, the AER (average error rate) is decreased by about 21%.

2:10PM TARC: A Novel Score Fusion Scheme for Multimodal Biometric Systems [#14737]

Kamlesh Tiwari, Aditya Nigam and Phalguni Gupta, Indian Institute of Technology Kanpur, India

This paper proposes a score level fusion scheme for a multimodal biometric system. Accuracy and reliability of a system are improved by utilizing more than one samples. Every matching of a biometric sample with its corresponding biometric sample in the database produces a matching score. There multiple scores from different biometric samples are fused for further utilization. It proposes an efficient threshold alignment and range compression scheme for score normalization. It uses statistical properties of biometric score distribution. The proposed scheme has been tested over a multimodal database which is constructed by using three publicly available database viz. FVC2006-DB2-A of fingerprint, CASIA-V4-Lamp of iris and PolyU of palmprint. Experimental results have shown the significant performance boost.

2:30PM Efficient Adaptive Face Recognition Systems Based on Capture Conditions [#14992]

Christophe Pagano, Eric Granger, Robert Sabourin, Ajita Rattani, Gian-Luca Marcialis and Fabio Roli, Laboratoire d'imagerie, de vision et d'intelligence artificielle, Ecole de technologie superieure, Universite du Quebec, Montreal, Canada; Pattern Recognition and Applications Group Dept. of Electrical and Electronic Engineering University of Cagliari, Cagliari, Italy

In many face recognition (FR) applications, changing capture conditions lead to divergence between facial models stored during enrollment and faces captured during operations. Moreover, it is often costly or infeasible to capture several high quality reference samples a priori to design representative facial models. Although self-updating models using high-confidence face captures appear promising, they raise several challenges when capture conditions change. In particular, face models of individuals may be corrupted by misclassified input captures, and their growth may require pruning to bound system complexity over time. This paper presents a system for self-update of facial models that exploits changes in capture conditions to assure the relevance of templates and to limit the growth of template galleries. The set of reference templates (facial model) of an individual is only updated to include new faces that are captured under significantly different conditions. In a particular implementation of this system, illumination changes are detected in order to select face captures from bio-login to be stored in a gallery. Face captures from a built-in still or video camera are taken at periodic intervals to authenticate the user having accessed a secured computer or network. Experimental results produced with the DIEE dataset show that the proposed system provides a comparable level of performance to the FR system that self-updates the gallery on all high-confidence face captures, but with significantly lower complexity, i.e., number of templates per individual.

2:50PM A New Wrist Vein Biometric System [#15093]

Abhijit Das, Umapada Pal, Miguel Ferrer Ballaster and Michael Blumenstein, GRIFFITH UNIVERSITY, Australia; ISI, India; Universidad de Las Palmas de Gran Canaria, Spain

In this piece of work a wrist vein pattern recognition and verification system is proposed. Here the wrist vein images from the PUT database were used, which were acquired in visible spectrum. The vein image only highlights the vein pattern area so, segmentation was not required. Since the wrist's veins are not prominent, image enhancement was performed. An Adaptive Histogram Equalization and Discrete Meyer Wavelet were used to enhance the vessel patterns. For feature extraction, the vein pattern is characterized with Dense Local Binary Pattern (D-LBP). D-LBP patch descriptors of each training image are used to form a bag of features, which was used to produce the training model. Support Vector Machines (SVMs) were used for classification. An encouraging Equal Error Rate (EER) of 0.79% was achieved in our experiments.

MCDM'14 Session 2: Algorithms II

Thursday, December 11, 1:30PM-3:10PM, Room: Bonaire 1, Chair: Juergen Branke and Piero Bonissone

1:30PM Clustering Decision Makers with respect to similarity of views [#14136]

Edward Abel, Ludmil Mikhailov and John Keane, Manchester School of Computer Science, United Kingdom; Manchester Business School, United Kingdom

Within a large group of decision makers, varying amounts of both conflicting and harmonious views will be prevalent within the group, but obscured due to group size. When the number of Decision Makers is large, utilizing clustering during the process of aggregation of their views should aid both knowledge discovery - about the group's conflict and consensus - as well as helping to streamline the aggregation process to reach a group consensus. We conjecture that this can be realized by using the similarity of views of a large group of decision makers to define clusters of analogous opinions. From each cluster of decision makers, a representation of the views of its members can then be sought. This set of representations can then be utilized for aggregation to help reach a final whole group consensus.

1:50PM Multi-Genomic Algorithms [#14313]

Mathias Ngo and Raphael Labayrade, Ecole Nationale des Travaux Publics de l'Etat, France

The first step of any optimization process consists in choosing the Decision Variables (DV) and its relationships that model the problem, system or object to optimize. Many problems cannot be represented by a unique, exhaustive model which would ensure a global best result: in those cases, the model (DV and relationships) choice matters on the quality of the results. In this paper, we tackle this problem by proposing algorithms handling multiple models simultaneously and altering the very nature of the population. These algorithms are designed in the context of Genetic Algorithms (GA) which represents a model by a unique genome. Modifying the model and using various models simultaneously leads to the coexistence of individiuals with chromosomes being instances of different genomes resulting in multi-genomic populations. We therefore introduce Multi-Genomic Algorithms (MGA) to handle such populations,allowing them to reproduce, mutate, and evolve. As a proof of concept, we use two implementations of MGA which are applied to a simple 2D shape optimization. The results of these first experimentations show immediate benefits of MGA (including computational speed-ups and identification of the model(s) best fitted to the problem) and raise some challenges to tackle in the future.

2:10PM A Perceptual Fuzzy Neural Model [#14663]

John Rickard and Janet Aisbett, Till Capital Ltd., United States; The University of Newcastle, Australia

We introduce a fuzzy neural model which is more intuitive and general than the traditional weighted sum/squashing function neuron model. Positively and negatively causal inputs are separately aggregated using operators that are selected to suit the particular application. The

aggregations are then combined using a simple arithmetic transformation. We outline the computational process when inputs and importance weights are vocabulary words modeled as interval type-2 fuzzy sets, and illustrate on predictions of gold price changes.

2:30PM Multicriteria Approaches for Predictive Model Generation: A Comparative Experimental Study [#14730]

Bassma Al-Jubouri and Bogdan Gabrys, Bournemouth University, United Kingdom

This study investigates the evaluation of machine learning models based on multiple criteria. The criteria included are: predictive model accuracy, model complexity, and algorithmic complexity (related to the learning/adaptation algorithm and prediction delivery) captured by monitoring the execution time. Furthermore, it compares the models generated from optimising the criteria using two approaches. The first approach is a scalarized Multi Objective Optimisation (MOO), where the models are generated from optimising a single cost function that combines the criteria. On the other hand the second approach uses a pareto-based MOO to trade-off the three criteria and to generate a set of non-dominated models. This study shows that defining universal measures for the three criteria is not always feasible. Furthermore, it was shown that, the models generated from pareto-based MOO approach can be more accurate and more diverse than the models generated from scalarized MOO approach.

2:50PM PICEA-g Using An Enhanced Fitness Assignment Method [#14535]

ZhiChao Shi, Rui Wang and Tao Zhang, National University of Defense Technology, China

The preference-inspired co-evolutionary algorithm using goal vectors (PICEA-g) has been demonstrated to perform well on multi-objective problems. The superiority of PICEA-g originates from the smart fitness assignment, that is, candidate solutions are co-evolved with goal vectors along the search. In this study, we identify a limitation of this fitness assignment method, and propose an enhanced fitness assignment method which considers both the performance of goal vectors and the Pareto dominance rank on the fitness calculation of candidate solutions. Experimental results show that PICEA-g with the enhanced approach is effective, especially for bi-objective problems.

RiiSS'14 Session 2: Intelligent Robots

Thursday, December 11, 1:30PM-3:10PM, Room: Bonaire 2, Chair: Janos Botzheim

1:30PM An Adaptive Force Reflective Teleoperation Control using Online Environment Impedance Estimation [#14030]

Faezeh Heydari Khabbaz, Andrew Goldenberg and James Drake, University of Toronto, Canada; Hospital for Sick Children - University of Toronto, Canada

This paper proposes a new adaptive method for two-channel bilateral teleoperation systems control; the control method consists of adaptive force feedback and motion command scaling factors that ensure stable teleoperation with maximum achievable transparency at every moment of operation. The method is based on the integration of the real time estimation of the robot's environment impedance with the adaptive force and motion scaling factors generator. This paper formulates the adaptive scaling factors for stable teleoperation based on the impedance models of master, slave and estimated impedance of the environment. Feasibility and accuracy of an online environment impedance estimation method are analyzed through simulations and experiments. Then the proposed adaptive bilateral control method is verified through simulation studies. Results show stable interactions with maximum transparency for the simulated teleoperation system.

1:50PM Development and Performance Comparison of Extended Kalman Filter and Particle Filter for Self-Reconfigurable Mobile Robots [#14041]

Peter Won, Mohammad Biglarbegian and William Melek, Postdoc, Canada; Assistant Professor, Canada; Associate Professor, Canada

In this paper we develop two filters, extended Kalman filter (EKF) and particle filter (PF), for autonomous docking of mobile robots and compare the performances of the two filers in terms of accuracy. Robots are equipped with IR emitters/receivers and encoders, and their data is used to estimate the distance and orientation of robots, which is needed for docking. The two state estimation methods are compared in simulations under different conditions. Simulation results demonstrate that the estimation accuracy of the EKF is higher than PF when the initial state is correctly estimated. However, when the initial state is not estimated correctly, the state estimation of EKF does not converge to the true value. On the other hand, PF state estimation successfully converges to the true value and the error is more consistent. The result of this work can help researchers and practitioners to design and use proper filters for docking applications.

2:10PM Autonomous Motion Primitive Segmentation of Actions for Incremental Imitative Learning of Humanoid [#14309]

Farhan Dawood and Chu Kiong Loo, University of Malaya, Malaysia

During imitation learning or learning by demonstration/observation, a crucial element of conception involves segmenting the continuous flow of motion into simpler units - motion primitives - by identifying the boundaries of an action. Secondly, in realistic environment the robot must be able to learn the observed motion patterns incrementally in a stable adaptive manner. In this paper, we propose an on-line and unsupervised motion segmentation method rendering the robot to learn actions by observing the patterns performed by other partner through Incremental Slow Feature Analysis. The segmentation model directly operates on the images acquired from the robot's vision sensor (camera) without requiring any kinematic model of the demonstrator. After segmentation, the spatio-temporal motion sequences are learned incrementally through Topological Gaussian Adaptive Resonance Hidden Markov Model. The learning model dynamically generates the topological structure in a self-organizing and self-stabilizing manner.

2:30PM A Computational Approach to Parameter Identification of Spatially Distributed Nonlinear Systems with Unknown Initial Conditions [#15070]

Josip Kasac, Vladimir Milic, Josip Stepanic and Gyula Mester, University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Croatia; Obuda University, Donat Banki Faculty of Mechanical and Safety Engineering, Doctoral School of Safety and Security Sciences, Hungary

In this paper, a high-precision algorithm for parameter identification of nonlinear multivariable dynamic systems is proposed. The proposed computational approach is based on the following assumptions: a) system is nonlinearly parameterized by a vector of unknown system parameters; b) only partial measurement of system state is available; c) there are no state observers; d) initial conditions are unknown except for measurable system states. The identification problem is formulated as a continuous dynamic optimization problem which is discretized by higher-order Adams method and numerically solved by a backward-in-time recurrent algorithm which is similar to the backpropagation-through-time (BPTT) algorithm. The proposed algorithm is especially effective for identification of homogenous spatially distributed nonlinear systems what is demonstrated on the parameter identifi64257;cation of a multi-degree-of-freedom torsional system with nonlinearly parameterized elastic forces, unknown initial velocities and positions measurement only.

2:50PM Multi-Robots Coverage Approach [#15086]

Ryad Chellali and Khelifa Baizid, Istituto Italiano di Technologia, Italy; University of Cassino and Southern Lazio, Italy

In this paper we present a full and effective system allowing the deployment of N semi-autonomous robots in order to cover a given area for video surveillance and search purposes. The coverage problem is solved through a new technique based on the exploitation of Voronoi tessellations. To supervise a given area, a set of viewpoints are extracted, then visited by a group of mobile rover. Robots paths are calculated by resorting a sales-man problem through Multi-objective Genetic Algorithms. In the running phase, robots deal with both motion and sensors uncertainties while performing the pre-established paths. Results of indoor scenario are given.

CIVTS'14 Session 2

Thursday, December 11, 1:30PM-3:10PM, Room: Bonaire 3, Chair: Justin Dauwels, Dipti Srinivasan and Ana Bazzan

1:30PM Dynamic Ridesharing with Intermediate Locations [#14489]

Kamel Aissat and Ammar Oulamara, University of Lorraine - LORIA. Nancy, France; University of Lorraine. Metz, France

Ridesharing is address to people that want to intelligently ride in order to save money and protect environment. The idea is based on a better use of private car. More precisely, it aims to bring together individuals that share, even partially, a trip. In the recurring ridesharing problem, when an offer is matched with a demand, the driver picks-up the rider at his starting location, drops him off at his ending location and continues to his target location. This approach lack of flexibility and misses some possible matchings. In this paper, we propose a new ridesharing approach in which a driver and a rider accept to meet in an intermediate starting location and to separate in another intermediate ending location. This allows to reduce both the driver's detour and the total travel cost. We propose exact and heuristic methods to compute meeting locations that minimize the total travel cost of the driver and the rider. We analyze their empirical performance on a set of real road networks consisting of up to 3,5 million nodes and 8,7 million edges. Our experimental analysis shows that our heuristics provide efficient performances within short CPU times and improves the recurring ridesharing approach.

1:50PM An Evolutionary Approach to Traffic Assignment [#14504]

Ana Bazzan, Daniel Cagara and Bjoern Scheuermann, UFRGS, Brazil; Humboldt University of Berlin, Germany

Traffic assignment is an important stage in traffic modeling. Most of the existing approaches are based on finding an approximate solution to the user equilibrium or to the system optimum, which can be computationally expensive. In this paper we use a genetic algorithm to compute an approximate solution (routes for the trips) that seeks to minimize the average travel time. To illustrate this approach, a non-trivial network is used, departing from binary route choice scenarios. Our result shows that the proposed approach is able to find low travel times, without the need of recomputing shortest paths iteratively.

2:10PM Car relocation for carsharing service: Comparison of CPLEX and Greedy Search [#15079]

Rabih Zakaria, Mohammad Dib, Laurent Moalic and Alexandre Caminada, Universite de technologie Belfort-Montbeliard, France; GDF Suez, France

In this paper, we present two approaches to solve the relocation problem in one-way carsharing system. We start by formulating the problem as an Integer Linear Programming Model. Then using mobility data collected from an operational carsharing system, we built demands matrices that will be used as input data for our solver. We notice that the time needed to solve the ILP using an exact solver increases dramatically when we increase the number of employees involved in the relocation process and when the system gets bigger. To cope with this problem, we develop a greedy algorithm in order to solve the relocation problem in a faster time. Our algorithm takes one second to solve the relocation problem in worst cases; also, we evaluated the robustness of the two approaches with stochastic input data using different numbers of employees.

2:30PM Evolving the Topology of Subway Networks using Genetic Algorithms [#14541]

Ana L. C. Bazzan and Silvio R. Dahmen, UFRGS, Brazil

EExisting public transportation networks are usually regarded as being static with respect to their topology. However, in fast growing cities, new lines are added, sometimes focussing only on the demand, without regard to overall efficiency of the system. In this work we propose the application of techniques from evolutionary computation. The aim here is to improve the efficiency of public transportation networks by altering the topology of links. We apply this approach to the particular case of the subway network of S. Paulo, Brazil.

2:50PM Driver Distraction Detection By In-Vehicle Signal Processing [#14068]

Seongsu Im, Cheolha Lee, Seokyoul Yang, Jinhak Kim and Byungyong You, Hyundai Motor Company, Korea (South)

Driver distraction is one of the major causes of vehicle accidents. Many people have researched methods for reducing distraction of drivers and helping them to drive safely. Many studies have concerned products that monitor the state of drivers directly or indirectly and warn them of risk. In many previous studies, test subjects were forced to drive normally and inattentively to find the distinct feature patterns. However, the problem is that each driver can have different patterns in normal and abnormal driving. Moreover, in real driving conditions, they do not behave inattentively on purpose, and thus the patterns may not be replicated. In this paper, we present algorithms and experimental results that detect distraction by using in-vehicle signals without planned distraction. By using two kinds of machine learning scheme--unsupervised learning and supervised learning together--, normal and distracted driving features can be classified in real driving situation.

CIES'14 Session 2: Machines and Micro-machines

Thursday, December 11, 1:30PM-3:10PM, Room: Bonaire 4, Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse

1:30PM Reliable Condition Monitoring of an Induction Motor using a Genetic Algorithm based Method [#14807]

Jang Won-Chul, Hung Nguyen, Myeongsu Kang, JaeYoung Kim and Jong-Myon Kim, University of Ulsan, Korea, Republic of; Le Quy Don University, Viet Nam

Condition monitoring is a vital task in the maintenance of industry machines. This paper proposes a reliable condition monitoring method using a genetic algorithm (GA) which selects the most discriminate features by taking a transformation matrix. Experimental results show that the features selected by the GA outperforms original and randomly selected features using the same k- nearest neighbor (k-NN) classifier in terms of convergence rate, the number of features, and classification accuracy. The GA-based feature selection method improves the classification accuracy from 3% to 100% and from 30% to 100% over the original and randomly selected features, respectively.

1:50PM Performance Comparison of classifiers in the detection of Short Circuit Incipient Fault in a Three-Phase Induction Motor [#15025]

David Coelho, Jose Alencar, Claudio Medeiros and Guilherme Barreto, Universidade Federal do Ceara, Brazil; Instituto Federal de Educacao Ciencia e tecnologia do Ceara, Brazil

This paper aims at the detection of short-circuit incipient fault condition in a three-phase squirrel-cage induction motor fed by a sinusoidal PWM converter. In order to detect this fault, different operation conditions are applied to an induction motor, and each sample of the real data set is taken from the line currents of the PWM converter aforementioned. For feature extraction, the Motor Current Signature Analysis (MCSA) is used. The detection of this fault is treated as a classification problem, therefore different supervised algorithms of machine learning are used so as to solve it: Multi-layer Perceptron (MLP), Extreme Learning Machine (ELM), Support-Vector Machine (SVM), Least-Squares Support-Vector Machine (LSSVM), and the Minimal Learning Machine (MLM). These classifiers are tested and the results are compared with other works with the same data set. In near future, an embedded system can be equipped with these algorithms.

2:10PM Artificial intelligence-based modelling and optimization of microdrilling processes [#14708]

Gerardo Beruvides, Ramon Quiza, Marcelino Rivas, Fernando Castano and Rodolfo Haber, Centre of Automation and Robotics, Spain; University of Matanzas, Cuba

This paper presents the modeling and optimization of a microdilling process. Experimental work has been carried out for measuring the thrust force for five different commonly used alloys, under several cutting conditions. An artificial neural network-based model was implemented for modelling the thrust force. Neural model showed a high goodness of fit and a good generalization capability. The optimization process was executed by considered two different and conflicting objectives: the unit machining time and the thrust force (based on the previously obtained model). A multiobjective genetic algorithm was used for solving the optimization problem and a set of non-dominated solutions was obtained. The Pareto's front representation was depicted and used for assisting the decision making process.

2:30PM Application of hybrid incremental modeling strategy for surface roughness estimation in micromachining processes [#14779]

Castano Fernando, Haber Rodolfo E., del Toro Raul M. and Beruvides Gerardo, Centre for Automation and Robotics (UPM-CSIC), Spain

This paper presents the application of a hybrid incremental modeling strategy (HIM) for real-time estimation of surface roughness in micromachining processes. This strategy essentially consists of two steps. First, a representative hybrid incremental model of micromachining process is obtained. The final result of this model describes output as a function of two inputs (feed per tooth quadratic and vibration mean quadratic (rms) in the Z axis) and output (surface roughness Ra). Second, the hybrid incremental model is evaluated in real time for predicting the surface roughness. The model is experimentally tested by embedding the computational procedure in a real-time monitoring system of surface roughness. The prototype evaluation shows a success rate in the estimate of surface roughness about 80%. These results are the basement for developing a new generation of embedded systems for monitoring surface roughness of micro components in real time and the further exploitation of the monitoring system at industrial level.

2:50PM A Tabu-search Algorithm for Two-machine Flow-shop with Controllable Processing Times [#14717]

Kailiang Xu, Gang Zheng and Sha Liu, School of Automation and Information Engineering, Xi'an University of Technology, China

This paper concerns on a two-machine flow-shop scheduling problem with controllable processing times modeled by a non-linear convex resource consumption function. The objective is to minimize the resource consumption that is needed to control the makespan not to exceed the given deadline. A tabu-search algorithm is designed, which searches for the optimal or near optimal job-processing sequence, while the

processing times of the operations are determined by an optimal resource allocation algorithm thereafter. Numerical experiment shows the tabu-search algorithm is able to provide optimal or near-optimal solutions for medium or large-scaled problems.

ISIC'14 Session 2: Independent Computing II

Thursday, December 11, 1:30PM-3:10PM, Room: Bonaire 5, Chair: Cheng-Hsiung Hsieh

1:30PM Improving Performance of Decision Boundary Making with Support Vector Machine Based Outlier Detection [#14696]

Yuya Kaneda, Yan Pei, Qiangfu Zhao and Yong Liu, The University of Aizu, Japan

Outlier detection is a method to improve perfor- mances of machine learning models. In this paper, we use an outlier detection method to improve the performance of our proposed algorithm called decision boundary making (DBM). The primary objective of DBM algorithm is to induce compact and high performance machine learning models. To obtain this model, the DBM reconstructs the performance of support vector machine (SVM) on a simple multilayer perceptron (MLP). If machine learning model has compact and high performance, we can implement the model into mobile application and improve usability of mobile devices, such as smart phones, smart tablets, etc. In our previous research, we obtained high performance and compact models by DBM. However in few cases, the performances are not well. We attempt to use a SVM-based outlier detection method to improve the performance in this paper. We define outlier using the method, and remove these outliers from training data that is generated by DBM algorithm. To avoid deleting normal data, we set a parameter $\delta_{outlier}$, which is used to control the boundary for deciding outlier point. Experimental results using public databases show the performance of DBM without outliers is improved. We investigate and discuss the effectiveness of parameter $\delta_{outlier}$ as well.

1:50PM Verification of an Image Morphing Based Technology for Improving the Security in Cloud Storage Services [#14682]

Ryota Hanyu, Kazuki Murakami and Qiangfu Zhao, University of Aizu, Japan

Recently, many kinds of cloud computing based services are provided and they are becoming more and more popular. But we think it is an urgent problem to improve the security of cloud services especially for storage services because the number of cyber-attacks is increasing. Currently, our research group proposed an image morphing based technology for improving the security of cloud services. This technology provides a novel way both for encrypting and for hiding secret information. In this paper, we verify and discuss about the vulnerability of the proposed technology, and suggest possible methods for further improvement.

2:10PM Simulation of Human Awareness Control in Spatiotemporal Language Understanding as Mental Image Processing [#14568]

Rojanee Khummongkol and Masao Yokota, Fukuoka Institute of Technology, Japan

Natural language can be the most convenient means for ordinary people at their intuitive interaction with home robots and among all its sublanguages, the spatiotemporal (or 4D) language is expected to be the most important when both the entities communicate each other in their casual scenes. As easily imagined, it is quite ordinary for people to understand a 4D expression with the mental image of a certain scene being described by it and therefore such a human mental process is worth simulating by computers in order to facilitate intuitive human-robot interaction. This paper attempts to model this human performance, considering what people attend to and how they control their awareness during spatiotemporal language understanding as mental image processing.

2:30PM A New Steganography Protocol for Improving Security of Cloud Storage Services [#14557]

Kazuki Murakam, Qiangfu Zhao and Ryota Hanyu, University of Aizu, Japan

In recent years, cloud computing services havebecome a must in our daily lives. Although well-known securitytechnologies are used for system protection and data protection, the security of existing service systems is far from enough. Themain problem is that existing systems and/or programs usuallyhave some unknown issues or vulnerabilities, and can be attackedby some unauthorized persons in some unexpected ways. Tosolve the problem, at least partially, we have proposed a newsteganography protocol for improving information security incloud storage services. The key point in this protocol is tosynthesize an image that can be used as the encryption/decryptionkey, the stego-key, as well as the cover data. Initial analysis showsthat the new protocol is very secure. This paper formulates theprotocol in a more formal way, so that based on the formulation,we can find possible weak points more easily, and make theprotocol more practically useful.

FOCI'14 Session 2: Evolutionary Algorithm and Memetic Computing

Thursday, December 11, 1:30PM-3:10PM, Room: Bonaire 6, Chair: Leonardo Franco and Ferrante Neri

1:30PM Test Problems and Representations for Graph Evolution [#14537]

Daniel Ashlock, Justin Schonfeld, Lee-Ann Barlow and Colin Lee, University of Guelph, Canada; University of Geulph, Canada

Graph evolution - evolving a graph or network to fit specific criteria - is a recent enterprise because of the difficulty of representing a graph in an easily evolvable form. Simple, obvious representations such as adjacency matrices can prove to be very hard to evolve and some easy-to-evolve representations place severe limits on the space of graphs that is explored. This study fills in a gap in the literature by presenting two scalable families of benchmark functions. These functions are tested on a number of representations. The first family of benchmark functions is matching the eccentricity sequences of graphs, the second is locating graphs that are relatively easy to color non-optimally. One hundred examples of the eccentricity sequence matching problem are tested. The examples have a difficulty, measured in time to solution, that varies through four orders of magnitude, demonstrating that this test problem exhibits scalability even within a particular size of problem. The ordering by problem hardness, for different representations, varies significantly from representation to representation. For the difficult coloring problem, a parameter study is presented demonstrating that the problem exhibits very different results for different algorithm parameters, demonstrating its effectiveness as a benchmark problem.

1:50PM Comparing Generic Parameter Controllers for EAs [#14343]

Giorgos Karafotias, Mark Hoogendoorn and Berend Weel, VU University Amsterdam, Netherlands

Parameter controllers for Evolutionary Algorithms (EAs) deal with adjusting parameter values during an evolutionary run. Many ad hoc approaches have been presented for parameter control, but few generic parameter controllers exist and, additionally, no comparisons or in depth analyses of these generic controllers are available in literature. This paper presents an extensive comparison of such generic parameter control methods, including a number of novel controllers based on reinforcement learning which are introduced here. We conducted experiments with different EAs and test problems in an one- off setting, i.e. relatively long runs with controllers used out- of-the-box with no tailoring to the problem at hand. Results reveal several interesting insights regarding the effectiveness of parameter control, the niche applications/EAs, the effect of continuous treatment of parameters and the influence of noise and randomness on control.

2:10PM A Discrete Representation for Real Optimization with Unique Search Properties [#14431]

Daniel Ashlock and Jeremy Gilbert, University of Guelph, Canada

Walking triangle representations for real optimization are linear representations drawn from the group that acts on simplices of Euclidean space. The representation encodes a series of modifications to an initial simplex, evaluating the quality of the point at its center of mass for the function being optimized. Different operations available in the representation permits easy tailoring of the degree of exploration and exploitation implemented and also permit control over the order in which they happen. Some operations perform search with linear differences in the position of the search point while others exponentially increase or decrease the distance between adjacent points. The current work focuses on developing theory and experimentally testing a walking triangle representation based on the walk, center, and uncenter moves representing changes in the position of the modeled point that are linear, exponentially decreasing, and exponentially increasing, respectively. The experimental results are compared with one another and with a standard evolutionary algorithm. A new test function called the eight hill function, specifically intended to test the ability of an algorithm to explore, is presented.

2:30PM Two Local Search Components that Move Along the Axes for Memetic Computing Frameworks [#14590]

Neri Ferrante and Khan Noel, De Montfort University, United Kingdom

Within memetic computing frameworks, the struc- ture as well as a correct choice of memes are important elements that drive successful optimization algorithms. This paper studies variations of a promising yet simple search operator, the S Algorithm, which can easily be integrated within a memetic framework to improve candidate solutions. S is a single-solution optimizer that iteratively perturbs variables and conditionally evaluates solutions along the axes. The first S variant, namely S2, unconditionally evaluates solutions in both directions while S3 maintains D uncorrelated step sizes that are either expanded in the direction of improving fitness or else redirected and contracted. Numerical results from the CEC2010 and CEC2014 benchmarks show that the variants outperform S in terms of the number of function evaluations for a given fitness value and, further, that S3 outperforms S in terms of final fitness against a wide range of problems and dimensionality.

2:50PM A Separability Prototype for Automatic Memes with Adaptive Operator Selection [#14607]

Michael G. Epitropakis, Fabio Caraffini, Ferrante Neri and Edmund Burke, University of Stirling, United Kingdom; De Montfort University, United Kingdom

One of the main challenges in algorithmics in general, and in Memetic Computing, in particular, is the automatic design of search algorithms. A recent advance in this direction (in terms of continuous problems) is the development of a software prototype that builds up an algorithm based upon a problem analysis of its separability. This prototype has been called the Separability Prototype for Automatic Memes (SPAM). This article modifies the SPAM by incorporating within it an adaptive model used in hyper-heuristics for tackling optimization problems. This model, namely Adaptive Operator Selection (AOS), rewards at run time the most promising heuristics/memes so that they are more likely to be used in the following stages of the search process. The resulting framework, here referred to as SPAM-AOS, has been tested on various benchmark problems and compared with modern algorithms representing the-state-of-the-art of search for continuous problems. Numerical results show that the proposed SPAM-AOS is a promising framework that outperforms the original SPAM and other modern algorithms. Most importantly, this study shows how certain areas of Memetic Computing and Hyper-heuristics are very closely related topics and it also shows that their combination can lead to the development of powerful algorithmic frameworks.

EALS'14 Session 2: Applications

Thursday, December 11, 1:30PM-3:10PM, Room: Bonaire 7, Chair: Jose Antonio Iglesias

1:30PM A Real-time Approach for Autonomous Detection and Tracking of Moving Objects from UAV [#14718]

Pouria Sadeghi-Tehran, Clarke Christopher and Angelov Plamen, School of Computing and Communications, Lancaster University, United Kingdom

A new approach to autonomously detect and track moving objects in a video captured by a moving camera from a UAV in real-time is proposed in this paper. The introduced approach replaces the need for a human operator to perform video analytics by autonomously detecting moving objects and clustering them for tracking purposes. The effectiveness of the introduced approach is tested on the footage taken from a real UAV and the evaluation results are demonstrated in this paper.

1:50PM Real Time Road Traffic Monitoring Alert based on Incremental Learning from Tweets [#14333]

Di Wang, Ahmad Al-Rubaie, John Davies and Sandra Stincic-Clarke, Khalifa University, United Arab Emirates; British Telecom Research and Innovation, United Kingdom

Social media has become an important source of near-instantaneous information about events and is increasingly also being analysed to provide predictive models, sentiment analysis and so on. One domain where social media data has value is transport and this paper looks at the exploitation of Twitter data in traffic management. A key issue is the identification and analysis of traffic- relevant content. A smart system is needed to identify traffic related tweets for traffic incident alerting. This paper proposes an instant traffic alert and warning system based on a novel LDA-based approach ("tweet-LDA") for classification of traffic-related tweets. The system is evaluated and shown to perform better than related approaches.

2:10PM Influence of the data codification when applying evolving classifiers to develop spoken dialog systems [#14595]

Jose Antonio Iglesias, David Griol, Agapito Ledezma and Araceli Sanchis, Carlos III University of Madrid, Spain

In this paper we present a study of the influence of the representation of the data when applying evolving classifiers in a specific classification task. In particular, we consider an evolving classifier for the development of a spoken dialog system interacting in a practical domain. In order to conduct this study, we will first introduce an approach based on evolving fuzzy systems (EFS) which is employed to select the next system action of the dialog system. This classifier takes into account a set of evolving fuzzy rules which are automatically obtained using evolving systems. The reason for using EFS in this domain is that we can process streaming data on-line in real time and the structure and operation of the dialog model can dynamically change by considering the interaction of the dialog system with its users. Since we want to apply this evolving approach in a real domain, our proposal considers the data supplied by the user throughout the complete dialog history and the confidence measures provided by the recognition and understanding modules of the system. The paper is focused on the study of the influence of the codification of this input data to achieve the best performance of the proposed approach. To do this, we have completed this study for a real spoken dialog system providing railway information.

2:30PM An Apprenticeship Learning Hyper-Heuristic for Vehicle Routing in HyFlex [#14322]

Shahriar Asta and Ender Ozcan, University of Nottingham, United Kingdom

Apprenticeship learning occurs via observations while an expert is in action. A hyper-heuristic is a search method or a learning mechanism that controls a set of low level heuristics or combines different heuristic components for solving a given problem. In this study, we investigate into a novel apprenticeship-learning-based approach which is used to automatically generate a hyper-heuristic for vehicle routing. This approach itself can be considered as a hyper-heuristic which operates in a train and test fashion. A state-of-the-art hyper-heuristic is chosen as an expert which is the winner of a previous hyper-heuristic competition. Trained on small vehicle routing instances, the learning approach yields various classifiers, each capturing different actions that the expert hyper-heuristic perform during the search process. Those classifiers are then used to produce a hyper-heuristic which is potentially capable of generalizing the actions of the expert hyper-heuristic while solving the unseen instances. The experimental results on vehicle routing using the Hyper-heuristic Flexible (HyFlex) framework show that the apprenticeship-learning-based hyper-heuristic delivers an outstanding performance when compared to the expert and some other previously proposed hyper-heuristics.

2:50PM Classification and Segmentation of fMRI spatio-temporal brain data with a NeuCube evolving spiking neural network model [#14932]

Maryam Gholami Doborjeh, Elisa Capecci and Kasabov Nikola, Knowledge Engineering and Discovery Research Institute (KEDRI), Auckland University of Technology, New Zealand

The proposed feasibility analysis introduces a new methodology for modelling and understanding functional Magnetic Resonance Image (fMRI) data recorded during human cognitive activity. This constitutes a type of Spatio-Temporal Brain Data (STBD) measured according to neurons spatial location inside the brain and their signals oscillating over the mental activity period [1]; thus, it is challenging to analyse and model dynamically. This paper addresses the problem by means of a novel Spiking Neural Networks (SNN) architecture, called NeuCube [2]. After the NeuCube is trained with the fMRI samples, the 'hidden' spatio- temporal relationship between data is learnt. Different cognitive states of the brain are activated while a subject is reading different sentences in terms of their polarity (affirmative and negative sentences). These are visualised via the SNN cube (SNNc) and then recognized through its classifier. The excellent classification accuracy of 90% proves the NeuCube potential in capturing the fMRI data information and classifying it correctly. The significant improvement in accuracy is demonstrated as compared with some already published results [3] on the same data sets and traditional machine learning methods. Future works is based on the proposed NeuCube model are also discussed in this paper.

CIMSIVP'14 Session 5: Algorithms II

Thursday, December 11, 1:30PM-3:10PM, Room: Bonaire 8, Chair: Aini Hussain

1:30PM A Ridge Extraction Algorithm Based on Partial Differential Equations of the Wavelet Transform [#14521]

Pan Jiasong and Yue Lin, College of Mechanical and Electrical Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China, China

In the time-frequency plane of the wavelet transform, the modulus of the wavelet coefficients concentrate near certain curves called wavelet ridges. Ridges reflect instantaneous characteristics of transient signals, and there is a corresponding relationship between the original signal and the wavelet coefficients located at the ridges. Therefore, wavelet ridge is widely used in fields of non-stationary signal feature extraction, filtering and reconstruction and modal parameter identification. For the disadvantages of traditional ridge extraction algorithms, this paper proposes a ridge extraction algorithm based on partial differential equations of the wavelet transform. According to the relationship between wavelet ridge and the modulus maxima of wavelet coefficients, the initial position of ridge is determined, and iterative formula of wavelet parameters is derived.A complete ridge will be fitted through several ridge points obtained by successive iteration using the derived iterative formula. The biggest advantage of this algorithm is that it does not need to calculate the entire wavelet transform time-frequency plane, so redundant computation is avoided. Experimental results show that the computing speed has been significantly improved compared with Carmona's Crazy-Climber algorithm.The extracted wavelet ridges can accurately restore effective frequency components of signals. Signals can be reconstructed by their ridges and the noise signals are removed. This algorithm is especially suitable for wavelet ridge extraction of multi frequency component asymptotic signals.

1:50PM cobICA: A Concentration-Based, Immune-Inspired Algorithm for ICA Over Galois Fields [#14863]

Daniel Silva, Jugurta Montalvao and Romis Attux, University of Brasilia - UnB, Brazil; Federal University of Sergipe - UFS, Brazil; University of Campinas - Unicamp, Brazil

An interesting and recent application of population-based metaheuristics resides in an unsupervised signal processing task: independent component analysis (ICA) over finite fields. Based on a state-of-the-art immune-inspired method, this work proposes a new ICA algorithm for finite fields of arbitrary order that employs mutation and local search operators specifically customized to the problem domain. The results

obtained with the new technique indicate that the proposal is effective in performing component separation, and the analysis includes a preliminary study on image separation.

2:10PM Multivariate PDF Matching via Kernel Density Estimation [#14935]

Denis Fantinato, Levy Boccato, Aline Neves and Romis Attux, University of Campinas, Brazil; Federal University of ABC, Brazil

In this work, a measure of similarity based on the matching of multivariate probability density functions (PDFs) is proposed. In consonance with the information theoretic learning (ITL) framework, the affinity comparison between the joint PDFs is performed using a quadratic distance, estimated with the aid of the Parzen window method with Gaussian kernels. The motivation underlying this proposal is to introduce a criterion capable of quantifying, to a significant extent, the statistical dependence present on information sources endowed with temporal and/or spatial structure, like audio, images and coded data. The measure is analyzed and compared with the canonical ITL-based approach - correntropy - for a set of blind equalization scenarios. The comparison includes elements like surface analysis, performance comparison in terms of bit error rate and a qualitative discussion concerning image processing. It is also important to remark that the study includes the application of two computational intelligence paradigms: extreme learning machines and differential evolution. The results indicate that the proposal can be, in some scenarios, a more informative formulation than correntropy.

2:30PM Unsupervised Learning Algorithm for Signal Separation [#14202]

Theju Jacob and Wesley Snyder, North Carolina State University, United States

We present a neural network capable of separating inputs in an unsupervised manner. Oja's rule and Self-Organizing map principles are used to construct the network. The network is tested using 1) straight lines 2)MNIST database. The results demonstrate that the network can operate as a general clustering algorithm, with neighboring neurons responding to geometrically similar inputs.

2:50PM Human Gait State Classification using Neural Network [#14361]

Win Kong, Mohamad Hanif Md Saad, Ma Hannan and Aini Hussain, Universiti Kebangsaan Malaysia, Malaysia

This paper describes an artificial neural network (ANN) based classification of human gait state. ANN is a well known classifier which is widely applied in many field of applications such as medical, business, computer vision and engineering. This study employs the understanding and knowledge of the human gait analysis. Human gait refers to one's walking pattern. In most cases, gait is used to identify individual due to its unique characteristics. In this work, the most significant gait features is the gait cycle which comprises six states. The six states are classified based on the similarity of the lower limbs' figure and the state of gait is beneficial to real time human tracking and occlusion handling. The state gait classification is performed using an ANN model and presented a performance accuracy of 89%.

Special Session: ADPRL'14 Learning Control and Optimization based on Adaptive Dynamic Programming

Thursday, December 11, 1:30PM-3:10PM, Room: Curacao 1, Chair: Dongbin Zhao and Derong Liu

1:30PM Data-Driven Partially Observable Dynamic Processes Using Adaptive Dynamic Programming [#14385]

Xiangnan Zhong, Zhen Ni, Yufei Tang and Haibo He, University of Rhode Island, United States

Adaptive dynamic programming (ADP) has been widely recognized as one of the "core methodologies" to achieve optimal control for intelligent systems in Markov decision process (MDP). Generally, ADP control design requires all the information of the system dynamics. However, in many practical situations, the measured input and output data can only represent part of the system states. This means the complete information of the system cannot be available in many real-world cases, which narrows the range of application of the ADP design. In this paper, we propose a data-driven ADP method to stabilize the system with partially observable dynamics based on neural network techniques. A state network is integrated into the typical actor-critic architecture to provide an estimated state from the measured input/output sequences. The theoretical analysis and the stability discussion of this data-driven ADP method are also provided. Two examples are studied to verify our proposed method.

1:50PM Model-free Q-learning over Finite Horizon for Uncertain Linear Continuous-time Systems [#14380]

Hao Xu and Sarangapani Jagannathan, Texas A and M University - Corpus Christi, United States; Missouri University of Science and Technology, United States

In this paper, a novel optimal control over finite horizon has been introduced for linear continuous-time systems by using adaptive dynamic programming (ADP). First, a new time-varying Q-function parameterization and its estimator are introduced. Subsequently, Q-function estimator is tuned online by using both Bellman equation in integral form and terminal cost. Eventually, near optimal control gain is obtained by using the Q-function estimator. All the closed-loop

signals are shown to be bounded by using Lyapunov stability analysis where bounds are functions of initial conditions and final time while the estimated control signal converges close to the optimal value. The simulation results illustrate the effectiveness of the proposed scheme.

2:10PM Optimal Self-Learning Battery Control in Smart Residential Grids by Iterative Q-Learning Algorithm [#14547]

Qinglai Wei, Derong Liu, Guang Shi, Yu Liu and Qiang Guan, Chinese Academy of Sciences, China

In this paper, a novel dual iterative Q-learning algorithm is developed to solve the optimal battery management and control problems in smart residential environments. The main idea is to use adaptive dynamic programming (ADP) technique to obtain the optimal battery management and control scheme iteratively for residential energy systems. In the developed dual iterative Q-learning algorithm, two iterations, including external and internal iterations, are introduced, where internal iteration minimizes the total cost of power loads in each period and the external iteration makes the iterative Q function converge to the optimum. For the first time, the convergence property of iterative Q-learning method is proven to guarantee the convergence property of the iterative Q function. Finally, numerical results are given to illustrate the performance of the developed algorithm.

2:30PM A Data-based Online Reinforcement Learning Algorithm with High-efficient Exploration [#14204]

Zhu Yuanheng and Zhao Dongbin, Institution of Automation, Chinese Academy of Sciences, China

An online reinforcement learning algorithm is proposed in this paper to directly utilizes online data efficiently for continuous deterministic systems without system parameters. The dependence on some specific approximation structures is crucial to limit the wide application of online reinforcement learning algorithms. We utilize the online data directly with the kd-tree technique to remove this limitation. Moreover, we design the algorithm in the Probably Approximately Correct principle. Two examples are simulated to verify its good performance.

2:50PM Reinforcement Learning-based Optimal Control Considering L Computation Time Delay of Linear Discrete-time Systems [#14098]

Taishi Fujita and Toshimitsu Ushio, Osaka University, Japan

In embedded control systems, the control input is computed based on sensing data of a plant in a processor and there is a delay, called the computation time delay, due to the computation and the data transmission. When we design an optimal controller, we need to take the delay into account to achieve its optimality. Moreover, in the case where it is difficult to identify a mathematical model of the plant, a model free approach is useful. Especially, the reinforcement learning-based approach has been much attention to in the design of an adaptive optimal controller. In this paper, we assume that the plant is a linear system but the parameters of the plant are unknown. Then, we apply the reinforcement learning to the design of an adaptive optimal digital controller with taking the computation time delay into consideration. First, we consider the case where all states of the plant are observed, and it takes L times to update the control input. An optimal feedback gain is learned from sequences of a pair of the state and the control input. Next, we consider the case where the control input is determined from outputs of the plant. We cannot use an observer to estimate the state of the plant since the parameters of the plant are unknown. So, we use a data-based control approach for the estimation. Finally, we apply the proposed adaptive optimal controller to attitude control of a quadrotor at the hovering state and show its efficiency by simulation.

Special Session: CIDM'14 Session 5: High Dimensional Data Analysis

Thursday, December 11, 1:30PM-3:10PM, Room: Curacao 2, Chair: Thomas Villmann

1:30PM Valid Interpretation of Feature Relevance for Linear Data Mappings [#14157]

Benoit Frenay, Daniela Hofmann, Alexander Schulz, Michael Biehl and Barbara Hammer, Universite catholique de Louvain, Belgium; Bielefeld University, Germany; University of Groningen, Netherlands

Linear data transformations constitute essential operations in various machine learning algorithms, ranging from linear regression up to adaptive metric transformation. Often, linear scalings are not only used to improve the model accuracy, rather feature coefficients as provided by the mapping are interpreted as an indicator for the relevance of the feature for the task at hand. This principle, however, can be misleading in particular for high-dimensional or correlated features, since it easily marks irrelevant features as relevant or vice versa. In this contribution, we propose a mathematical formalisation of the minimum and maximum feature relevance for a given linear transformation which can efficiently be solved by means of linear programming. We evaluate the method in several benchmarks, where it becomes apparent that the minimum and maximum relevance closely resembles what is often referred to as weak and strong relevance of the features; hence unlike the mere scaling provided by the linear mapping, it ensures valid interpretability.

1:50PM High Dimensional Exploration: A Comparison of PCA, Distance Concentration, and Classification Performance in two fMRI Datasets [#14231]

Joset Etzel and Todd Braver, Washington University in St Louis, United States

fMRI (functional magnetic resonance imaging) studies frequently create high dimensional datasets, with far more features (voxels) than examples. It is known that such datasets frequently have properties that make analysis challenging, such as concentration of distances. Here, we calculated the probability of distance concentration and proportion of variance explained by PCA in two fMRI datasets, comparing these measures with each other, as well as with the number of voxels and classification accuracy. There are clear differences between the datasets, with one showing levels of distance concentration comparable to those reported in microarray data [1, 2]. While it remains to be determined how typical these results are, they suggest that problematic levels of distance concentration in fMRI datasets may not be a rare occurrence.

2:10PM Two key properties of dimensionality reduction methods [#14598]

John A. Lee and Michel Verleysen, Universite catholique de Louvain, Belgium

Dimensionality reduction aims at providing faithful low-dimensional representations of high-dimensional data. Its general principle is to attempt to reproduce in a low-dimensional space the salient characteristics of data, such as proximities. A large variety of methods exist in the literature, ranging from principal component analysis to deep neural networks with a bottleneck layer. In this cornucopia, it is rather difficult to find out why a few methods clearly outperform others. This paper identifies two important properties that enable some recent methods like stochastic neighborhood embedding and its variants to produce improved visualizations of high-dimensional data. The first property is a low sensitivity to the phenomenon of distance concentration. The second one is plasticity, that is, the capability to forget about some data characteristics to better reproduce the other ones. In a manifold learning perspective, breaking some proximities typically allow for a better unfolding of data. Theoretical developments as well as experiments support our claim that both properties have a strong impact. In particular, we show that equipping classical methods with the missing properties significantly improves their results.

2:30PM Generalized kernel framework for unsupervised spectral methods of dimensionality reduction [#14888]

Diego Hernan Peluffo-Ordonez, John Aldo Lee and Michel Verleysen, Universidad Cooperativa de Colombia - Pasto, Colombia; Universite Catholique de Louvain, Belgium; Universite catholique de Louvain, Belgium

This work introduces a generalized kernel perspective for spectral dimensionality reduction approaches. Firstly, an elegant matrix view of kernel principal component analysis (PCA) is described. We show the relationship between kernel PCA, and conventional PCA using a parametric distance. Secondly, we introduce a weighted kernel PCA framework followed from leastsquares support vector machines (LS-SVM). This approach starts with a latent variable that allows to write a relaxed LS-SVMproblem. Such a problem is addressed by a primal-dual formulation. As a result, we provide kernel alternatives to spectral methods for dimensionality reduction such as multidimensional scaling, locally linear

embedding, and laplacian eigenmaps; as well as a versatile framework to explain weighted PCA approaches. Experimentally, we prove that the incorporation of a SVM model improves the performance of kernel PCA.

2:50PM Evaluating Topic Quality using Model Clustering [#15043]

Vineet Mehta, Rajmonda Caceres, and Kevin Carter, MIT, United States

Topic modeling continues to grow as a popular technique for finding hidden patterns, as well as grouping collections of new types of text and non-text data. Recent years have witnessed a growing body of work in developing metrics and techniques for evaluating the quality of topic models and the topics they generate. This is particularly true for text data where significant attention has been given to the semantic interpretability of topics using measures such as coherence. It has been shown however that topic assessments based on coherence metrics do not always align well with human judgment. Other efforts have examined the utility of information-theoretic distance metrics for evaluating topic quality in connection with semantic interpretability. Although there has been progress in evaluating interpretability of topics, the existing intrinsic evaluation metrics do not address some of the other aspects of concern in topic modeling such as: the number of topics to select, the ability to align topics from different models, and assessing the quality of training data. Here we propose an alternative metric for char- acterizing topic quality that addresses all three aforementioned issues. Our approach is based on clustering topics, and using the silhouette measure, a popular clustering index, for characterizing the quality of topics. We illustrate the utility of this approach in addressing the other topic modeling concerns noted above. Since this metric is not focused on interpretability, we believe it can be applied more broadly to text as well as non-text data. In this paper however we focus on the application of this metric to archival and non-archival text data.

SIS'14 Session 5: Particle Swarm Optimization - II

Thursday, December 11, 1:30PM-3:10PM, Room: Curacao 3, Chair: Andries Engelbrecht and Katherine Malan

1:30PM Asynchronous Particle Swarm Optimization with Discrete Crossover [#14018]

Andries Engelbrecht, University of Pretoria, South Africa

Recent work has evaluated the performance of a synchronous global best (gbest) particle swarm optimization (PSO) algorithm hybridized with discrete crossover operators. This paper investigates if using asynchronous position updates instead of synchronous updates will result in improved performance of a gbest PSO that uses these discrete crossover operators. Empirical analysis of the performance of the resulting algorithms provides strong evidence that asynchronous position updates significantly improves performance of the PSO discrete crossover hybrid algorithms, mainly with respect to accuracy and convergence speed. These improvements were seen over an extensive benchmark suite of 60 boundary constrained minimization problems of various characteristics.

1:50PM Particle Swarm Optimisation Failure Prediction Based on Fitness Landscape Characteristics [#14151]

Katherine Malan and Andries Engelbrecht, University of Pretoria, South Africa

Particle swarm optimisation (PSO) algorithms have been successfully used to solve many complex real-world optimisation problems. Since their introduction in 1995, the focus of research in PSOs has largely been on the algorithmic side with many new variations proposed on the original PSO algorithm. Relatively little attention has been paid to the study of problems with respect to PSO performance. The aim of this study is to investigate whether a link can be found between problem characteristics and algorithm performance for PSOs. A range of benchmark problems are numerically characterised using fitness landscape analysis techniques. Decision tree induction is used to develop failure prediction models for seven different variations on the PSO algorithm. Results show that for most PSO models, failure could be predicted to a fairly high level of accuracy. The resulting prediction models are not only useful as predictors of failure, but also provide insight into the algorithms themselves, especially when expressed as fuzzy rules in terms of fitness landscape features.

2:10PM Evolutionary Design of Self-Organizing Particle Systems for Collective Problem Solving [#14637]

Benjamin Bengfort, Philip Y. Kim, Kevin Harrison and James Reggia, University of Maryland, United States

Using only simple rules for local interactions, groups of agents can form self-organizing super- organisms or "flocks" that show global emergent behavior. When agents are also extended with memory and goals the resulting flock not only demonstrates emergent behavior, but also collective intelligence: the ability for the group to solve problems that might be beyond the ability of the individual alone. Until now, research has focused on the improvement of particle design for global behavior; however, techniques for human-designed particles are task-specific. In this paper we will demonstrate that evolutionary computing techniques can be applied to design particles, not only to optimize the parameters for movement but also the structure of controlling finite state machines that enable collective intelligence. The evolved design not only exhibits emergent, self-organizing behavior but also significantly outperforms a human design in a specific problem domain. The strategy of the evolved design may be very different from what is intuitive to humans and perhaps reflects more accurately how nature designs systems for problem solving. Furthermore, evolutionary design of particles for collective intelligence is more flexible and able to target a wider array of problems either individually or as a whole.

2:30PM Towards a Network-based Approach to Analyze Particle Swarm Optimizers [#14677]

Marcos Oliveira, Carmelo Bastos-Filho and Ronaldo Menezes, Florida Institute of Technology, United States; University of Pernambuco, Brazil

In Particle Swarm Optimizers (PSO), the way particles communicate plays an important role on their search behavior influencing the trade-off between exploration and exploitation. The interactions boundaries defined by the swarm topology is an example of this influence. For instance, a swarm with the ring topology tends to explore the environment more than with the fully connected global topology. On the other hand, more connected topologies tend to present a higher exploitation capability. We propose that the analysis of the particles interactions can be used to assess the swarm search mode, without the need for any particles properties (e.g. the particle's position, the particle's velocity, etc.). We define the weighted swarm influence graph Itw that keeps track of the interactions from the last tw iterations before a given iteration t. We show that the search mode of the swarm does have a signature on this graph based on the analysis of its components and the distribution of the node strengths.

2:50PM Particle Swarm Optimization based Distributed Agreement in Multi-Agent Dynamic Systems [#14848]

Veysel Gazi and Raul Ordonez, Istanbul Kemerburgaz University, Turkey; University of Dayton, United States

In this article we approach the problem of distributed agreement in multi-agent systems using asynchronous particle swarm optimization (PSO) with dynamic neighborhood. The agents are considered as PSO particles which are assumed to have time-dependent neighborhoods, operate asynchronously and incur time delays during information exchange. The performance of the PSO based agreement algorithm is verified using representative numerical simulations.

CIASG'14 Session 5: Optimization and Scheduling

Thursday, December 11, 1:30PM-3:10PM, Room: Curacao 4, Chair: Zita Vale

1:30PM An Evolutionary Approach for the Demand Side Management Optimization in Smart Grid [#14251]

Andre Vidal, Leonardo Jacobs and Lucas Batista, Universidade Federal de Minas Gerais, Brazil

An important function of a Smart Grid (SG) is the Demand Side Management (DSM), which consists on controlling loads at customers side, aiming to operate the system with major efficiency and sustainability. The main advantages of this technique are (i) the decrease of demand curve's peak, that results on smoother load profile and (ii) the reduction of both operational costs and the requirement of new investments in the system. The customer can save money by using loads on schedules with lower taxes instead of schedules with higher taxes. In this context, this work proposes a simple metaheuristic to solve the problem of DSM on smart grid. The suggested approach is based on the concept of day-ahead load shifting, which implies on the exchange of the use schedules planned for the next day and aims to obtain the lowest possible cost of energy. The demand management is modeled as an optimization problem whose solution is obtained by using an Evolutionary Algorithm (EA). The experimental tests are carried out considering a smart grid with three distinct demand areas, the first with residential clients, other one with commercial clients and a third one with industrial clients, all of them possessing a major number of controllable loads of diverse types. The obtained results were significant in all three areas, pointing substantial cost reductions for the customers, mainly on the industrial area.

1:50PM Quantum-based Particle Swarm Optimization Application to Studies of Aggregated Consumption Shifting and Generation Scheduling in Smart Grids [#14469]

Pedro Faria, Joao Soares and Zita Vale, Polytechnic of Porto, Portugal

Demand response programs and models have been developed and implemented for an improved performance of electricity markets, taking full advantage of smart grids. Studying and addressing the consumers' flexibility and network operation scenarios makes possible to design improved demand response models and programs. The methodology proposed in the present paper aims to address the definition of demand response programs that consider the demand shifting between periods, regarding the occurrence of multi-period demand response events. The optimization model focuses on minimizing the network and resources operation costs for a Virtual Power Player. Quantum Particle Swarm Optimization has been used in order to obtain the solutions for the optimization model that is applied to a large set of operation scenarios. The implemented case study illustrates the use of the proposed methodology to support the decisions of the Virtual Power Player in what concerns the duration of each demand response event.

2:10PM A New Heuristic Providing an Effective Initial Solution for a Simulated Annealing approach to Energy Resource Scheduling in Smart Grids [#14470]

Tiago Sousa, Hugo Morais, Rui Castro and Zita Vale, Polytechnic of Porto, Portugal; Technical University of Denmark (DTU), Denmark; University of Lisbon, Portugal

An intensive use of dispersed energy resources is expected for future power systems, including distributed generation, especially based on renewable sources, and electric vehicles. The system operation methods and tool must be adapted to the increased complexity, especially the optimal resource scheduling problem. Therefore, the use of metaheuristics is required to obtain good solutions in a reasonable amount of time. This paper proposes two new heuristics, called naive electric vehicles charge and discharge allocation and generation tournament based on cost, developed to obtain an initial solution to be used in the energy resource scheduling methodology based on simulated annealing previously developed by the authors. The case study considers two scenarios with 1000 and 2000 electric vehicles connected in a distribution network. The proposed heuristics are compared with a deterministic approach and presenting a very small error concerning the objective function with a low execution time for the scenario with 2000 vehicles.

2:30PM A Learning Algorithm and System Approach to Address Exceptional Events in the Domestic Consumption Management [#14471]

Luis Gomes, Filipe Fernandes, Zita Vale, Pedro Faria and Carlos Ramos, Polytechnic of Porto, Portugal

The integration of the Smart Grid concept into the electric grid brings to the need for an active participation of small and medium players. This active participation can be achieved using decentralized decisions, in which the end consumer can manage loads regarding the Smart Grid needs. The management of loads must handle the users' preferences, wills and needs. However, the users' preferences, wills and needs can suffer changes when faced with exceptional events. This paper proposes the integration of exceptional events into the SCADA House Intelligent Management (SHIM) system developed by the authors, to handle machine learning issues in the domestic consumption context. An illustrative application and learning case study is provided in this paper.

Thursday, December 11, 1:30PM-3:10PM

SSCI DC Session 5

Thursday, December 11, 1:30PM-3:10PM, Room: Curacao 7, Chair: Xiaorong Zhang

1:30PM Analysis of Tor Anonymity [#14538]

Khalid Shahbar, Dalhousie University, Canada

Anonymity on the Internet has its advantages and disadvantages. Some of the advantages are to encourage and to facilitate reporting any kind of illegal activities to the authorities without the fair of exposing the reporter's identity, provide space of freedom to express thoughts and ideas, and ensure the person's privacy for the journalists' (or other) sources. The usage of anonymity is not limited and can be expanded to many other examples. On the other hand, not everyone looking for anonymity is using it in a proper way. Anonymity can be used to hide illegal activities such as pornography or drugs distribution and promotion, hiding identity to perform illegal access to networks or information, or even providing fake threat reports to authorities. There are many ways and tools that provide anonymity to the Internet users. The missing part is the way to enhance the advantages of the anonymity tools and reduce or block the illegal use of the anonymity tools. There is a tradeoff between providing anonymity and controlling it. One of the goals of our research is to find the balance between increasing the user's anonymity and decreasing the misbehavior of this useful tool. To achieve this goal, we select to study Tor ; one of the widely used anonymity tools.

1:50PM A Generic Framework for Multi-Method Modeling and Simulation in Complex Systems [#14511]

Konstantinos Mykoniatis and Waldemar Karwowski, Department of Modeling and Simulation, United States; Industrial Engineering and Management Systems, United States

The focus of this research is to develop a generic conceptual framework for Multi- Method Modeling and Simulation, (integrated deployment of Modeling and Simulation using Discrete Events (DE), System Dynamics (SD) and Agent Based (AB)) in Complex Systems. The framework aims to provide a guideline on how to select the most-suitable Modeling and Simulation method(s) based on established requirements, in order to allow better representation of the modeler's intention(s) and more realistic representation of complex systems with less assumptions and complexity. The framework will be evaluated empirically with real case studies from a business and a health care organization.

2:10PM Developing a Business Case for Probabilistic Risk Assessment of Complex Socio-Technical Systems [#14939]

Marzieh Abolhelm, University of Illinois at Urbana-Champaign, United States

For most modern industries, safety is a goal that is given the same priority as efficient and economical production and, therefore, the connection between profitability and safety has long been an issue of interest to researchers. However, the economic gains from using Probabilistic Risk Assessment (PRA) are yet to be discovered. The key questions in this research include: Can PRA help Nuclear Power Plants (NPPs) become more profitable and, at the same time, meet safety requirements? If PRA applications help avoid costly plant outages (which run nearly two million U.S. dollars per day), should PRA still be considered as an "expensive" tool? Should industry and regulatory agencies continue to implement, regulate and enforce the use of PRA? This is a first-of-its-kind research aimed at uncovering the financial advantage of conducting PRA- based applications in high-risk, socio-technical systems such as Nuclear Power Plants (NPPs). By discovering the causal relationships between system safety and financial performance, this research will (1) model and quantify the costs and benefits associated with PRA programs (2) provide critical insights for the industry and regulatory agencies on the enhancement of risk- informed applications and the enforcement of risk-informed regulations (3) advance methodologies to quantify a socio-technical risk framework, where organizational and environmental factors dynamically interact and shape financial outcome and system safety risk (4) help identify and mitigate the underlying organizational root causes of accidents (e.g., managerial decision-making)

Thursday, December 11, 3:30PM-5:10PM

CICA'14 Session 3: Neural Network Systems and Control with Applications I

Thursday, December 11, 3:30PM-5:10PM, Room: Antigua 2, Chair: Ming Zhang, Edgar Sanchez

3:30PM Ultra High Frequency Polynomial and Sine Artificial Higher Order Neural Networks for Control Signal Generator [#14109]

Ming Zhang, Christopher Newport University, United States

New open box and nonlinear model of Ultra High Frequency Polynomial and Sine Artificial Higher Order Neural Network (UPS-HONN) is presented in this paper. A new learning algorithm for UPS-HONN is also developed from this study. A control signal generating system, UPS-HONN Simulator, is built based on the UPS- HONN models. Test results show that, to generate any nonlinear control signal, average error of UPS-HONN models is under 1e-6.

3:50PM Robust Pinning Control of Complex Dynamical Networks using Recurrent Neural Networks [#14201]

Edgar Sanchez and David I. Rodriguez, CINVESTAV Unidad Guadalajara, Mexico

In this paper, using recurrent high order neural networks as an identification strategy for unknown pinned nodes dynamics, a new scheme for pinning control of complex networks with changing unknown coupling strengths is proposed and a robust regulation behavior on such scenario is demonstrated.

4:10PM Dissolved Oxygen Control of Activated Sludge Biorectors using Neural-Adaptive Control [#14209]

Seyedhossein Mirghasemi, Chris J.B. Macnab and Angus Chu, University of Calgary, Canada

In a mixed liquor biological wastewater treatment process, the dissolved oxygen level is a very important factor. This paper proposes an adaptive neural network control strategy to maintain a set point in aerated bioreactors. For neural adaptive control, CMAC (Cerebellar Model Arithmetic Computer) neural network has been considered. The exact model of the process considered to be unknown, as The CMAC can model the nonlinearities of the system, and adapt in real time. The proposed method prevents weight drift and associated bursting, without sacrificing

performance. The controller is tested on a simplified version of the benchmark simulation model number 1 (BSM1), with disturbances in influent. The proposed controller outperforms PID control.

4:30PM Estimation of States of a Nonlinear Plant using Dynamic Neural Network [#15059]

Alok Kanti Deb and Dibyendu Guha, INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR, India

The purpose of this paper is to design a dynamic neural network that can effectively estimate all the states of single input non linear plants. Lyapunov's stability theory along with solution of full form Ricatti equation is used to guarantee that the tracking errors are uniformly bounded. No a priori knowledge on the bounds of weights and errors are required. The nonlinear plant and the dynamic neural network models have been simulated by the same input to illustrate the validity of theoretical results.

4:50PM Cascaded Free Search Differential Evolution Applied to Nonlinear System Identification Based on Correlation Functions and Neural Networks [#14882]

Helon Vicente Hultmann Ayala, Luciano Cruz, Roberto Zanetti Freire and Leandro dos Santos Coelho, PUCPR, Brazil; PUCPR and UFPR, Brazil

This paper presents a procedure for input selection and parameter estimation for system identification based on Radial Basis Functions Neural Networks (RBFNNs) models and Free Search Differential Evolution (FSDE). We adopt a cascaded evolutionary algorithm approach and problem decomposition to define the model orders and the related model parameters based on higher orders correlation functions. Thus, we adopt two distinct populations: the first to select the lags on the inputs and outputs of the system and the second to define the parameters for the RBFNN. We show the results when the proposed methodology is applied to model a coupled drives system with real acquired data. We use to this end the canonical binary genetic algorithm (selection of lags) and the recently proposed FSDE (definition of the model parameters), which is very convenient for the present problem for having few control parameters. The results show the validity of the approach when compared to a classical input selection algorithm.

ICES'14 Session 3: Evolutionary Techniques Applied to FPGAs

Thursday, December 11, 3:30PM-5:10PM, Room: Antigua 3, Chair: Jason Lohn

3:30PM Evolving Hierarchical Low Disruption Fault Tolerance Strategies for a Novel Programmable Device [#14755]

David Lawson, James Walker, Martin Trefzer, Simon Bale and Andy Tyrrell, University of York, United Kingdom

Faults can occur in transistor circuits at any time, and increasingly so as fabrication processes continue to shrink. This paper describes the use of evolution in creating fault recovery strategies for use on the PAnDA architecture. Previous work has shown how such strategies, applied in a random but biased fashion can be used to overcome transistor faults and also how, without knowledge of the fault, the average time to find a fix could be reduced. This work presents a further optimisation where an Evolutionary Algorithm (EA) is used to optimise the order that deterministic strategies are applied to a faulty circuit in order to reduce the average time to find a fix. The two methods are compared and this comparison is used to set the path for future work.

3:50PM Evolutionary Digital Circuit Design with Fast Candidate Solution Establishment in Field Programmable Gate Arrays [#14206]

Roland Dobai, Kyrre Glette, Jim Torresen and Lukas Sekanina, Brno University of Technology, Czech Republic; University of Oslo, Norway

Field programmable gate arrays (FPGAs) are a popular platform for evolving digital circuits. FPGAs allow to be reconfigured partially which provides a natural way of establishing candidate solutions. Recent research focuses on the hardware implementation of evolutionary design platforms. Several approaches have been developed for effective establishment and evaluation of candidate solutions in FPGAs. In this paper a new mutation operator is proposed for evolutionary algorithms. The chromosome representing the candidate solution is mutated in such a way that only one configuration frame is required for establishing the mutated candidate solution in hardware. The experimental results confirm that the reduced number of configuration frames and mutations at lower level of granularity ensure faster evolution, generation of more candidate solutions in a given time as well as solutions with better quality.

4:10PM Optimising Ring Oscillator Frequency on a Novel FPGA Device via Partial Reconfiguration [#14890]

Pedro Campos, Martin A. Trefzer, James Alfred Walker, Simon J. Bale and Andy Tyrrell, University of York, United Kingdom

The random variations which are present at sub-micron technology nodes have been proven to have significant impact on both yield and device performance. The circuit-scale effects of transistor variability for a particular architecture are hard to estimate, and device manufacturers face the risk of functional failures due to these stochastic variations, which is a growing problem for the FPGA community and the circuit design community in general. The novel PAnDA architecture aims to tackle some of those effects by allowing post-fabrication reconfiguration of the fabric, which in turn makes it possible to both optimise performance of a singular chip and to reduce the impact that these adverse effects have on manufacturing yield. A series of 3 stage ring oscillator circuits are mapped onto the PAnDA fabric, and a Genetic Algorithm is used to find a configuration which minimises the difference in frequency between the oscillator outputs and a target. Combinations of transistor sizes are used to induce changes in the performance of the logic blocks. A configuration is found which reduces the difference in frequencies to less than 1.5%.

4:30PM Temperature Management for Heterogeneous Multi-core FPGAs Using Adaptive Evolutionary Multi-Objective Approaches [#14879]

Renzhi Chen, Peter R. Lewis and Xin Yao, CERCIA, School of Computer Science, University of Birmingham, United Kingdom; School of Engineering, and Applied Science, Aston University, United Kingdom

Heterogeneous multi-core FPGAs contain different types of cores, which can improve efficiency when use with an effective online task scheduler. However, it is not easy to find the right cores for tasks when there are multiple objectives or dozens of cores. Inappropriate scheduling may cause hot spots which decrease the reliability of the chip. Given that, our research builds a simulating platform to evaluate all kinds of scheduling algorithms on a variety of architectures. On this platform, we provide an online scheduler which uses multi-objective evolutionary algorithm (EA).

Comparing EA and current algorithms such as Predictive Dynamic Thermal Management (PDTM) and Adaptive Temperature Threshold Dynamic Thermal Management (ATDTM), we find some drawbacks. First, current algorithms are overly dependent on manually set constant parameters. Second, those algorithms neglect optimization for heterogeneous architecture. Third, they use single-objective methods, or use linear weighting method to convert a multi-objective optimization into a single-objective optimization. Unlike other algorithms, EA is adaptive and does not require resetting parameters when workloads switch from one to another. EAs also improve performance when used on heterogeneous architecture. A efficient Pareto Front can be obtained with EAs for the purpose of multiple objectives.

4:50PM Multiobjective Genetic Algorithm for Routability-Driven Circuit Clustering on FPGAs [#14346]

Yuan Wang, Simon J. Bale, James Alfred Walker, Martin A. Trefzer and Andy Tyrrell, University of York UK, United Kingdom

This paper presents a novel routability-driven circuit clustering (packing) technique, DBPack, to improve function packing on FPGAs. We address a number of challenges when optimising packing of generic FPGA architectures, which are input bandwidth constraints (the number of unique cluster input signals is greater than the number of unique signals available from routing channel), density of packing to satisfy area constraints and minimisation of exposed nets outside the cluster in order to facilitate routability. In order to achieve optimal trade-off solutions when mapping for groups of Basic Logic Elements (BLEs) into clusters with regard to multiple objectives, we have developed a population based circuit clustering algorithm based on non-dominated sorting multi-objective genetic algorithm (NSGA-II). Our proposed method is tested using a number of the "Golden 20" MCNC benchmark circuits that are regularly used in FPGA-related literature. The results show that the techniques proposed in the paper considerably improve both packing density of clusters and their routability when compared to the state-of-art routability-driven packing algorithms, including VPack, T-VPack and RPack.

CIBIM'14 Session 3: Face Detection and Recognition

Thursday, December 11, 3:30PM-5:10PM, Room: Antigua 4, Chair: Gelson da Cruz Junior and Marina Gavrilova

3:30PM Robust Face Detection from Still Images [#14057]

Patrick Laytner, Chrisford Ling and Qinghan Xiao, University of Waterloo, Canada; Defence Research and Development Canada, Canada

Facial recognition is one of the most studied topics in the field of biometrics because of its varied applications. Detection of dark colored faces and poorly illuminated faces are not well studied in the literature due to several challenges. The most critical challenge is that there is inadequate contrast among facial features. To overcome this challenge, a new face detection methodology, which consists of histogram analysis, Haar wavelet transformation and Adaboost learning techniques, is proposed. The extended Yale Face Database B is used to examine the performance of the proposed method and compared against commonly used OpenCV's Haar detection algorithm. The experimental results with 9,883 positive images and 10,349 negative images showed a considerable improvement in face hit rates without a significant change in false acceptance rates.

3:50PM Handling Session Mismatch by Fusion-based Co-training: An Empirical Study using Face and Speech Multimodal Biometrics [#14300]

Norman Poh, Ajita Rattani and Josef Kittler, University of Surrey, United Kingdom; Michigan State University, United States

Semi-supervised learning has been shown to be a viable training strategy for handling the mismatch between training and test samples. For multimodal biometric systems, classical semi-supervised learning strategies such as self- training and co-training may not have fully exploited the advantage of a multimodal fusion, notably due to the fusion module. For this reason, we explore a novel semi-supervised training strategy known as fusion-based co- training that generalizes the classical co-training such that it can use a trainable fusion classifier. Our experiments on the BANCA face and speech database show that this proposed strategy is a viable approach. In addition, we also address the resolved issue of how to select the decision threshold for adaptation. In particular, we find that a strong classifier, including a multimodal system, may benefit better from a more relaxed threshold whereas a weak classifier may benefit better from a more stringent one.

4:10PM Disguised face detection and recognition under the complex background [#14434]

Jing Li, Bin Li, Yong Xu, Kaixuan Lu, Lunke Fei and Ke Yan, Harbin Institute of Technology Shenzhen Graduate School, China; Harbin Institute of Technology Shenzhen Graduate Schoool, China

In this paper, we propose an effective method for disguised face detection and recognition under the complex background. This method consists of two stages. The first stage determines whether the object is a person. In this stage, we propose the first-dynamic-then-static foreground object detection strategy. This strategy exploits the updated learning-based codebook model for moving object detection and uses the LBP + HOG feature-based head-shoulder detection for static target detection. The second stage determines whether the face is disguised and the classes of disguises. Experiments show that our method can detect disguised faces in real time under the complex background and achieve acceptable disguised face recognition rate.

4:30PM Adaptive Multi-Stream Score Fusion for Illumination Invariant Face Recognition [#14625]

Madeena Sultana, Marina Gavrilova, Reda Alhajj and Svetlana Yanushkevich, University of Calgary, Canada

Quality variations of samples significantly affect the performance of biometric recognition systems. In case of face recognition systems, illumination degradation is the most common contributor of enormous intra-class variation. Wavelet transforms are very popular techniques for face or object recognition from images due to their illumination insensitiveness. However, low and high frequency subbands of wavelet transforms do not possess equal insensitiveness to different degree of illumination change. In this paper, we investigated the illumination insensitiveness of the subbands of Dual-Tree Complex Wavelet Transform (DTCWT) at different scales. Based on the investigations, a novel face recognition system has been proposed using weighted fusion of low and high frequency subbands that can adapt extensive illumination variations and produces high recognition rate even with a single sample. A novel fuzzy weighting scheme has been proposed to determine the adaptive weights during uncertain illuminations conditions. In addition, an adaptive normalization approach has been applied for illumination quality enhancement of the poor lit samples while retaining the quality of good samples. The performance of the proposed adaptive method has

been evaluated on Extended Yale B and AR face databases. Experimental results exhibit significant performance improvement of the proposed adaptive face recognition approach over benchmark methods under extensive illumination change.

4:50PM Multi-Spectral Facial Biometrics in Access Control [#14639]

Kenneth Lai, Steven Samoil and Svetlana Yanushkevich, University of Calgary, Canada

This paper demonstrates how facial biometrics, acquired using multi-spectral sensors, such as RGB, depth, and infrared, assist the data accumulation in the process of authorizing users of automated and semi-automated access systems. This data serves the purposes of person authentication, as well as facial temperature estimation. We utilize depth data taken using an inexpensive RGB-D sensor, to find the head pose of a subject. This allows the selection of video frames containing a frontal-view head pose for face recognition and face temperature reading. Usage of the frontal-view frames improves the efficiency of face recognition while the corresponding synchronized IR video frames allow for more efficient temperature estimation for facial regions of interest. The examples of dialogue support protocols in the access authorization process are provided.

MCDM'14 Session 3: Applications

Thursday, December 11, 3:30PM-5:10PM, Room: Bonaire 1, Chair: Yaochu Jin, Juergen Branke and Mitsukuni Matayoshi

3:30PM Sustainability Status of Indian States: Application and Assessment of MCDM frameworks [#14855]

Nandita Sen, Akash Ghosh, Arnab Saha and Bhaskar Roy Karmaker, CAEPHT, Central Agricultural University , Ranipoool , Sikkim, India; RCC Institute Of Information Technology, Beliaghata, Kolkata, West Bengal, India; Global IDs, Sector V, Kolkata, West Bengal, India; C/O Shila Neopany, Ranipool, Sikkim, India

The evidence of UNDESA framework of sustainability assessment in MCDM paradigm is scarce generically and particularly, the status of sustainability of Indian states has never been assessed in accordance with UNDESA 2007 framework. This paper is an attempt to explore the paradigm of Multicriteria Decision Making (MCDM) Methods in construction of sustainability index. To do so, we have used methods namely, Simple Additive Weighted Sum (SAWM), ELECTRE II, TOPSIS, PROMETHEE on the United Nations CSD indicators framework to evaluate the sustainability status of different states of India, which is among the fastest growing countries of todays world. We also try to understand the relative stability and distributional property of sustainability ranks obtained by different states. The ranks obtained by the different Methods are found to be relatively stable in comparative aspect. This implies that the choice of method does not make a big difference if the policy makers are interested for a group of entities to reward the superiors and support the laggards. On the other hand, a comprehensible and tractable method can be recommended for policy practice instead of less comprehensible one. Of course, use of a compendium of MCDM methods is always preferable for robustness analysis in decision-analytic aspect.

3:50PM Evaluation of E-commerce System Trustworthiness Using Multi-criteria Analysis [#14885]

Lifeng Wang and Zhengping Wu, Department of Computer Science and Engineering University of Bridgeport, United States; Department of Computer Science and Engineering California State University at San Bernardino, United States

Trustworthiness is a very critical element and should be treated as an important reference when customers try to select proper e-commerce systems. Trustworthiness evaluation requires the management of a wide variety of information types, parameters and uncertainties. Multi-criteria decision analysis (MCDA) has been regarded as a suitable set of methods to perform trustworthiness evaluations as a result of its flexibility and the possibility. For making trustworthiness measurement simple and standardized, this paper proposes a novel trustworthiness measurement model based on multi-criteria decision analysis. Recently, a lot of great efforts have been carried out to develop decision making for evaluation of trustworthiness and reputation. However, these research works still stay on the stage of theoretical research. This paper proposes and implements a trustworthiness measurement model using multi-criteria decision making approach for e- commerce systems. Firstly, this paper recognizes trust factors of e-commerce systems and distributes the factors in our designed multi-dimensional trust space and trust trustworthiness measurement model. All relevant factors are filtered, categorized and quantified. Then, our designed multi-criteria analysis mechanism can deal with the trust factors and analyze their trust features from different perspectives. Finally, the evaluated trustworthiness result is provided. Meanwhile, we also have a knowledge learning based approach to improve the accuracy of the result. At the end of this paper, we have conducted several experiments to validate our designed trustworthiness measurement by involving real world data. Our evaluated trustworthiness result and real world data are matched very well.

4:10PM Nonlinear Programming Models and Method for Interval-Valued Multiobjective Cooperative Games [#14958]

Fei-Mei Wu and Deng-Feng Li, Minjiang University, China; Fuzhou University, China

The purpose of this paper is to develop a nonlinear programming method for solving a type of cooperative games in which there are multiple objectives and coalitions' values on objectives are expressed with intervals, which are called interval valued multiobjective cooperative games for short. In this method, we define the concepts of interval-valued cores of interval-valued multiobjective cooperative games and satisfactory degrees of comparing intervals with inclusion and/or overlap relations. The interval-valued cores can be computed by developing a new two-phase method based on the auxiliary nonlinear programming models. The proposed method can seek cooperative chances under the situations of inclusion and/or overlap relations of intervals in which the traditional interval ranking method may not always assure that the interval-valued cores exist. The feasibility and applicability of the developed method are illustrated with a real example.

4:30PM An Extended Bilevel Programming Model and Its Kth-Best Algorithm for Dynamic Decision Making in Emergency Situations [#14143]

Hong Zhou, Jie Lu and Guangquan Zhang, Univerity of Southern Queensland, Australia; University of Technology, Sydney, Australia

Linear bilevel programming has been studied for many years and applied in different domains such as transportation, economics, engineering, environment, and telecommunications. However, there is lack of attention of the impacts on dynamic decision making with abrupt or unusual events caused by unpredictable natural environment or human activities (e.g. Tsunami, earthquake, and malicious or terrorist attacks). In reality

these events could happens more often and have more significant impacts on decision making in an increasingly complex and dynamic world. This paper addresses this unique problem by introducing a concept of Virtual Follower (VF). An extended model of bilevel multi-follower programming with a virtual follower (BLMFP-VF) is defined and the kth-best algorithm for solving this problem is proposed. An example is given to illustrate the working of the extended model and approach.

4:50PM Partially Optimized Cyclic Shift Crossover for Multi-Objective Genetic Algorithms for the Multi-Objective Vehicle Routing Problem with Time-Windows [#14773]

Djamalladine Mahamat Pierre and Nordin Zakaria, High Performance Computing Center, Universiti Teknologi PETRONAS, Malaysia

The complexity of the Vehicle Routing Problems (VRPs) and their applications in our day to day life has garnered a lot of attentions in the area of optimization. Recently, attentions have turned to multi-objective VRPs with Multi-Objective Genetic Algorithms (MOGAs). MOGAs, thanks to its genetic operators such as selection, crossover, and/or mutation, constantly modify a population of solutions in order to find optimal solutions. However, given the complexity of VRPs, conventional crossover operators have major drawbacks. The Best Cost Route Crossover is lately gaining popularity in solving multi-objective VRPs. It employs a brute force approach to generate new children. Such approach may be unacceptable when presented with a relatively large problem instance. In this paper, we introduce a new crossover operator, called Partially Optimized Cyclic Shift Crossover (POCSX). A comparative study, between a MOGA based on POCSX, and a MOGA which is based on the Best Cost Route Crossover affirms the level of competitiveness of the former.

Special Session: RiiSS'14 Session 3: Human-centric Robotics I

Thursday, December 11, 3:30PM-5:10PM, Room: Bonaire 2, Chair: Takenori Obo

3:30PM Medical Interview Training Using Depressed Patient Robot in Psychiatric Education [#14387]

Takuya Hashimoto, Ryo Kurimoto, Hideyuki Nakane and Hiroshi Kobayashi, The University of Electro-Communications, Japan; Tokyo University of Science, Japan; Nagasaki University, Japan

This paper introduces a psychiatric patient robot that can be used for medical interview training in psychiatric education. The patient robot is developed based on an android robot. Medical interview training in psychiatric field is generally conducted by employing human simulated or standardized patient (SP) who is trained to portray symptoms of intended mental disorder by veteran psychiatrists. But there are some problems such as mental burden, time-consuming for training, the rack of human resource, and so forth In contrast, the merit of the patient robot is to offer standardized and reproducible interview training to psychiatric trainees. Furthermore, it is expected that psychiatric trainees are able to experience realistic medical interview as if they face to a real human SP by taking advantage of the characteristics of android robots. As the first step, the patient robot was particularly designed to portray symptoms of unipolar depression, because it is a major mental disorder of worldwide prevalence. The interview scenario, that is question and answer process between an interviewer and the patient robot, was prepared based on the "Structured Interview Guide for the Hamilton Depression Rating Scale (SIGH-D)" which is widely used for interview training and clinical studies. The medical interview training with patient robot was introduced in actual psychiatric education, and eight students participated and evaluated its educational effects.

3:50PM A Route Planning for Disaster Waste Disposal Based on Robot Technology [#14980]

Takahiro Takeda, Yuki Mori, Naoyuki Kubota and Yasuhiro Arai, Tokyo Metropolitan University, Japan

This paper describes a transportation management system for disaster wastes to support early recovery from great the effect of earthquakes and other natural disasters. The system consists of a route selection process and a waste allocation process. For the system, the simplification map is made from arterial roads, temporally storage yards and disposal facilities. And, a directed graph with traveling times and transportation distances of adjacent nodes was generated from the simplification map. The route selection process calculates path length between all pairs of nodes by Warshall-Floyd algorithm. The allocation process decides transportation amount for each disposal facility by linear programming method. In the experiment, we confirm our method is able to manage waste transportation by using a map that simulated south Tokyo. Our system selected the shortest route from a disaster waste source to the nearest disposal facility with related to traffic conditions. The system allocated simulated disaster wastes for the facilities in proper quantities.

4:10PM Fuzzy Neural Network based Activity Estimation for Recording Human Daily Activity [#14952]

Manabu Nii, Kazunobu Takahama, Takuya Iwamoto, Takafumi Matsuda, Yuki Matsumoto and Kazusuke Maenaka, University of Hyogo, Japan

We proposed a standard three-layer feedforward neural network based human activity estimation method. The purpose of the proposed method is to record the subject activity automatically. Here, the recorded activity includes not only actual accelerometer data but also rough description of his/her activity. In order to train the neural networks, we needed to prepare numerical datasets of accelerometer which are measured for every subject person. In this paper, we propose a fuzzy neural network based method for recording the subject activity. The proposed fuzzy neural network can handle both real and fuzzy numbers as inputs and outputs. Since the proposed method can handle fuzzy numbers, the training dataset can contain some general rules, for example, ``If x and y axis accelerometer outputs are almost zero and z axis accelerometer output is equal to acceleration of gravity then the subject person is standing.''

4:30PM Behavior Pattern Learning for Robot Partner based on Growing Neural Networks in Informationally Structured Space [#15062]

Takenori Obo and Naoyuki Kubota, Tokyo Metropolitan University, Japan

In this paper, we focus on human behavior estimation for human-robot interaction. Human behavior recognition is one of the most important techniques, because bodily expressions convey important and effective information for robots. This paper proposes a learning structure composed of two learning modules for feature extraction and contextual relation modeling, using Growing Neural Gas (GNG) and Spiking Neural Network (SNN). GNG is applied to the feature extraction of human behavior, and SNN is used to associate the features with verbal labels that robots can get through human-robot interaction. Furthermore, we show an experimental result, and discuss effectiveness of the proposed method.

Special Session: CIVTS'14 Session 3: Intelligent Vehicle Systems

Thursday, December 11, 3:30PM-5:10PM, Room: Bonaire 3, Chair: Yi Lu Murphey, Mahmoud Abou-Nasr, Ishwar K Sethi, Robert Karlsen, and Chaomin Luo

3:30PM Trust-Based Controller for Convoy String Stability [#14168]

Dariusz Mikulski, U.S. Army TARDEC, United States

This paper describes a trust-based vehicle controller that can be tuned to ensure decentralized string stability in a convoy. The controller leverages the RoboTrust algorithm to mitigate risks associated with trust-based vulnerabilities, such as cyber attacks, poor decisions, and malfunctions. In our scenario, we simulate a simple convoy mission in which twelve vehicles move together between waypoints, stopping at each waypoint before proceeding. We examine the decisions of the convoy leader at each waypoint and show how its behaviors can introduce spacing errors throughout the convoy column. We then show how the trust-based controller can modify the leader's behaviors and minimize the effect of error propagation and amplification in the convoy.

3:50PM Cloud Aided Semi-Active Suspension Control [#14405]

Zhaojian Li, Ilya Kolmanovsky, Ella Atkins, John Michelini, Jianbo Lu and Dimitar Filev, University of Michigan, United States; Ford Motor Company, United States

This paper considers the problem of vehicle suspension control from the perspective of a Vehicle-to-Cloud-to-Vehicle (V2C2V) distributed implementation. A simplified variant of the problem is examined based on the linear quarter-car model of semi-active suspension dynamics. Road disturbance is modeled as a combination of a known road profile, an unmeasured stochastic road profile and potholes. Suspension response when the vehicle hits the pothole is modeled as an impulsive change in wheel velocity with magnitude linked to physical characteristics of the pothole and the vehicle. The problem of selecting the optimal damping mode from a finite set of damping modes is considered, based on road profile data. The information flow and V2C2V implementation are defined based on partitioning the computations and data between the vehicle and the cloud. A simulation example is presented.

4:10PM Exploring the Mahalanobis-Taguchi Approach to Extract Vehicle Prognostics and Diagnostics [#14929]

Michael Gosnell and Robert Woodley, 21st Century Systems, Inc, United States

Army logistical systems and databases contain massive amounts of data that require effective methods of extracting actionable information and generating knowledge. Vehicle diagnostics and prognostics can be challenging to analyze from the Command and Control (C2) perspective, making management of the fleet difficult within existing systems. Databases do not contain root causes or the case-based analyses needed to diagnose or predict breakdowns. 21st Century Systems, Inc. previously introduced the Agent-Enabled Logistics Enterprise Intelligence System (AELEIS) to assist logistics analysts with assessing the availability and prognostics of assets in the logistics pipeline. One component being developed within AELEIS is incorporation of the Mahalanobis-Taguchi System (MTS) to assist with identification of impending fault conditions along with fault identification. This paper presents an analysis into the application of MTS within data representing a known vehicular fault, showing how construction of the Mahalanobis Space using competing methodologies can lead to reduced false positives while still capturing true positive fault conditions. These results are then discussed within the larger scope of AELEIS and the resulting C2 benefits.

4:30PM Robust Obstacle Segmentation based on Topological Persistence in Outdoor Traffic Scenes [#14402]

Chunpeng Wei, Qian Ge, Somrita Chattopadhyay and Edgar Lobaton, North Carolina State University, United States

In this paper, a new methodology for robust segmentation of obstacles from stereo disparity maps in an onroad environment is presented. We first construct a probability of the occupancy map using the UV- disparity methodology. Traditionally, a simple threshold has been applied to segment obstacles from the occupancy map based on the connectivity of the resulting regions; however, this outcome is sensitive to the choice of parameter value. In our proposed method, instead of simple thresholding, we perform a topological persistence analysis on the constructed occupancy map. The topological framework hierarchically encodes all possible segmentation results as a function of the threshold, thus we can identify the regions that are most persistent. This leads to a more robust segmentation. The approach is analyzed using real stereo image pairs from standard datasets.

4:50PM An Effective Search and Navigation Model to an Auto-Recharging Station of Driverless Vehicles [#14279]

Chaomin Luo, Yu-Ting Wu, Mohan Krishnan, Mark Paulik, Gene Eu Jan and Jiyong Gao, Department of Electrical and Computer Engineering, University of Detroit Mercy, United States; Institute of Electrical Engineering, National Taipei University, Taiwan, Taiwan

An electric vehicle auto-recharging station is a component in an infrastructure supplying electric energy for the recharging of plug-in electric vehicles. An auto-recharging station is usually accessible to an autonomous driverless vehicle driven by intelligent algorithms. A driverless vehicle is assumed to be capable of autonomously searching and navigating it into a recharging station. In this paper, a novel hybrid intelligent system is developed to navigate an autonomous vehicle into a recharging station. The driverless vehicle driven by D*Lite path planning methodology in conjunction with a Vector Field Histogram (VFH) local navigator is developed for search and navigation purpose to reach an auto-recharging station with obstacle avoidance. Once it approaches vicinity of the recharging station, the driverless vehicle should be directed at the recharging station at a proper angle, which is accomplished by a Takagi-Sugeno fuzzy logic model. A novel error control of angle and distance heuristic approach is proposed to adjust the vehicle straight at the recharging station. Development of the driverless vehicle in terms of hardware and software design is described. Simulation studies on the Player/Stage platform demonstrate that the proposed model can successfully guide an autonomous driverless vehicle into the recharging station. Experimental effort shows its promising results that the driverless vehicle is able to autonomously navigate it to an auto-recharging station.

CIES'14 Session 3: Applications I

Thursday, December 11, 3:30PM-5:10PM, Room: Bonaire 4, Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse

3:30PM From Offline to Onboard System Solution for a Control Sequence Optimization Problem [#14995]

Jin Huang, Xibin Zhao, Xinjie Chen, Qinwen Yang and Jiaguang Sun, Tsinghua University, China; Hunan University, China

The control sequence optimization problem is difficult to solve due to its high nonlinearity, various constraints and the possible changing of the sequence elements at any instant of time. The optimization of train trip running profile is a typical control sequence optimization problem, whose optimization object is to minimize the energy consumption as well as the time deviation under various constraints. Engineers always have to face the trade-off between the optimization performance and calculation time for an onboard control system for such problems. The current literature mainly proposed a frame of an offline to onboard system solution for control sequence optimization problems, specifically using on the train trip profile optimization problems. The frame choose the parameter-decision tree solution for the onboard control system, and then a serial offline process including sequence mining, optimal computation, and machine learning is proposed for getting the parameter-decision tree. The framework inherits the good optimization performance of offline systems, as well as guaranteed the onboard calculation time for real-time control. Performance on using such a frame for solving train trip profile optimization problems is shown in the literature, which shows the potentials of using such frames on solving related control sequence optimization problems.

3:50PM GA optimized time delayed feedback control of chaos in a memristor based chaotic circuit [#14378]

Sanju Saini and Jasbir Singh Saini, Asstt. Professor, Electrical Engineering Department D.C.R. University of Sci. and Tech. Murthal, Sonepat (Haryana), India, India; Professor and Dean of Colleges, EED D.C.R. University of Sci. and Tech. Murthal, Sonepat (Hr.), India, India

-- A nonlinear system in a chaotic state may be harmful due to its extreme sensitivity to its initial condition and irregularity in behavior. This paper addresses the problem of controlling chaos in a memristor based chaotic circuit using time delayed feedback method. Genetic algorithm has been used as a search tool to optimize the feedback path gain. Extensive computer simulations, demonstrate that successful chaos control can be achieved by using this scheme, leading the system's chaotic state towards a fixed point or sustained oscillations depending on the range of feedback gain values.

4:10PM A graph-based signal processing approach for low-rate energy disaggregation [#14476]

Vladimir Stankovic, Jing Liao and Lina Stankovic, University of Strathclyde, United Kingdom

Graph-based signal processing (GSP) is an emerging field that is based on representing a dataset using a discrete signal indexed by a graph. Inspired by the recent success of GSP in image processing and signal filtering, in this paper, we demonstrate how GSP can be applied to non-intrusive appliance load monitoring (NALM) due to smoothness of appliance load signatures. NALM refers to disaggregating total energy consumption in the house down to individual appliances used. At low sampling rates, in the order of minutes, NALM is a difficult problem, due to significant random noise, unknown base load, many household appliances that have similar power signatures, and the fact that most domestic appliances (for example, microwave, toaster), have usual operation of just over a minute. In this paper, we proposed a different NALM approach to more traditional approaches, by representing the dataset of active power signatures using a graph signal. We develop a regularization on graph approach where by maximizing smoothness of the underlying graph signal, we are able to perform disaggregation. Simulation results using publicly available REDD dataset demonstrate potential of the GSP for energy disaggregation and competitive performance with respect to more complex Hidden Markov Model-based approaches.

4:30PM Neural Networks for Prediction of Stream Flow based on Snow Accumulation [#14701]

Sansiri Tarnpradab, Kishan Mehrotra, Chilukuri Mohan and David Chandler, Syracuse University, United States

This study aims to improve stream-ow forecast at Reynolds Mountain East watersheds, which is located at the southernmost of all watersheds in Reynolds Creek Experimental Watershed Idaho, USA. Two separate models, one for the annual data and the other for the seasonal (April-June) data from 1983- 1995 are tested for their predictability. Due to the difficulties in collecting data during winter months, in particular the snow water equivalent (SWE), this study evaluates the impact of excluding this variable. Our results show that multilayer perceptrons (MLP) and support vector machines (SVM) are more suitable for modeling the data. The results also reveal that the difference between stream-ow forecast via annual and seasonal models is insignicant and for longer term predictions SWE is a strong driver in the stream-ow forecast. Principal Component Analysis (PCA) and Particle Swarm Optimization (PSO) are also used in this study to identify useful features. The results from PCA derived models show that PCA helps reduce prediction error and the results are more stable than using models without PCA. PSO also improved results; however, the set of selected attributes by PSO is less believable than given by PCA. The best prediction is achieved when MLP model is implemented with attributes generated by PCA.

4:50PM A Survey on the Application of Neural Networks in the Safety Assessment of Oil and Gas Pipelines [#15013]

Mohamed Layouni, Sofiene Tahar and Mohamed Salah Hamdi, Concordia University, Canada; Ahmed Bin Mohammed Military College, Qatar

Pipeline systems are an essential component of the oil and gas supply chain today. Although considered among the safest transportation methods, pipelines are still prone to failure due to corrosion and other types of defects. Such failures can lead to serious accidents resulting in big losses to life and the environment. It is therefore crucial for pipeline operators to reliably detect pipeline defects in an accurate and timely manner. Because of the size and complexity of pipeline systems, however, relying on human operators to perform the inspection is not possible. Automating the inspection process has been an important goal for the pipeline industry for a number of years. Significant progress has been made in that regard, and available techniques combine analytical modeling, numerical computations, and machine learning. This paper presents a survey of state-of-the-art methods used to assess the safety of the oil and gas pipelines. The paper explains the principles behind each method, highlights the setting where each method is most effective, and shows how several methods can be combined to achieve a higher level of accuracy.

ISIC'14 Session 3: Independent Computing III

Thursday, December 11, 3:30PM-5:10PM, Room: Bonaire 5, Chair: Junbo Wang

3:30PM A Concept Model of 'Two-Ties-Aware' and Design of a Discovery Engine based on User Experienced Bigdata [#14600]

Junbo Wang, Yilang Wu and Zixue Cheng, The University of Aizu, Japan

IoT/Bigdata is a hot research topic all over the world in recent years and is expecting to change the world greatly in the near future. Comparing with the data in traditional websites, Bigdata from IoT devices have 4 big Vfeatures, i.e., volume, velocity, variety, and veracity. Due to the above four features, it is hard to provide timely services to users by data analysis, especially with the great growth of data types, volume and so on. Data should be able to aware situations/demands of users, and automatically be adjusted for discovering the situations/demands of users'. Therefore, in this paper, we propose a two-ties-aware mechanism for Bigdata management and analysis. The first-tie-aware is to automatically grasp the situations around the user, and encapsulate the situation together when data is generated. The second-tie-aware is to automatically change the data to fit users' situations/demands. Furthermore, we propose a novel discovery algorithm based on the two-tiles-aware model. Given the user inputs from their ambiguous memory fragments, the discovery algorithm tries to discover the truly wanted information. Currently, the system is going to be implemented based on some open sources.

3:50PM The Development of a Multi-Piecewise-Based Thinning Description Method [#14608]

Wen-Chang Cheng, Dep. of Computer Science and Information Engineering, Chaoyang University of Technology, Taiwan

In this study, we proposed a multi-piecewise thinning description method. Thinning is a preprocessing technology often applied in the fields of binary image processing; it is used to transform thick elements in an image into lines with a single pixel width. Because lines include closed and open lines, an effective description method is required for post-processing procedures. Regarding the proposed method, branch points of thinning lines are first identified and used as a basis for segmenting the lines, which are originally connected, into multiple line segments. Subsequently, we employed the find contour function available in the OpenCV library to describe the coordinates of the contours of the line segments. The starting and endpoints of closed lines can be directly obtained using the contour results of closed lines. By contrast, the starting and endpoints of open lines are achieved by first using turning points to confirm the position of line-end points and employing the adjacent pixels of the line-end and branch points before the contour results of open lines can be used. The experimental results indicated that the proposed method effectively achieved accurate descriptions for thinned lines.

4:10PM Development of A Control System for Home Appliances Based on BLE Technique [#14669]

Junbo Wang, Lei Jing, Zixue Cheng, Yinghui Zhou and Yilang Wu, University of Aizu, Japan

Recently, in Internet of Things field, cooperation between smartphone and home appliances becomes important and popular. Especially, smart phones equipped with Bluetooth4.0 can reduce the power consumption, increase connectable devices, and promote the cooperation between things and smart terminals. Currently, many smartphone-based control system for home appliances have appeared by combining 3G and Wi-Fi technology. However, the problem of using Wi-Fi is big power consumption, and difficult for minimization. In addition, some methods adopt Infrared in smartphone to control appliances. But many smartphones have no Infrared ready, and have to set up many processes to use. Compared with the above approaches, BLE can resolve those problems. BLE has the advantages of low-power consumption, minimization, and ready reminding service. In this paper, we develop a smartphone-based appliance control system based on BLE. The system has a dynamic control menu that can scan any appliance around a user at anywhere. Meanwhile, we develop a device named "Middle- Device" for the communication between smartphone and appliances using Arduino, because Arduino is popular, easy to be used for hardware programming, and better extensibility by attaching a function board called "Shield" with many functions such as Wi-Fi, ZigBee, Bluetooth, and etc.

4:30PM Topological Approaches to Locative Prepositions [#14927]

Ikumi Imani and Itaru Takarajima, Nagoya Gakuin Univeristy, Japan; Nagoya Gakuin Univesity, Japan

It is well-known that locative prepositions are used to make temporal expressions, and that they have been intensively studied in theoretical, cognitive and psycho-linguistics. However, there have been few attempts to develop a theoretical framework to deal with linguistic data on the locative prepositions (see Pinon (1997), Zwarts and Winter (1997) and Zwarts (2000) for a vector semantics to capture parallelism between aspects and a certain kind of locative prepositions). There are two purposes in this paper. One is to investigate prepositions "in," "on," "at" and "from-to" in English that have correlations between space and time, and show how the topological properties of the locative prepositions are preserved in temporal expressions. The other purpose is to develop a theoretical framework, or what we call a "topological approach" to natural languages, in which we use topological concepts such as spaces, paths and dimensions to analyze the linguistic data.

4:50PM Word Sense Disambiguation using Author Topic Model [#14684]

Shougo Kaneishi and Takuya Tajima, Fukuoka Institute of Technology FIT, Japan

Purpose of this paper is what decrease situations of misleading in text, blog, tweet etc.. We use Latent Dirichlet Allocation (LDA) for Word Sense Disambiguation (WSD). This paper experiments with a new approaches for WSD. The approach is WSD with author topic model. The availability of this approach is exerted on modeling of sentence on the Twitter. In this study, first flow is author estimate, and second flow is WSD. In the first flow, we use LDA topic modeling and dataset from novels in Japanese. We use collapsed Gibbs sampling as the estimated method for parameter of LDA. In the second flow, we use the dataset from the tweet on Twitter. By the two experiments, author topic model is found to be useful for WSD.

FOCI'14 Session 3: Neural Networks

Thursday, December 11, 3:30PM-5:10PM, Room: Bonaire 6, Chair: Leonardo Franco

3:30PM Explicit Knowledge Extraction in Information-Theoretic Supervised Multi-Layered SOM [#14634]

Ryotaro Kamimura, Tokai univerisity, Japan

In this paper, we examine the effectiveness of SOM knowledge to train multi- layered neural networks. We have known that the SOM can produce very rich knowledge, used for visualization and class structure interpretation. It is expected that this SOM knowledge can be used for many different purposes in addition to visualization and interpretation. By using more flexible information- theoretic SOM, we examine the effectiveness of SOM knowledge for training multi- layered networks. We applied the method to the spam mail identification problem. We found that SOM knowledge greatly facilitated the learning of multi-layered networks and could be used to improve generalization performance.

3:50PM Adaptive Particle Swarm Optimization Learning in a Time Delayed Recurrent Neural Network for Multi-Step Prediction [#14275]

Kostas Hatalis, Basel Alnajjab, Shalinee Kishore and Alberto Lamadrid, Lehigh University, United States

In this study we propose the development of an adaptive particle swarm optimization (APSO) learning algorithm to train a non-linear autoregressive (NAR) neural network, which we call PSONAR, for short term time series prediction of ocean wave elevations. We also introduce a new stochastic inertial weight to the APSO learning algorithm. Our work is motivated by the expected need for such predictions by wave energy farms. In particular, it has been shown that the phase resolved predictions provided in this paper could be used as inputs to novel control methods that hold promise to at least double the current efficiency of wave energy converter (WEC) devices. As such, we simulated noisy ocean wave heights for testing. We utilized our PSONAR to get results for 5, 10, 30, and 60 second multistep predictions. Results are compared to a standard backpropagation model. Results show APSO can outperform backpropagation in training a NAR neural network.

4:10PM Attractor Flow Analysis for Recurrent Neural Network with Back-to-Back Memristors [#14207]

Gang Bao and Zhigang Zeng, college of Electrical Engineering and New Energy, China Three Gorges University, China; School of Automation, Huazhong University of Science and Technology, China

Memristor is a nonlinear resistor with the character of memory and is proved to be suitable for simulating synapse of neuron. This paper introduces two memristors in series with the same polarity (back-to-back) as simulator for neuron's synapse and presents the model of recurrent neural networks with such back-to-back memristors. By analysis techniques and fixed point theory, some sufficient conditions are obtained for recurrent neural network having single attractor flow and multiple attractors flow. At last, simulation with numeric examples verify our results.

4:30PM Fingerprint multilateration for automatically classifying evolved Prisoner's Dilemma agents [#14835]

Jeffrey Tsang, University of Guelph, Canada

We present a novel tool for automatically analyzing evolved Prisoner's Dilemma agents, based on combining two existing techniques: fingerprinting, which turns a strategy into a representation-independent functional summary of its behaviour, and multilateration, which finds the location of a point in space using measured distances to a known set of anchor points. We take as our anchor points the space of 2-state deterministic transducers; using this, we can emplace an arbitrary strategy into 7-dimensional real space by computing numerical integrals and solving a set of linear equations, which is sufficiently fast to be doable online. Several new aspects of evolutionary behaviour, such as the velocity of evolution and population diversity, can now be directly quantified.

4:50PM Visual Analytics for Neuroscience-Inspired Dynamic Architectures [#14751]

Margaret Drouhard, Catherine Schuman, J. Douglas Birdwell and Mark Dean, University of Tennessee, Knoxville, United States

We introduce a visual analytics tool for neuroscience-inspired dynamic architectures (NIDA), a network type that has been previously shown to perform well on control, anomaly detection, and classification tasks. NIDA networks are a type of spiking neural network, a non-traditional network type that captures dynamics throughout the network. We demonstrate the utility of our visualization tool in exploring and understanding the structure and activity of NIDA networks. Finally, we describe several extensions to the visual analytics tool that will further aid in the development and improvement of NIDA networks and their associated design method.

EALS'14 Session 3: Techniques for Learning Systems

Thursday, December 11, 3:30PM-5:10PM, Room: Bonaire 7, Chair: Plamen Angelov

3:30PM RTSDE: Recursive Total-Sum-Distances-based Density Estimation Approach and its Application for Autonomous Real-Time Video Analytics [#14249]

Plamen Angelov and Ashley Wilding, Lancaster University, United Kingdom

In this paper, we propose a new approach to data density estimation based on the total sum of distances from a data point, and the recently introduced Recursive Density Estimation technique. It is suitable for autonomous real-time video analytics problems, and has been specifically designed to be executed very fast; it uses integer-only arithmetic with no divisions and no floating point numbers (no FLOPs), making it particularly useful in situations where a hardware floating point unit may not be available, such as on embedded hardware and digital signal processors, allowing for high definition video to be processed for novelty detection in real-time.

3:50PM Self-learning Data Processing Framework Based on Computational Intelligence: Enhancing Autonomous Control by Machine Intelligence [#14329]

Prapa Rattadilok and Andrei Petrovski, Robert Gordon University, United Kingdom

A generic framework for evolving and autonomously controlled systems has been developed and evaluated in this paper. A three-phase approach aimed at identification, classification of anomalous data and at prediction of its consequences is applied to processing sensory inputs from multiple data sources. An ad-hoc activation of sensors and processing of data minimises the quantity of data that needs to be analysed at

any one time. Adaptability and autonomy are achieved through the combined use of statistical analysis, computational intelligence and clustering techniques. A genetic algorithm is used to optimise the choice of data sources, the type and characteristics of the analysis undertaken. The experimental results have demonstrated that the framework is generally applicable to various problem domains and reasonable performance is achieved in terms of computational intelligence accuracy rate. Online learning can also be used to dynamically adapt the system in near real time.

4:10PM Distributed GAs with Case-Based Initial Populations for Real-Time Solution of Combinatorial Problems [#14290]

Kawabe Takashi, Masaki Suzuki, Matsumaru Taro, Yamamoto Yukiko, Setsuo Tsuruta, Yoshitaka Sakurai and Rainer Knauf, Tokyo Denki University, Japan; Meiji University, Japan; Ilmenau University of Technology, Germany

Combinatorial problems are NP-complete, which means even infinite number of CPUs take polynomial time to search an optimal solution. Therefore approximate search algorithms such as Genetic Algorithms are used. However, such an approximate search algorithm easily falls into local optimum and just distributed / parallel processing seems inefficient. In this paper, we introduce distributed GAs, which compute their initial population in a case-based manner and compose their upcoming generations by the particular GAs, which exchange their solutions and make their individual decisions, when composing a next generation based on the fitness of the candidates and diversity issues.

4:30PM Heuristic Generation via Parameter Tuning for Online Bin Packing [#14392]

Ahmet Yarimcam, Shahriar Asta, Ender Ozcan and Andrew J. Parkes, University of Nottingham, United Kingdom

Online one-dimensional bin packing problem is a variant of the well-known bin packing for which decisions have to be made immediately to place each incoming item into bins of fixed capacity without causing any overflow, and so as to maximise the average bin fullness after placement of all items. A recent work presented an approach for solving this problem based on a 'policy matrix' representation in which each decision option is independently given a value and the highest value option is selected. A policy matrix can also be viewed as a heuristic with many parameters and then the search for a good policy matrix can be treated as a parameter tuning process. We show that the Irace parameter tuning algorithm produces heuristics which outperform the standard human designed heuristics for various instances of the online bin packing problem.

4:50PM Evolving Maximum Likelihood Clustering Algorithm [#14938]

Orlando Donato Rocha Filho and Ginalber Serra, IFMA, Brazil

This paper proposes an online evolving fuzzy clustering algorithm based on maximum likelihood estimator. In this methodology, the distance from a point to center of the cluster is computed by maximum likelihood similarity of data. The mathematical formulation is developed from the Takagi--Sugeno (TS) fuzzy inference system. The performance and application of the proposed methodology is based on prediction of the Box-Jenkins (Gas Furnace) time series. Computational results of a comparative analysis with other methods widely cited in the literature illustrates the effectiveness of the proposed methodology.

CIMSIVP'14 Session 6: Algorithms III

Thursday, December 11, 3:30PM-5:10PM, Room: Bonaire 8, Chair: Biovanna Castellano

3:30PM Manifold Learning Approach to Curve Identification with Applications to Footprint Segmentation [#14456]

Namita Lokare, Qian Ge, Wesley Snyder, Zoe Jewell, Sky Allibhai and Edgar Lobaton, North Carolina State University, United States; Duke University, United States

Recognition of animals via images of their footprints is a non-invasive technique recently adopted by researchers interested in monitoring endangered species. One of the challenges that they face is the extraction of features from these images, which are required for this approach. These features are points along the boundary curve of the footprints. In this paper, we propose an innovative technique for extracting these curves from depth images. We formulate the problem of identification of the boundary of the footprint as a pattern recognition problem of a stochastic process over a manifold. This methodology has other applications on segmentation of biological tissue for medical applications and tracking of extreme weather patterns. The problem of pattern identification in the manifold is posed as a shortest path problem, where the path with the smallest cost is identified as the one with the highest likelihood to belong to the stochastic process. Our methodology is tested in a new dataset of normalized depth images of tiger footprints with ground truth selected by experts in the field.

3:50PM Self-Localization Method for Three-dimensional Handy Scanner Using Multi Spot Laser [#14213]

Kumiko Yoshida and Kikuhito Kawasue, University of Miyazaki, Japan

On the computer vision system, if the shape of the object includes complex parts, unmeasurable area exists for occlusions of the part on its surface in many cases. The area where camera can observe in a frame is also limited and the limitation causes the unmeasurable area. In order to reduce the unmeasurable area, scanning of the measurement device is required. Many numbers of views of each model from different position (orientation) have to be taken to reconstruct the whole shape of the model. The point cloud data (surface data) obtained by the measurement device are connected to reconstruct the model. The connection of the data is executed by considering the movement of the measurement system (Self-localization) or using ICP (Iterative Closest Point) algorism. Accuracy of the connection influences the result of the model reconstructions. Reliable and accurate self-localization of measurement device is introduced in this paper.

4:10PM Clustering and Visualization of Geodetic Array Data Streams using Self-Organizing Maps [#14407]

Razvan Popovici, Razvan Andonie, Walter Szeliga, Tim Melbourne and Craig Scrivner, Altair Engineering Inc., Troy, MI, United States; Central Washington University, Computer Science Department, United States; Central Washington University, Department of Geological Sciences, United States

The Pacific Northwest Geodesic Array at Central Washington University collects telemetered streaming data from 450 GPS stations. These real-time data are used to monitor and mitigate natural hazards arising from earthquakes, volcanic eruptions, landslides, and coastal sea-level hazards in the Pacific Northwest. Recent improvements in both accuracy of positioning measurements and latency of terrestrial data communication have led to the ability to collect data with higher sampling rates. For seismic monitoring applications, this means 1350 separate position streams from stations located across 1200 km along the West Coast of North America must be able to be both visually observed and

automatically analyzed at a sampling rate of up to 1 Hz. Our goal is to efficiently extract and visualize useful information from these data streams. We propose a method to visualize the geodetic data by clustering the signal types with a Self-Organizing Map (SOM). The similarity measure in the SOM is determined by the similarity of signals received from GPS stations. Signals are transformed to symbol strings, and the distance measure in the SOM is defined by an edit distance. The symbol strings represent data streams and the SOM is dynamic. We overlap the resulted dynamic SOM on the Google Maps representation.

4:30PM Incremental Semi-Supervised Fuzzy Clustering for Shape Annotation [#15067]

Giovanna Castellano, Anna Maria Fanelli and Maria Alessandra Torsello, University of Bari "Aldo Moro", Italy

In this paper, we present an incremental clustering approach for shape annotation, which is useful when new sets of images are available over time. A semi-supervised fuzzy clustering algorithm is used to group shapes into a number of clusters. Each cluster is represented by a prototype that is manually labeled and used to annotate shapes belonging to that cluster. To capture the evolution of the image set over time, the previously discovered prototypes are added as pre-labeled objects to the current shape set and semi-supervised clustering is applied again. The proposed incremental approach is evaluated on two benchmark image datasets, which are divided into chunks of data to simulate the progressive availability of images during time.

Special Session: ADPRL'14 Online Learning Control Algorithms Based on ADP for Uncertain Dynamic Systems

Thursday, December 11, 3:30PM-5:10PM, Room: Curacao 1, Chair: Xin Xu and Yanhong Luo

3:30PM Pseudo-MDPs and Factored Linear Action Models [#14612]

Hengshuai Yao, Csaba Szepesvari, Bernardo Avila Pires and Xinhua Zhang, University of Alberta, Canada; National ICT Australia, Australia

In this paper we introduce the concept of pseudo-MDPs to develop abstractions. Pseudo-MDPs relax the requirement that the transition kernel has to be a probability kernel. We show that the new framework captures many existing abstractions. We also introduce the concept of factored linear action models; a special case. Again, the relation of factored linear action models and existing works are discussed. We use the general framework to develop a theory for bounding the suboptimality of policies derived from pseudo-MDPs. Specializing the framework, we recover existing results. We give a least-squares approach and a constraint optimization approach of learning the factored linear model as well as efficient computation methods. We demonstrate that the constraint optimization approach gives better performance than the least-squares approach with normalization.

3:50PM Event-based Optimal Regulator Design for Nonlinear Networked Control Systems [#14622]

Avimanyu Sahoo, Hao Xu and Sarangapani Jagannathan, Missouri University of Science and Technology, United States; College of Science and Engineering, Texas A and M University-Corpus Christi,, United States

This paper presents a novel stochastic event-based near optimal control strategy to regulate a networked control system (NCS) represented as an uncertain nonlinear continuous time system. An online stochastic actor- critic neural network (NN) based approach is utilized to achieve the near optimal regulation in the presence of network constraints, such as, network induced time-varying delays and random packet losses under event-based transmission of the feedback signals. The transformed nonlinear NCS in discrete-time after the incorporation the delays and packet losses is utilized for the actor-critic NN based controller design. To relax the knowledge of the control coefficient matrix, a NN based identifier is used. Event sampled state vector is utilized as NN inputs and their respective weights are updated non-periodically at the occurrence of events. Further, an event-trigger condition is designed by using the Lyapunov technique to ensure ultimate boundedness of all the closed-loop signals and save network resources and computation. Moreover, policy and value iterations are not utilized for the stochastic optimal regulator design. Finally, the analytical design is verified by using a numerical example by carrying out Monte-Carlo simulations.

4:10PM Adaptive Fault Identification for a Class of Nonlinear Dynamic Systems [#14268]

Li-Bing Wu, Dan Ye and Xin-Gang Zhao, Northeastern University, China; Shenyang Institute of Automation, CAS, China

TThis paper is concerned with the diagnosis problem of actuator faults for a class of nonlinear systems. It is assumed that the upper bound of the Lipschtiz constant of the nonlinearity in the faulty system is unknown. Then, a new nonlinear observer for fault diagnosis based on an adaptive estimator is proposed. Moreover, by making use of the designed adaptive observer with on-line update control law without sigma-modification condition to approximate the faulty system, it is proved that the estimate error of the adaptive control parameter, the output observation error and the error between the system fault and the corresponding estimate value are uniformly ultimately bounded via Lyapunov stability analysis. Finally, simulation examples are provided to illustrate the efficiency of the proposed fault identification approach.

4:30PM Adaptive Dynamic Programming for Discrete-time LQR Optimal Tracking Control Problems with Unknown Dynamics [#14281]

Yang Liu, Yanhong Luo and Huaguang Zhang, Northeastern University, China

In this paper, an optimal tracking control approach based on adaptive dynamic programming (ADP) algorithm is proposed to solve the linear quadratic regulation (LQR) problems for unknown discrete-time systems in an online fashion. First, we convert the optimal tracking problem into designing infinite horizon optimal regulator for the tracking error dynamics based on the system transformation. Then we expand the error state equation by the history data of control and state. The iterative ADP algorithm of policy iteration (PI) and value iteration (VI) are introduced to solve the value function of the controlled system. It is shown that the proposed ADP algorithm solves the LQR without requiring any knowledge of the system dynamics. The simulation results show the convergence and effectiveness of the proposed control scheme.

4:50PM Neural-Network-Based Adaptive Dynamic Surface Control for MIMO Systems with Unknown Hysteresis [#14681]

Lei Liu, Zhanshan Wang and Zhengwei Shen, College of Information Science and Engineering, Northeastern University, China

This paper focuses on the composite adaptive tracking control for a class of nonlinear multiple-input-multiple-output (MIMO) systems with unknown backlash-like hysteresis nonlinearities. A dynamic surface control method is incorporated into the proposed control strategy to eliminate the problem of explosion of complexity. Compared with some existing methods, the prediction error between system state and serial-parallel estimation model is combined with compensated tracking error to construct the adaptive laws for neural network (NN) weights. It is shown that the proposed control approach can guarantee that all the signals of the resulting closed-loop systems are semi-globally uniformly ultimately bounded and the tracking error converges to a small neighborhood. Finally, simulation results are provided to confirm the effectiveness of the proposed approaches.

CIDM'14 Session 6: Rule based Modelling, Model Performance, and Interpretability

Thursday, December 11, 3:30PM-5:10PM, Room: Curacao 2, Chair: Oliver Schulte

3:30PM Optimization of the Type-1 and Interval Type-2 Fuzzy Integrators in Ensembles of ANFIS models for Prediction of the Dow Jones Time Series [#14169]

Jesus Soto, Patricia Melin and Oscar Castillo, Tijuana Institute of Technology, Mexico

This paper describes the optimization of interval type-2 fuzzy integrators in Ensembles of ANFIS (adaptive neuro-fuzzy inferences systems) models for the prediction of the Dow Jones time series. The Dow Jones time series is used to the test of performance of the proposed ensemble architecture. We used the interval type-2 and type-1 fuzzy systems to integrate the output (forecast) of each Ensemble of ANFIS models. Genetic Algorithms (GAs) were used for the optimization of membership function parameters of each interval type-2 fuzzy integrators. In the experiments we optimized Gaussian, Generalized Bell and Triangular membership functions parameter for each of the fuzzy integrators, thereby increasing the complexity of the training. Simulation results show the effectiveness of the proposed approach.

3:50PM Accurate and Interpretable Regression Trees using Oracle Coaching [#14410]

Ulf Johansson, Cecilia Sonstrod and Rikard Konig, University of Boras, Sweden

In many real-world scenarios, predictive models need to be interpretable, thus ruling out many machine learning techniques known to produce very accurate models, e.g., neural networks, support vector machines and all ensemble schemes. Most often, tree models or rule sets are used instead, typically resulting in significantly lower predictive performance. The overall purpose of oracle coaching is to reduce this accuracy vs. comprehensibility trade-off by producing interpretable models optimized for the specific production set at hand. The method requires production set inputs to be present when generating the predictive model, a demand fulfilled in most, but not all, predictive modeling scenarios. In oracle coaching, a highly accurate, but opaque, model is first induced from the training data. This model ("the oracle") is then used to label both the training instances and the production instances. Finally, interpretable models are trained using different combinations of the resulting data sets. In this paper, the oracle coaching produces regression trees, using neural networks and random forests as oracles. The experiments, using 32 publicly available data sets, show that the oracle coaching leads to significantly improved predictive performance, compared to standard induction. In addition, it is also shown that a highly accurate opaque model can be successfully used as a preprocessing step to reduce the noise typically present in data, even in situations where production inputs are not available. In fact, just augmenting or replacing training data with another copy of the training set, but with the predictions from the opaque model as targets, produced significantly more accurate and/or more compact regression trees.

4:10PM Product Aspect Identification: Analyzing Role of Different Classifiers [#14670]

Xing Yu, Sukanya Manna and Brian N Truong, California State Polytechnic University, Pomona, United States

With the rapid advancement of eCommerce, it has become a common trend for customers to write reviews about any product they purchase. For certain popular products, such as cell phones, laptops, tablets, the number of reviews can be hundreds or even thousands, making it difficult for potential customers to identify specific aspect based overview of the product (for example, screen, camera, battery etc). This paper studies different classifiers for aspect identification from unlabeled free-form textual customer reviews. Firstly, a multi-aspect classification is proposed to learn implicit and explicit aspect-related context from the reviews for aspect identification, which does not require any manually labeled training data. Secondly, extensive experiments for analyzing the effectiveness of classifiers and feature selection for aspect identification have also been shown. The results of our experiments on smartphone reviews from Amazon show that Support Vector Machine's accuracy in aspect identification is best, followed by Random Forest and Naive Bayes.

4:30PM Rule Extraction using Genetic Programming for Accurate Sales Forecasting [#14875]

Rikard Konig and Ulf Johansson, University of Boras, Sweden

The purpose of this paper is to propose and evaluate a meth-od for reducing the inherent tendency of genetic programming to overfit small and noisy data sets. In addition, the use of different optimization criteria for symbolic regression is demonstrated. The key idea is to reduce the risk of overfitting noise in the training data by introducing an intermediate predictive model in the pro-cess. More specifically, instead of directly evolving a genetic re-gression model based on labeled training data, the first step is to generate a highly accurate ensemble model. Since ensembles are very robust, the resulting predictions will contain less noise than the original data set. In the second step, an interpretable model is evolved, using the ensemble predictions, instead of the true labels, as the target variable. Experiments on 175 sales forecasting data sets, from one of Sweden's largest wholesale companies, show that the proposed technique obtained significantly better predic-tive performance, compared to both straightforward use of genet-ic programming and the standard M5P technique. Naturally, the level of improvement depends critically on the performance of the intermediate ensemble.

4:50PM Facial Image Clustering in Stereo Videos Using Local Binary Patterns and Double Spectral Analysis [#14163]

Georgios Orfanidis, Anastasios Tefas, Nikos Nikolaidis and Ioannis Pitas, Aristotle University of Thessaloniki, Greece

In this work we propose the use of local binary patterns in combination with double spectral analysis for facial image clustering applied to 3D (stereoscopic) videos. Double spectral clustering involves the fusion of two well known algorithms: Normalized cuts and spectral clustering in order to improve the clustering performance. The use of local binary patterns upon selected fiducial points on the facial images proved to be a good choice for describing images. The framework is applied on 3D videos and makes use of the additional information deriving from the existence of two channels, left and right for further improving the clustering results.

SIS'14 Session 6: Swarm Algorithms & Applications - I

Thursday, December 11, 3:30PM-5:10PM, Room: Curacao 3, Chair: Simone Ludwig and Alok Singh

3:30PM Fitness Function Evaluations: A Fair Stopping Condition? [#14069]

Andries Engelbrecht, University of Pretoria, South Africa

It has become acceptable practice to use only a limit on the number of fitness function evaluations (FEs) as a stopping condition when comparing population- based optimization algorithms, irrespective of the initial number of candidate solutions. This practice has been advocated in a number of competitions to compare the performance of population-based algorithms, and has been used in many articles that contain empirical comparisons of algorithms. This paper advocates the opinion that this practice does not result in fair comparisons, and provides an abundance of empirical evidence to support this claim. Empirical results are obtained from application of a standard global best particle swarm optimization (PSO) algorithm with different swarm sizes under the same FE computational limit, on a large benchmark suite.

3:50PM Parallel Glowworm Swarm Optimization Clustering Algorithm based on MapReduce [#14081]

Nailah Almadi, Ibrahim Aljarah and Simone Ludwig, North Dakota State University, United States

Clustering large data is one of the recently challenging tasks that is used in many application areas such as social networking, bioinformatics and many others. Traditional clustering algorithms need to be modified to handle the increasing data sizes. In this paper, a scalable design and implementation of glowworm swarm optimization clustering (MRCGSO) using MapReduce is introduced to handle big data. The proposed algorithm uses glowworm swarm optimization to formulate the clustering algorithm. Glowworm swarm optimization is used to take advantage of its ability in solving multimodal problems, which in terms of clustering means finding multiple centroids. MRCGSO uses the MapReduce methodology for the parallelization since it provides fault tolerance, load balancing and data locality. The experimental results reveal that MRCGSO scales very well with increasing data set sizes and achieves a very close to the linear speedup while maintaining the clustering quality.

4:10PM Analysis of Stagnation Behaviour of Competitive Coevolutionary Trained Neuro-Controllers [#14085]

Christiaan Scheepers and Andries Engelbrecht, University of Pretoria, South Africa

A new variant of the competitive coevolutionary team-based particle swarm optimiser (CCPSO(t)) algorithm is developed to train multi-agent teams from zero knowledge. Analysis show that the CCPSO algorithm stagnates during the training of simple soccer players. It is hypothesised that the stagnation is caused by saturation of the neural network weights. The CCPSO(t) algorithm is developed to overcome the stagnation problem. CCPSO(t) is based on the previously developed CCPSO algorithm with two additions. The first addition is the introduction of a restriction on the personal best particle positions. The second addition is the introduction of a linearly decreasing perception and core limit of the charged particle swarm optimiser. The final results show that the CCPSO(t) algorithm successfully addresses the CCPSO algorithm's neural network weight saturation problem.

4:30PM Learning Bayesian Classifiers using Overlapping Swarm Intelligence [#14131]

Nathan Fortier, John Sheppard and Shane Strasser, Montana State University, United States

Bayesian networks are powerful probabilistic models that have been applied to a variety of tasks. When applied to classification problems, Bayesian networks have shown competitive performance when compared to other state-of-the-art classifiers. However, structure learning of Bayesian networks has been shown to be NP-Hard. In this paper, we propose a novel approximation algorithm for learning Bayesian network classifiers based on Overlapping Swarm Intelligence. In our approach a swarm is associated with each attribute in the data. Each swarm learns the edges for its associated attribute node and swarms that learn conflicting structures compete for inclusion in the final network structure. Our results indicate that, in many cases, Overlapping Swarm Intelligence significantly outperforms competing approaches, including traditional particle swarm optimization.

4:50PM Human-Swarm Hybrids Outperform Both Humans and Swarms Solving Digital Jigsaw Puzzles [#14993]

Daniel Palmer, Marc Kirschenbaum, Eric Mustee and Jason Dengler, John Carroll University, United States

We compare three approaches to solving digital jigsaw puzzles with wrap-around connections: human-only, swarm-only, and a hybrid approach that requires humans to interact with the swarm in a high-level, scalable manner. Using an iterative improvement strategy, some positive aspects of the human solvers migrate to the swarm-only approach. As the swarm-only approach gets better, humans continue to assist and the hybrid outperforms either of the independent approaches. This strategy for improving swarms is general, and continuously applicable. We show that even after many iterations and significant improvements to the swarm-only approach, support from a human improves the performance of the swarm.

CIASG'14 Session 6: Stability and Analysis

Thursday, December 11, 3:30PM-5:10PM, Room: Curacao 4, Chair: Ganesh Kumar Venayagamoorthy

3:30PM Remote Power System Stabilizer Tuning Using Synchrophasor Data [#14994]

Paranietharan Arunagirinathan, Hany Abdelsalam and Ganesh Kumar Venayagamoorthy, Real-Time Power and Intelligent Systems Lab., Holcombe Department of Electrical and Computer Engineering, Clemson University, SC 29634, United States; Electrical Engineering Department, Faculty of Engineering, Kafrelshikh University, Kafr Elsheikh, Egypt

Power system stabilizer (PSS) tuning is an important and challenging task in today's power system. In order to investigate the use of remote measurements of generator speed signals in respective PSS tuning, data from phasor measurement units (PMUs) are used in this paper. The PSSs parameter remote tuning is illustrated using a real-time digital simulator (RTDS). A MATLAB- based particle swarm optimization (PSO) algorithm is implemented including the interface with the RTDS system. The two-area four-machine power system benchmark is simulated, and speed signals obtained from PMUs are used in the tuning process. The best parameters obtained for PSSs and typical results are presented to show the effectiveness of using PMU measurements for remote tuning of a number of PSSs.

3:50PM Multi-Machine Power System Control based on Dual Heuristic Dynamic Programming [#14386]

Zhen Ni, Yufei Tang, Haibo He and Jinyu Wen, University of Rhode Island, United States; Huazhong University of Science and Technology, China

In this paper, we integrate a goal network into the existing dual heuristic dynamic programming (DHP) architecture, and study its damping performance on the multi-machine power system. There are four types of neural network in our proposed design: a goal network, a critic network, an action network and a model network. The motivation of this design is to build a general mapping between the system variables and the partial derivatives of the utility function, so that these required derivatives can be directly obtained and adaptively tuned over time. Whereas, the existing DHP design can only obtain a predefined (fixed) external utility function (or its derivatives). We apply both the proposed approach and the existing DHP approach on the multi-machine power system, and compare the damping performance on a four-machine two-area power system. The simulation results demonstrate the improved control performance with the proposed design.

4:10PM Impact of Signal Transmission Delays on Power System Damping Control Using Heuristic Dynamic Programming [#14189]

Yufei Tang, Xiangnan Zhong, Zhen Ni, Jun Yan and Haibo He, University of Rhode Island, United States

In this paper, the impact of signal transmission delays on static VAR compensator (SVC) based power system damping control using reinforcement learning is investigated. The SVC is used to damp low-frequency oscillation between interconnected power systems under fault conditions, where measured signals from remote areas are first collected and then transmitted to the controller as the inputs. Inevitable signal transmission delays are introduced into such design that will degrade the dynamic performance of SVC and in the worst case, cause system instability. The adopted reinforcement learning algorithm, called goal representation heuristic dynamic programming (GrHDP), is employed to design the SVC controller. Impact of signal transmission delays on the adopted controller is investigated with fully transient model based time-domain simulation in Matlab/Simulink environment. The simulation results on a four-machine two-area benchmark system with SVC demonstrate the effectiveness of the adopted algorithm on damping control and the impact of signal transmission delays.

4:30PM Time-Delay Analysis on Grid-Connected Three-Phase Current Source Inverter based on SVPWM Switching Pattern [#14813]

Arman Sargolzaei, Amirhasan Moghadasi, Kang Yen and Arif Sarwat, PhD Candidate, United States; Professor, United States

Time delays exist in most of the electronic components, digital controllers and DSPs. Certain values of time delay can easily corrupt the performance of a power control system. This time delay can strictly disturb the system dynamic in power control applications with low to medium switching frequency. In this paper, we overcome the effect of time delay in an SVPWM based switching pattern for a grid connected three-phase current source inverter. The time delay is tracked in real time and the states of the system are estimated. Our experimental results clearly show that the proposed approach can compensate the effect of the time delay and improve the quality of the performance.

4:50PM A low-complexity energy disaggregation method: Performance and robustness [#14186]

Hana Altrabalsi, Jing Liao, Lina Stankovic and Vladimir Stankovic, University of Strathclyde, United Kingdom

Disaggregating total household's energy data down to individual appliances via non-intrusive appliance load monitoring (NALM) has generated renewed interest with ongoing or planned large-scale smart meter deployments worldwide. Of special interest are NALM algorithms that are of low complexity and operate in near real time, supporting emerging applications such as in-home displays, remote appliance scheduling and home automation, and use low sampling rates data from commercial smart meters. NALM methods, based on Hidden Markov Model (HMM) and its variations, have become the state of the art due to their high performance, but suffer from high computational cost. In this paper, we develop an alternative approach based on support vector machine (SVM) and k-means, where k-means is used to reduce the SVM training set size by identifying only the representative subset of the original dataset for the SVM training. The resulting scheme outperforms individual k-means and SVM classifiers and shows competitive performance to the state-of-the-art HMM-based NALM method with up to 45 times lower execution time (including training and testing).

SSCI DC Social

Thursday, December 11, 3:30PM-5:10PM, Room: Curacao 7, Chair: Xiaorong Zhang

Poster Session: SSCI'14 Poster Session

Thursday, December 11, 5:10PM-6:45PM, Room: Grand Sierra E, Chair: Dongbin Zhao and Haibo He

P101 Adaptive dynamic programming-based optimal tracking control for nonlinear systems using general value iteration [#14033]

Xiaofeng Lin, Qiang Ding, Weikai Kong, Chunning Song and Qingbao Huang, Guangxi University, China

For the optimal tracking control problem of affine nonlinear systems, a general value iteration algorithm based on adaptive dynamic programming is proposed in this paper. By system transformation, the optimal tracking problem is converted into the optimal regulating problem for the tracking error dynamics. Then, generalvalue iteration algorithm is developed to obtain the optimal control with convergence analysis. Considering the advantages of echo state network, we use three echo state networks with levenberg-Marquardt (LM) adjusting algorithm to approximate the system, the cost function and the control law. A simulation example is given to demonstrate the effectiveness of the presented scheme.

P102 ADP-based Optimal Control for a Class of Nonlinear Discrete-time Systems with Inequality Constraints [#14567]

Yanhong Luo and Geyang Xiao, Northeastern University, China

In this paper, the adaptive dynamic programming (ADP) approach is utilized to design a neural-network-based optimal controller for a class of nonlinear discrete-time (DT) systems with inequality constraints. To begin with, the initial constrained optimal control problem is transformed into an infinite horizon optimal control problem by introducing the penalty function. Then, the iterative ADP algorithm is developed to handle the nonlinear optimal control problem with two neural networks. The two neural networks are aimed at generating the optimal cost and the optimal control policy respectively. Finally, the numerical results and analysis are presented to illustrate the performance of the developed method.

P103 Using supervised training signals of observable state dynamics to speed-up and improve reinforcement learning [#14823]

Daniel Elliott and Charles Anderson, Colorado State University, United States

A common complaint about reinforcement learning (RL) is that it is too slow to learn a value function which gives good performance. This issue is exacerbated in continuous state spaces. This paper presents a straight-forward approach to speeding-up and even improving RL solutions by reusing features learned during a pre-training phase prior to Q-learning. During pre-training, the agent is taught to predict state change given a state/action pair. The effect of pre-training is examined using the model-free Q-learning approach but could readily be applied to a number of RL approaches including model-based RL. The analysis of the results provides ample evidence that the features learned during pre-training is the reason behind the improved RL performance.

P104 A Two Stage Learning Technique for Dual Learning in the Pursuit-Evasion Differential Game [#14352]

Ahmad Al-Talabi and Howard Schwartz, Carleton University, Canada

This paper addresses the case of dual learning in the pursuit-evasion (PE) differential game and examines how fast the players can learn their default control strategies. The players should learn their default control strategies simultaneously by interacting with each other. Each player's learning process depends on the rewards received from its environment. The learning process is implemented using a two stage learning algorithm that combines the particle swarm optimization (PSO)-based fuzzy logic control (FLC) algorithm with the Q- Learning fuzzy inference system (QFIS) algorithm. The PSO algorithm is used as a global optimizer to autonomously tune the parameters of a fuzzy logic controller whereas the QFIS algorithm is used as a local optimizer. The two stage learning algorithm is compared through simulation with the default control strategy, the PSO-based FLC algorithm, and the QFIS algorithm. Simulation results show that the players are able to learn their default control strategies. Also, it shows that the two stage learning algorithm outperforms the PSO-based FLC algorithm and the QFIS algorithm with respect to the learning time.

P105 Heuristics for Multiagent Reinforcement Learning in Decentralized Decision Problems [#14536]

Martin Allen, David Hahn and Douglas MacFarland, University of Wisconsin-La Crosse, United States; Worcester Polytechnic Institute, United States

Decentralized partially observable Markov decision processes (Dec-POMDPs) model cooperative multiagent scenarios, providing a powerful general framework for team-based artificial intelligence. While optimal algorithms exist for Dec-POMDPs, theoretical and empirical results demonstrate that they are impractical for many problems of real interest. We examine the use of reinforcement learning (RL) as a means to generate adequate, if not optimal, joint policies for Dec-POMDPs. It is easily demonstrated (and expected) that single-agent RL produces results of little joint utility. We therefore investigate heuristic methods, based upon the dynamics of the Dec-POMDP formulation, that bias the learning process to produce coordinated action. Empirical tests on a benchmark problem show that these heuristics significantly enhance learning performance, even out-performing a hand-crafted heuristic in cases where the learning process converges quickly.

P106 An Adaptive Dynamic Programming Algorithm to Solve Optimal Control of Uncertain Nonlinear Systems [#14161]

Xiaohong Cui, Yanhong Luo and Huaguang Zhang, Northeastern University, China

In this paper, an approximate optimal control method based on adaptive dynamic programming(ADP) is discussed for the uncertain nonlinear system. An online critic-action-identifier algorithm is developed using neural network systems,where the critic -action networks approximate the optimal value function and optimal control and the other two neural networks identifier model approximates the unknown system. Furthermore the adaptive tuning laws are given based on Lyapunov approach, which ensure that the uniform ultimate bounded stability of the closed-loop system. Finally, the effectiveness is demonstrated by a simulation example.

P107 Effect Of tDCS Application On P300 Potentials: A Randomized, Double Blind Placebo Controlled Study [#15022]

Sriharsha Ramaraju, Ahmed Izzidien, Mohammed Ali Roula and Peter McCarthy, University Of Southwales, United Kingdom

In this paper, we report the results of a study on the post-intervention effects of applying anodal transcranial direct current stimulation (A-tDCS) on the intensity of P300 potentials. Each of the eight subjects were given both 15 minutes sham and 1.5 mA tDCS in randomized order, in two separate experiments separated by 1 week. The interventions were double blinded. Post- intervention EEG was then recorded after each experiment while subjects were asked to perform a spelling task based on the "odd ball paradigm". Results show a 22% difference, in normalized signal power between tDCS and sham when recorded at 250ms-450ms with a paired t-test p value of 0.057.

P108 EEG dynamics in Inhibition of Left-hand and Right-hand Responses during Auditory Stop Signal Task [#15071]

Rupesh Kumar Chikara, Ramesh Perumal, Li-Wei Ko and Hsin Chen, Department of Biological Science and Technology, National Chiao Tung University, Taiwan; Department of Electrical Engineering, National Tsing Hua University, Taiwan; a Department of Biological Science and Technology, National Chiao Tung University, Taiwan

An experimental design is programmed using the presentation tool to investigate the global response inhibition process by quantifying the parameters such as inhibition efficiency, stop-signal delay (SSD) and stop- signal reaction time (SSRT) in the stop-signal paradigm. The aim of this study is to explore the response inhibition mechanisms in the left-hand and right- hand responses by using ERP and ERSP results obtained from the EEG data of different subjects. The inhibition efficiency of the right-hand response and left-hand response appears to be independent of each other as there is no significant difference between them. From these results, the inhibition mechanisms corresponding to these two regions of the brain may be viewed as statistically independent processes. Further, we inferred that the response inhibition mechanisms for both left-hand and right-hand responses have approximately the same spectral power observation analysis and we conclude that these processes are statistically independent of each other.

P109 An Adaptive EEG Filtering Approach to Maximize the Classification Accuracy in Motor Imagery [#14794]

Kais Belwafi, Ridha Djemal, Fakhreddine Ghaffari and Olivier Romain, ETIS - Information Processing and System Research Lab, France; King Saud University, Saudi Arabia

We propose in this paper a novel approach of adaptive filtering of EEG signals. The filter adapts to the intrinsic characteristics of each person. The goal of the proposed method is to enhance the accuracy of the home devices system controlled by the thoughts related to two motor imagery actions. Mu-rhythm and Beta-rhythm are the specific returned bands that contain the information. The main idea of the proposed method is to preserve the frequency bands of interest with a different value of the SNR on the stop-band. Our experimental results show the benefits of a suitable tuning of the filter on the accuracy of the classifier on the output of the EEG system. The proposed approach outperforms significantly performances reported in the literature and the effectively enhancement of the classification accuracy can reach up to 40% based only on filtering tuning.

P110 Modulation of Brain Connectivity by Memory Load in a Working Memory Network [#14766]

Pouya Bashivan, Gavin Bidelman and Mohammed Yeasin, University of Memphis, United States

Cognition is the product of activation of billions of neurons and their timely interactions. While the activity of individual neurons is essential for proper functioning of the brain, the communication among them is arguably more vital. Previous studies of brain connectivity have largely focused on investigating causality across the brain in order to reveal the existing communication channels that form its internal networks. However, little is known about how these neuronal pathways respond to task demands with varying degrees of complexity. Towards understanding the pathways of information flow, we investigated the effect of memory load on network connectivity of brain. Independent component analysis (ICA) was used to identify brain areas, active during a working memory task, whose activations co-varied with memory load. An information theoretic metric called transfer entropy was adopted to examine the directed links across these areas. Empirical results suggest that the information flow rate across a primary working memory network is modulated by memory load. Furthermore, it was observed that the information flow is affected in pathways with opposite direction during encoding and maintenance stages of working memory operation.

P111 Distributed Robust Training of Multilayer Neural Netwroks Using Normalized Risk-Averting Error [#14727]

Hiroshi Ninomiya, Shonan Institute of Technology, Japan

This paper describes a novel distributed quasi-Newton-based robust training using the normalized risk-averting error (NRAE) with the gradual deconvexification (GDC) strategy. The main purpose of the computation is accomplished by optimizing the NRAE criterion parallely across different computing units, thereby two big advantages such as faster computation and global convergence can be obtained. The key idea is to replace the log partition function of the NRAE with a parallelizable upper-bound based on the concavity of the log-function. As a result, it is confirmed that the method is robust, and provides high quality training solutions regardless of initial values. Furthermore, the CPU time is drastically improved by the proposed distribution method without losing the quality of solutions.

P112 Multi-Layer Cortical Learning Algorithms [#14498]

Pulin Agrawal and Stan Franklin, The University of Memphis, United States

Hierarchical Temporal Memory (HTM) is a model with hierarchically connected modules doing spatial and temporal pattern recognition, as described by Jeff Hawkins in his book entitled On Intelligence. Cortical Learning Algorithms (CLAs) comprise the second implementation of HTM. CLAs are an attempt by Numenta Inc. to create a computational model of perceptual analysis and learning inspired by the neocortex in the brain. In its current state only an implementation of one isolated region has been completed The goal of this paper is to demonstrate that adding a second higher level region implementing CLAs to a system with just one region of CLAs, helps in improving the prediction accuracy of the system. The LIDA model (Learning Intelligent Distribution Agent - LIDA is a cognitive architecture) can use such a hierarchical implementation of CLAs for its Perceptual Associative Memory.

P113 RSS based Loop-free Compass Routing Protocol for Data Communication in Advanced Metering Infrastructure (AMI) of Smart Grid [#14377]

Imtiaz Parvez, Mahdi Jamei, Aditya Sundararajan and Arif I Sarwat, Florida International University, United States

Communication is the heart of the Smart Grid. Smart Grid metering and control applications require fast, reliable and secured two-way communication network. In this study, random signal strength (RSS) based localization of smart meters of Advanced Metering Infrastructure (AMI) has been proposed using the location information of meters whose position are known. Based on the location information, a loop free routing protocol has been developed. As a consequence, loop freedom, local routing decision and limited flooding, faster and reliable data transmission can be achieved.

P114 Frequency Band for HAN and NAN Communication in Smart Grid [#14798]

Imtiaz Parvez, Aditya Sundararajan and Arif I Sarwat, Florida International University, United States

Smart Grid metering and control applications require fast and secured two-way communication. IEEE 802.15.4 based ZigBee is one of the leading communication protocols for Advanced Metering Infrastructure (AMI). In North America, ZigBee supports two distinguished frequency bands- 915MHz and 2.4GHz. In Home Area Network (HAN) of AMI, home appliances communicate with smart meters whereas the communication among neighboring meters is termed as Neighborhood Area Network (NAN). In this study, optimum frequency bands for NAN and HAN communication have been proposed based on the throughput, reliability and scalability. We evaluated and compared the performance of bands 868/915MHz and 2.4GHz for AMI context. The solution also meets the requirements for Smart Grid communication standards as recommended by the US Department of Energy (DOE).

P115 Integrated Analytics of Microarray Big Data for Revealing Robust Gene Signature [#14289]

Wanting Liu, Yonghong Peng and Desmond J Tobin, University of Bradford, United Kingdom

The advance of high throughput biotechnology enables the generation of large amount of biomedical data. The microarray is becoming increasingly an popular approach for the detection of genome-wide gene expression, and the microarray data have been increased significantly on public accessible database repositories, which provide valuable big data for scientific research. To deal with the challenge of microarray big data that were collected in different research lab used different experiment set-up and on different bio-samples, this paper presents a primary study to evaluate the impact of two important factors (the origin of bio-samples and the quality of microarray data) to the integrated analytics of multiple microarray data. This is to enable the extraction of reliable and robust gene biomarker from microarray big data. Our work showed that in order for enhancing the biomarker discovery from microarray big data (i) it is necessary to treat the microarray data differently in terms of the quality, (ii) it is recommended to stratify (sub-group) the data according to the origin of bio-samples in the analytics.

P116 Large Graph Clustering Using DCT-Based Graph Clustering [#14978]

Nikolaos Tsapanos, Anastasios Tefas, Nikolaos Nikolaidis and Ioannis Pitas, Aristotle University of Thessaloniki, Greece

With the proliferation of the World Wide Web, graph structures have arisen on social network/media sites. Such graphs usually number several million nodes, which means that they can be called Big Data. Graph clustering is an important analysis tool for other graph related tasks, such as compression, community discovery and recommendation systems, to name a few. We propose a novel extension to an algorithm for graph clustering, that attempts to cluster a graph, through the optimization of selected terms of the Discrete Cosine Transform of the graph weight/adjacency matrix.

P117 A Scalable Machine Learning Online Service for Big Data Real-Time Analysis [#14621]

Alejandro Baldominos, Esperanza Albacete, Yago Saez and Pedro Isasi, Universidad Carlos III de Madrid, Spain

This work describes a proposal for developing and testing a scalable machine learning architecture able to provide real-time predictions or analytics as a service over domain-independent big data, working on top of the Hadoop ecosystem and providing real-time analytics as a service through a RESTful API. Systems implementing this architecture could provide companies with on-demand tools facilitating the tasks of storing, analyzing, understanding and reacting to their data, either in batch or stream fashion; and could turn into a valuable asset for improving the business performance and be a key market differentiator in this fast pace environment. In order to validate the proposed architecture, two systems are developed, each one providing classical machine-learning services in different domains: the first one involves a recommender system for web advertising, while the second consists in a prediction system which learns from gamers' behavior and tries to predict future events such as purchases or churning. An evaluation is carried out on these systems, and results show how both services are able to provide fast responses even when a number of concurrent requests are made, and in the particular case of the second system, results clearly prove that computed predictions significantly outperform those obtained if random guess was used.

P118 Target-based evaluation of face recognition technology for video surveillance applications [#14655]

Dmitry Gorodnichy and Eric Granger, Canadian Border Services Agency, Canada; Ecole de technologie superieure, Universite du Quebec, Canada

This paper concerns the problem of real-time watch-list screening (WLS) using face recognition (FR) technology. The risk of flagging innocent travellers can be very high when deploying a FR system for WLS since: (i) faces captured in surveillance video vary considerably due to pose, expression, illumination, and camera inter-operability; (ii) reference images of targets in a watch-list are typically of limited quality or quantity; (iii) the performance of FR systems may vary significantly from one individual to another (according to so called "biometric menagerie" phenomenon); (iv) the number of travellers drastically exceeds the number of target people in a watch-list; and finally and most critically, (v) due to the nature of optics, images of faces captured by video-surveillance cameras are focused and sharp only over a very short period of time if ever at all. Existing evaluation frameworks were originally developed for spatial face identification from still images, and do not allow one to properly examine the suitability of the FR technology for WLS with respect to the above listed risk factors intrinsically present in any video surveillance application. This paper introduces the target-based multi-level FR performance evaluation framework that is suitable for WLS. According to the framework, Level 0 (face detection analysis) deals with the system's ability to process low resolution faces. The results from testing a commercial state-of-art COTS FR product on a public video data-set are shown to illustrate the benefits of this framework.

P119 Automated Border Control: Problem Formalization [#14658]

Dmitry Gorodnichy, Vlad Shmerko and Svetlana Yanushkevich, Canadian Border Services Agency, Canada; University of Calgary, Canada

This paper introduces a formalization of the Automated Border Control (ABC) machines deployed worldwide as part of the eBorder infrastructure for automated traveller clearance. Proposed formalization includes classification of the eBorder technologies, definition of the basic components of the ABC machines, identification of their key properties, establishment of metrics for their evaluation and comparison, as well as development of a dedicated architecture based on the assistant-based concept. Specifically, three generations of the ABC machines are identified: Gen-1 ABC machines which are biometric enabled kiosks, such as Canada's NEXUS or UK IRIS, to process low-risk pre-enrolled travellers; Gen-2 ABC machines which are eGate systems to serve travellers with biometric eID / ePassports; and Gen-3 ABC machines that will be working to support the eBorder process of the future. These ABC machines are compared in this paper based on certain criteria, such as availability of the dedicated architectural components, and in terms of the life-cycle performance metrics. This paper addresses the related problems of deployment and evaluation of the ABC technologies and machines, including the vulnerability analysis and strategic planning of the eBorder infrastructure.

P120 Computationally Efficient Statistical Face Model in the Feature Space [#14609]

Mohammad Haghighat, Mohamed Abdel-Mottaleb and Wadee Alhalabi, Department of Electrical and Computer Engineering, University of Miami, United States; Department of CS, Effat University, Saudi Arabia

In this paper, we present a computationally efficient statistical face modeling approach. The efficiency of our proposed approach is the result of mathematical simplifications in the core formula of a previous face modeling method and the use of the singular value decomposition. In order to reduce the errors in our resulting models, we preprocess the facial images to normalize for pose and illumination and remove little occlusions. Then, the statistical face models for the enrolled subjects are obtained from the normalized face images. The effects of the variations in pose, facial expression, and illumination on the accuracy of the system are studied. Experimental results demonstrate the reduction in the computational complexity of the new approach and its efficacy in modeling the face images.

P121 A Feasibility Study of Using a Single Kinect Sensor for Rehabilitation Exercises Monitoring: A Rule Based Approach [#14548]

Wenbing Zhao, Deborah Espy, Ann Reinthal and Hai Feng, Cleveland State University, United States

In this paper, we present a feasibility study for using a single Microsoft Kinect sensor to assess the quality of rehabilitation exercises. Unlike competing studies that have focused on the validation of the accuracy of Kinect motion sensing data at the level of joint positions, joint angles, and displacement of joints, we take a rule based approach. The advantage of our approach is that it provides a concrete context for judging the feasibility of using a single Kinect sensor for rehabilitation exercise monitoring. Our study aims to answer the following question: if it is found that Kinect's measurement on a metric deviates from that obtained from the ground truth by some amount, is this an acceptable error? By defining a set of correctness rules for each exercise, such questions will be answered definitively with no ambiguity. Defining appropriate context in a validation study is especially important because (1) the deviation of Kinect measurement from the ground truth varies significantly for different exercises, even for the same joint, and (2) different exercises have different tolerance levels for the movement restrictions of body segments. In this study, we also show that large but systematic deviations of the Kinect measurement from the ground truth are not as harmful as it seems because the problem can be overcome by adjusting parameters in the correctness rules.

P122 Automating Assessment in Video Game Teletherapy: Data Cutting [#14591]

William Blewitt, Martin Scott, Gray Ushaw, Jian Shi, Graham Morgan and Janet Eyre, Newcastle University, United Kingdom

In this paper we describe how a video game designed to deliver a rehabilitation therapy can produce data of a standard that is clinically useful. Our approach is based entirely on commodity video game hardware, making our solution one that may be delivered in a cost efficient manner. The step of ensuring data fidelity was crucial in allowing clinical assessment to be derived from standard video game technology without therapist intervention. We achieved this by cutting the data to provide our statistical model with only the information that accurately represented patient activities that contribute to clinical assessment.

P123 An efficient Computer Aided Decision Support System for breast cancer diagnosis using Echo State Network Classifier [#14891]

Summrina Kanwal Wajid, Prof. Amir Hussain and Prof. Bin Luo, University of Stirling, United Kingdom; Anhui University, China

The paper presents Echo State Network (ESN) as classifier to diagnose the abnormalities in mammogram images. Abnormalities in mammograms can be of different types. An efficient system which can handle these abnormalities and draw correct diagnosis is vital. We experimented with wavelet and Local Energy based Shape Histogram (LESH) features combined with Echo State Network classifier. The suggest system produces high classification accuracy of 98% as well as high sensitivity and specificity rates. We compared the performance of ESN with Support Vector Machine (SVM) and results generated indicate that ESN can compete with SVM classifier and in some cases beat it. The high rate of Sensitivity and Specificity also signifies the power of ESN classifier to detect positive and negative case correctly.

P124 Intelligent Image Processing Techniques for Cancer Progression, Detection, Recognition and Prediction in the Human Liver [#14917]

Liaqat Ali, Amir Hussain, Usman Zakir, Xiu Yan, Sudhakar Unnam, M.Abdur Rajak, Amir Shah and Mufti Mahmud, University of Stirling, United Kingdom; University of Strathclyde, United Kingdom; Crosshouse Hospital Scotland, United Kingdom; Ucare Foundation, United Kingdom; Theoretical Neurobiology and Neuroengineering Lab, University of Antwerp, 2610-Wilrijk, Belgium,Institute of Information Technology, Jahangirnagar University, Savar, 1342-Dhaka, Bangladesh,COSIPRA Lab, University of Stirling, Stirling FK9 4LA, United King, Belgium

Clinical Decision Support (CDS) aids in early diagnosis of liver cancer, a potentially fatal disease prevalent in both developed and developing countries. Our research aims to develop a robust and intelligent clinical decision support framework for disease management of cancer based on legacy Ultrasound (US) image data collected during various stages of liver cancer. The proposed intelligent CDS framework will automate real-time image enhancement, segmentation, disease classification and progression in order to enable efficient diagnosis of cancer patients at early stages. The automation of image segmentation and extraction of object boundary features plays a fundamental role in understanding

image contents for searching and mining in medical image archives. The CDS framework is inspired by the human interpretation of US images from the image acquisition stage to cancer progression prediction. Specifically, the proposed framework is composed of a number of stages where images are first acquired from an imaging source and pre-processed before running through an image enhancement algorithm. The detection of cancer and its segmentation is considered as the second stage in which different image segmentation techniques are utilized to partition and extract objects from the enhanced image. The third stage involves disease classification of segmented objects, in which the meanings of an investigated object are matched with the disease dictionary defined by physicians and radiologists.

P125 An approximate inverse recipe method with application to automatic food analysis [#14287]

Jieun Kim and Mireille Boutin, Purdue University, United States

We propose a method for automatically determining the amount of each ingredient used to prepare a commercial food using the information provided on its label. The method applies when no part of any ingredient is removed in the preparation process and as long as we can collect the nutrition data (e.g., from the USDA Food Database) for at least some of the ingredients. Using this information, we first find a set of initial minimum and maximum bounds for each ingredient amount. Then we improve these maximum and minimum bounds using an iterative method. The resulting bounds on the ingredient amounts can then be used to estimate the nutrient content of the food. We tested this approach for estimating the phenylalanine content of various commercial foods. Phenylalanine is an amino acid that must be carefully monitored when treating patients with the metabolic disease phenylketonuria (PKU). Our numerical tests indicate that the accuracy of our method is within an acceptable range (10mg Phe) for most of the foods we considered. We implemented a web-based application of our proposed method for public use. Our method should be applicable to the estimation of nutrients involved in the management of other medical diets.

P126 The design, implementation and evaluation of a relaxation service with facial emotion detection [#14321]

Somchanok Tivatansakul and Michiko Ohkura, Graduate School of Engineering,Shibaura Institute of Technology, Tokyo, Japan; College of Engineering, Shibaura Institute of Technology, Tokyo, Japan

Even though current research includes many proposals for systems that provide assistance and services to people in healthcare fields, such systems generally emphasize the support of physical rather than emotional aspects. Emotional health is as important as physical health. Negative emotional health can lead to social or mental health problems. To cope with negative emotional health, we propose a healthcare system that focuses on emotional aspects by integrating emotion detection from facial expressions because emotion detection is essential and useful to indicate feelings and needs. Moreover, using facial expression to detect emotion is more suitable for our healthcare system because these approaches recognize emotions from a natural user interface (face). Thus, our system can recognize user emotion to provide the appropriate services. When they are experiencing negative emotions, our system suggests that they take a break and provides appropriate services (including relaxation, amusement and excitement services) with augmented reality and Kinect to improve their emotional state. This paper presents a prototype of a relaxation service with real-time facial emotion detection, describes its design and implementation, and experimentally evaluates user feelings while they experience our relaxation service with real-time facial emotion detection. Our experimental results show that our real-time emotion detection by facial expressions needs improvement to accurately recognize emotions. However, integrating it into our emotional healthcare system is useful for recognizing negative emotions. Our results also confirm that our relaxation service with a breathing control application effectively decreases negative emotions.

P127 Intelligent emotions stabilization system using standardized images, breath sensor and biofeedback - new concept [#14869]

Oleksandr Sokolov, Krzysztof Dobosz, Joanna Dreszer, Bibianna Balaj, Wlodzislaw Duch, Slawomir Grzelak, Tomasz Komendzinski, Dariusz Mikolajewski, Tomasz Piotrowski, Malgorzata Swierkocka and Piotr Weber, Faculty of Physics, Astronomy and Informatics, Nicolaus Copernicus University, Poland; Faculty of Humanities, Nicolaus Copernicus University, Poland; Neurocognitive Laboratory, Centre for Modern Interdisciplinary Technologies, Nicolaus Copernicus University, Poland; Collegium Medicum, Nicolaus Copernicus University, Poland

This paper addresses the problem of designing closed-loop control of emotion based on affective measures and computing. The work is focused on design rule base control system that serves for positive emotion state stabilization. The proposed approach is based on analyzing of breathing signal. The measured signal is analyzed according to features important for emotional changes. Knowing emotional state of person and desired level of affect should allow to modify it through knowledge base engine. Closed-loop control system is a fuzzy rule base that is designed on fuzzy model of breathing time series and data base of affective images. Proposed system may constitute basis for the whole family of new tools. All results are illustrated with examples.

P128 Cognitively Inspired Speech Processing For Multimodal Hearing Technology [#14603]

Andrew Abel, Amir Hussain and Bin Luo, University of Stirling, Scotland; Anhui University, China

In recent years, the link between the various human communication production domains has become more widely utilised in the field of speech processing. Work by the authors and others has demonstrated that intelligently integrated audio and visual information can be used for speech enhancement. This advance in technology means that the use of visual information as part of hearing aids or assistive listening devices is becoming ever more viable. One issue that is not commonly explored is how a multimodal system copes with variations in data quality and availability, such as a speaker covering their face while talking, or the existence of multiple speakers in a conversational scenario, an issue that a hearing device would be expected to cope with by switching between different programmes and settings to adapt to changes in the environment. We present the ChallengAV audiovisual corpus, which is used to evaluate a novel fuzzy logic based audiovisual switching system, designed to be used as part of a next-generation adaptive, autonomous, context aware hearing system. Initial results show that the detectors are capable of determining environmental conditions and responding appropriately, demonstrating the potential of such an adaptive multimodal system as part of a state of the art hearing aid device.

P129 Analysis of Three-Dimensional Vasculature Using the Multifractal Theory [#14819]

Li Bai, Ward Wil and Ding Yuchun, University of Nottingham, United Kingdom

This paper investigates the use of multifractal formalism for characterising 3D brain vasculature of 2 different mammalian species. Multifractal properties were found across all the 3D vascular models. Variations in the analysis results appear to correspond with vessel density ans morphology. The implication of the research is that multifractal analysis could potentially provide a useful tool for clinical assessment of diseases that are known to alter density and structure of brain microvasculature.

P130 New frequent pattern mining algorithm tested for activities models creation [#14065]

Mohamed Tarik Moutacalli, Abdenour Bouzouane and Bruno Bouchard, UQAC, Canada

When extracting frequent patterns, usually, the events order is either ignored or handled with a simple precedence relation between instants. In this paper we propose an algorithm applicable when perfect order, between events, must be respected. Not only it estimates delay between two adjacent events, but its first part allows non temporal algorithms to work on temporal databases and reduces the complexity of dealing with temporal data for the others. The algorithm has been implemented to address the problem of activities models creation, the first step in activity recognition process, from sensors history log recorded in a smart home. Experiments, on synthetic data and on real smart home sensors log, have proven the algorithm effectiveness in detecting all frequent activities in an efficient time.

P131 Developing an Affective Point-of-Care Technology [#14523]

Pedro Bacchini, Erlan Lopes, Marco Aurelio Barbosa, Jose Ferreira, Olegario Silva Neto, Adson da Rocha and Talles Barbosa, PUC Goias, Brazil; Santa Casa de Misericordia de Goiania Hospital, Brazil; University of Brasilia, Brazil

Mobile intelligent clinical monitoring systems provide mobility and out of hospital monitoring. It can be used in the follow-up of high-risk patients in out of hospital situations and to monitor "healthy" persons to prevent medical events. The inherent characteristics of local diagnosis and actuation permit an improvement and advance in the diagnosis and emergency decision support. Additionally, Affective Systems have been used in different applications, such as stress monitoring in aircraft seats and managing sensitivity in autism spectrum disorder. Although many scientific progresses have been made there are many computational challenges in order to embedded affectivity into traditional user interfaces. For example, context-sensitive algorithms, low-complexity pattern recognition models and hardware customizations are requirements to support the simplification of user's experience becoming more intuitive, transparent and less obstructive. In this paper a multiparametric affective monitor is presented. The Emopad acquisition system has been developed to analyze user's biofeedback particularly when they are playing games. It is able to capture Galvanic Skin Response (GSR), Temperature, Force, Heart Rate (HR) and its variability (HRV) while complementary algorithms are executed to recognize events related to user's emotional states. Also, in this paper a sliding window- based algorithm is presented and evaluated to detect specific events related to emotional responses. The success of multiparametric affective monitors can lead to a paradigm shift, establishing new scenarios for the Point-of-Care technologies applications.

P132 Weighted Feature-based Classification of Time series Data [#14566]

Ravikumar Penugonda and V. Susheela Devi, Rajiv Gandhi University of Knowledge Technologies, India; Indian Institute of Science, India

Classification is one of the most popular techniques in the data mining area. In supervised learning, a new pattern is assigned a class label based on a training set whose class labels are already known. This paper proposes a novel classification algorithm for time series data. In our algorithm, we use four parameters and based on their significance on different benchmark data sets, we have assigned the weights using simulated annealing process. We have taken the combination of these parameters as a performance metric to find the accuracy and time complexity. We have experimented with 6 benchmark data sets and results shows that our novel algorithm is computationally fast and accurate in several cases when compared with 1NN classifier.

P133 Gender classification of subjects from cerebral blood flow changes using Deep Learning [#14675]

Tomoyuki Hiroyasu, Kenya Hanawa and Utako Yamamoto, Doshisha University, Japan; Doshisha University Graduate School, Japan

In this study, using Deep Learning, the gender of subjects is classified the cerebral blood flow changes that are measured by fNIRS. It is reported that cerebral blood flow changes are triggered by brain activities. Thus, if this classification has a high searching accuracy, gender classification should be related to brain activities. In the experiment, fNIRS data are derived from subjects who perform a memory task in white noise environment. From the results, it is confirmed that the learning classifier exhibits high accuracy. This fact suggests that there exists a relation between cerebral blood flow changes and biological information.

P134 A feature transformation method using genetic programming for two-class classification [#15008]

Tomoyuki Hiroyasu, Toshihide Shiraishi, Tomoya Yoshida and Utako Yamamoto, Faculty of Life and Medical Sciences Doshisha University, Japan; Graduate School of Life and Medical Sciences, Japan

In this paper, a feature transformation method for two-class classification using genetic programming (GP) is proposed. GP derives a transformation formula to improve the classification accuracy of Support Vector Machine, SVM. In this paper, we propose a weight function to evaluate converted feature space and the proposed function is used to evaluate the function of GP. In the proposed function, the ideal two-class distribution of items is assumed and the distance between the actual and ideal distributions is calculated. The weight is imposed to these distances. To examine the effectiveness of the proposed function, a numerical experiment was performed. In the experiment, as the result, the classification accuracy of the proposed method showed the better result than that of the existing method.

P135 Dependency Network Methods for Hierarchical Multi-label Classification of Gene Functions [#14482]

Fabio Fabris and Alex A. Freitas, University of Kent, United Kingdom

Hierarchical Multi-label Classification (HMC) is a challenging real-world problem that naturally emerges in several areas. This work proposes two new algorithms using a Probabilistic Graphical Model based on Dependency Networks (DN) to solve the HMC problem of classifying gene functions into pre-established class hierarchies. DNs are especially attractive for their capability of using traditional, "out-of-the-shelf", classification algorithms to model the relationship among classes and for their ability to cope with cyclic dependencies, resulting in greater flexibility with respect to Bayesian Networks. We tested our two algorithms: the first is a stand-alone Hierarchical Dependency Network (HDN) algorithm, and the second is a hybrid between the HDN and the Predictive Clustering Tree (PCT) algorithm, a well-known classifier for HMC. Based on our experiments, the hybrid classifier, using SVMs as base classifiers, obtained higher predictive accuracy than both the standard PCT algorithm and the HDN algorithm, considering 22 bioinformatics datasets and two out of three evaluation measures specific for hierarchical classification.

P136 A Novel Criterion for Overlapping Communities Detection and Clustering Improvement [#15073]

Alessandro Berti, Alessandro Sperduti and Andrea Burattin, University of Padova, Italy

In community detection, the theme of correctly identifying overlapping nodes, i.e. nodes which belong to more than one community, is important as it is related to role detection and to the improvement of the quality of clustering: proper detection of overlapping nodes gives a better understanding of the community structure. In this paper, we introduce a novel measure, called cuttability, that we show being useful for reliable detection of overlaps among communities and for improving the quality of the clustering, measured via modularity. The proposed algorithm shows better behaviour than existing techniques on the considered datasets (IRC logs and Enron e-mail log). The best behaviour is caught when a network is split between micro-communities. In that case, the algorithm manages to get a better description of the community structure.

P137 Incremental Transfer RULES with Incomplete Data [#14122]

Hebah ElGibreen and Mehmet Sabih Aksoy, King Saud University, Saudi Arabia

Recently strong AI emerged from artificial intelligence due to need for a thinking machine. In this domain, it is necessary to deal with dynamic incomplete data and understanding of how machines make their decision is also important, especially in information system domain. One type of learning called Covering Algorithms (CA) can be used instead of the difficult statistical machine learning methods to produce simple rule with powerful prediction ability. However, although using CA as the base of strong AI is a novel idea, doing so with the current methods available is not possible. Thus, this paper presents a novel CA (RULES-IT) and tests its performance over incomplete data. This algorithm is the first incremental algorithm in its family, and CA as a whole, that transfer rules from different domains and introduce intelligent aspects using simple representation. The performance of RULES-IT will be tested over incomplete and complete data along with other algorithms in the literature. It will be validated using 5-fold cross validation in addition to Friedman with Nemenyi post hoc tests to measure the significance and rank the algorithms.

P138 Novelty Detection Applied to the Classification Problem Using Probabilistic Neural Network [#14311]

Balvant Yadav and V. Susheela Devi, Department Of Computer Science and Automation Indian Institute Of Science, Bangalore, India

A novel pattern is an observation which is different as compared to the rest of the data. The task of novelty detection is to build a model which identifies novel patterns from a data set. This model has to be built in such a way that if a pattern is distant from the given training data, it should be classified as a novel pattern otherwise it should be classified into any one of the given classes. In this paper, we present two such new models, based on Probabilistic Neural Network for novelty detection. In the first model, we generate negative examples around the target class data and then train the classifier with these negative examples. In the second model, which is an incremental model, we present a new method to find optimal threshold for each class and if output value for a test pattern being assigned to a target class is less than the threshold of the target class, then we classify that pattern as a novel pattern. We show how decision boundaries are created when we add novelty detection mechanism and when we do not add novelty detection to our model. We show a comparative performance of both approaches.

P139 A Framework for Initialising a Dynamic Clustering Algorithm: ART2-A [#14808]

Simon Chambers, Ian Jarman and Paulo Lisboa, Liverpool John Moores University, United Kingdom

Algorithms in the Adaptive Resonance Theory (ART) family adapt to structural changes in data as new information presents, making it an exciting candidate for dynamic online clustering of big health data. Its use however has largely been restricted to the signal processing field. In this paper we introduce an adaptation of the ART2-A method within a separation and concordance (SeCo) framework which has been shown to identify stable and reproducible solutions from repeated initialisations that also provides evidence for an appropriate number of initial clusters that best calibrates the algorithm with the data presented. The results show stable, reproducible solutions for a mix of real-world heath related datasets and well known benchmark datasets, selecting solutions which better represent the underlying structure of the data then using a single measure of separation. The scalability of the method and it's facility for dynamic online clustering makes it suitable for finding structure in big data.

P140 Recommendation for Web Services with Domain Specific Context Awareness [#14665]

B. T. G. S. Kumara, Incheon Paik, K. R. C. Koswatte and Wuhui Chen, University of Aizu, Japan

Construction of Web service recommendation system for users has become an important issue in service computing area. Content-based service recommendation is one category of recommendation systems, which recommended services based on functionality. Current content-based approach used syntactic or semantic approach to calculate the similarity. However, Syntactic methods are insufficient in expressing semantic concepts and semantic content-based methods only consider basic semantic level. Further, the approaches do not consider the domain specific context in measuring the similarity. Thus, they have been failed to capture the semantic similarity of Web services under a certain domain and this is affected to the performance of the recommendation. In this paper, we propose domain specific context aware recommendation approach that uses support vector machine and domain data set from search engine. Experimental results show that our approach works efficiently.

P141 Tibetan-Chinese Cross Language Named Entity Extraction Based on Comparable Corpus and Naturally Annotated Resources [#14367]

Yuan Sun, Wenbin Guo and Xiaobing Zhao, Minzu University of China, China

Tibetan-Chinese named entity extraction can effectively improve the performance of Tibetan-Chinese cross language question answering system, information retrieval, machine translation and other researches. In the condition of no practical Tibetan named entity recognition system and Tibetan-Chinese translation model, this paper proposes a method to extract Tibetan-Chinese entities based on comparable corpus and naturally annotated resources from webs. The main work of this paper is in the following: (1) Tibetan-Chinese comparable corpus construction. (2) Combining sentence length, word matching and boundary term features, using multi-feature fusion algorithm to obtain parallel sentences from comparable corpus. (3) Tibetan- Chinese entity mapping based on the maximum word continuous intersection model of parallel sentence. Finally, the experimental results show that our approach can effectively find Tibetan-Chinese cross language named entity.

P142 Detecting and profiling sedentary young men using machine learning algorithms [#14440]

Pekka Siirtola, Riitta Pyky, Riikka Ahola, Heli Koskimaki, Timo Jamsa, Raija Korpelainen and Juha Roning, University of Oulu, Finland

Many governments and institutions have guidelines for health-enhancing physical activity. Additionally, according to recent studies, the amount of time spent on sitting is a highly important determinant of health and wellbeing. In fact, sedentary lifestyle can lead to many diseases and, what is more, it is even found to be associated with increased mortality. In this study, a data set consisting of self-reported questionnaire, medical

diagnoses and fitness tests was studied to detect sedentary young men from a large population and to create a profile of a sedentary person. The data set was collected from 595 young men and contained altogether 678 features. Most of these are answers to multi-choice close-ended questions. More precisely, features were mostly discrete values with a scale from 1 to 5 or from 1 to 2, and therefore, there was only a little variability in the values of features. In order to detect and profile a sedentary young man, machine learning algorithms were applied to the data set. The performance of five algorithms is compared (quadratic discriminant analysis (QDA), linear discriminant analysis (LDA), C4.5, random forests, and k nearest neighbours (kNN), with k values 1,3,5 and 7) to find the most accurate algorithm. The results of this study show that when the aim is to detect a sedentary person based on medical records and fitness tests, LDA performs better than the other algorithms, but still the accuracy is not high. In the second part of the study the differences between highly sedentary and non-sedentary young men are searched, recognition can be obtained with high accuracy with each algorithm.

P143 Patient Level Analytics Using Self-Organising Maps: A Case Study on Type-1 Diabetes Self-care Survey Responses [#14741]

Santosh Tirunagari, Norman Poh, Kouros Aliabadi, David Windridge and Deborah Cooke, University of Surrey, United Kingdom

Survey questionnaires are often heterogeneous because they contain both quantitative (numeric) and qualitative (text) responses, as well as missing values. While traditional, model-based methods are commonly used by clinicians, we deploy Self Organizing Maps (SOM) as a means to visualize the data. In a survey study aiming at understanding the self-care behaviour of 611 patients with Type-1 Diabetes, we show that SOM can be used to (1) identify co-morbidities; (2) to link self-care factors that are dependent on each other; and (3) to visualize individual patient profiles; In evaluation with clinicians and experts in Type-1 Diabetes, the knowledge and insights extracted using SOM correspond well to clinical expectation. Furthermore, the output of SOM in the form of a U-matrix is found to offer an interesting alternative means of visualising patient profiles instead of a usual tabular form.

P144 Interpolation and Extrapolation: Comparison of Definitions and Survey of Algorithms for Convex and Concave Hulls [#14792]

Tobias Ebert, Julian Belz and Oliver Nelles, University of Siegen, Germany

Any data based method is vulnerable to the problem of extrapolation, nonetheless there exists no unified theory on handling it. The main topic of this publication is to point out the differences in definitions of extrapolation and related methods. There are many different interpretations of extrapolation and a multitude of methods and algorithms, which address the problem of extrapolation detection in different fields of study. We examine popular definitions of extrapolation, compare them to each other and list related literature and methods. It becomes apparent, that the opinions what extrapolation is and how to handle it, differ greatly from each other. We categorize existing literature and give guidelines to choose an appropriate definition of extrapolation for a present problem. We also present hull algorithms, from classic approaches to recent advances. The presented guidelines and categorized literature enables the reader to categorize a present problem, inspect relevant literature and apply suitable methods and algorithms to solve a problem, which is affected by extrapolation.

P145 Takagi-Sugeno-Kang Type Collaborative Fuzzy Rule Based System [#14947]

Kuang-pen Chou, Mukesh Prasad, Yang-Yin Lin, Sudhanshu Joshi, Chin-Teng Lin and Jyh-Yeong Chang, National Chiao Tung University, Taiwan; Doon University, India

In this paper, a Takagi-Sugeno-Kang (TSK) type collaborative fuzzy rule based system is proposed with the help of knowledge learning ability of collaborative fuzzy clustering (CFC). The proposed method split a huge dataset into several small datasets and applying collaborative mechanism to interact each other and this process could be helpful to solve the big data issue. The proposed method applies the collective knowledge of CFC as input variables and the consequent part is a linear combination of the input variables. Through the intensive experimental tests on prediction problem, the performance of the proposed method is as higher as other methods. The proposed method only uses one half information of given dataset for training process and provide an accurate modeling platform while other methods use whole information of given dataset for training.

P146 Recognizing Gym Exercises Using Acceleration Data from Wearable Sensors [#14162]

Heli Koskimaki and Pekka Siirtola, University of Oulu, Finland

The activity recognition approaches can be used for entertainment, to give people information about their own behavior, and to monitor and supervise people through their actions. Thus, it is a natural consequence of that fact that the amount of wearable sensors based studies has increased as well, and new applications of activity recognition are being invented in the process. In this study, gym data, including 36 different exercise classes, is used aiming in the future to create automatic activity diaries showing reliably to end users how many sets of given exercise have been performed. The actual recognition is divided into two different steps. In the first step, activity recognition of certain time intervals is performed and in the second step the state-machine approach is used to decide when actual events (sets in gym data) were performed. The results showed that when recognizing different exercise sets from the same occasion (sequential exercise sets), on average, over 96 percent window-wise true positive rate can be achieved, and moreover, all the exercise events can be discovered using the state-machine approach. When using a separate validation test set, the accuracies decreased significantly for some classes, but even in this case, all the different sets were discovered for 26 different classes.

P147 What can Spatial Collectives tell us about their environment? [#14915]

Zena Wood, University of Greenwich, United Kingdom

Understanding how large groups of individuals move within their environment, and the social interactions that occur during this movement, is central to many fundamental interdisciplinary research questions; ranging from understanding the evolution of cooperation, to managing human crowd behaviour. If we could understand how groups of individuals interact with their environment, and any role that the environment plays in their behaviour, we could design and develop space to better suit their needs. Spatiotemporal datasets that record the movement of large groups of individuals are becoming increasingly available. A method, based on a set of coherence criteria, has previously been developed to identify different types of collective within such datasets. However, further investigations have revealed that the method can be used to reveal important information about the environment. This paper applies the method to a spatiotemporal dataset that records the movements of ships within the Solent, in the UK, over a twenty-four hour period to explore what can be inferred from the movement of groups of individuals, referred to as spatial collectives, regarding the environment.

P148 Weighted One-Class Classification for Different Types of Minority Class Examples in Imbalanced Data [#14606]

Bartosz Krawczyk, Michal Wozniak and Francisco Herrera, Wroclaw University of Technology, Poland; University of Granada, Spain

Imbalanced classification is one of the most challenging machine learning problem. Recent studies show, that often the uneven ratio of objects in classes is not the biggest factor, determining the drop of classification accuracy. It is also related to some difficulties embedded in the nature of the data. In this paper we study the different types of minority class examples and distinguish four groups of objects - safe, borderline, rare and outliers. To deal with the imbalance problem, we use a one-class classification, that is focused on a proper identification of the minority class samples. We further augment this model by incorporating the knowledge about the minority object types in the training dataset. This is done applying weighted one-class classifier and adjusting weights assigned to minority class objects, depending on their type. A strategy for calculating the new weights for minority examples is proposed. Experimental analysis, carried on a set of benchmark datasets, confirms that the proposed model can achieve a satisfactory recognition rate and often outperform other state-of-the-art methods, dedicated to the imbalanced classification.

P149 A Sparsity-Based Training Algorithm for Least Squares SVM [#14550]

Jie Yang and Jun Ma, University of Wollongong, Australia

We address the training problem of the sparse Least Squares Support Vector Machines (SVM) using compressed sensing. The proposed algorithm regards the support vectors as a dictionary and selects the important ones that minimize the residual output error iteratively. A measurement matrix is also introduced to reduce the computational cost. The main advantage is that the proposed algorithm performs model training and support vector selection simultaneously. The performance of the proposed algorithm is tested with several benchmark classification problems in terms of number of selected support vectors and size of the measurement matrix. Simulation results show that the proposed algorithm performs competitively when compared to existing methods.

P150 Wolf Search Algorithm for Attribute Reduction in classification [#14909]

Waleed Yamany, Eid Emary and Aboul Ella Hassanien, Fayoum University, Egypt; Cairo university, Egypt; Cairo unviersity (SRGE), Egypt

Data sets ordinarily includes a huge number of attributes, with irrelevant and redundant attributes. Redundant and irrelevant attributes might minimize the classification accuracy because of the huge search space. The main goal of attribute reduction is choose a subset of relevant attributes from a huge number of available attributes to obtain comparable or even better classification accuracy than using all attributes. A system for feature selection is proposed in this paper using a modified version of the wolf search algorithm optimization. WSA is a bio-inspired heuristic optimization algorithm that imitates the way wolves search for food and survive by avoiding their enemies. The WSA can quickly search the feature space for optimal or near-optimal feature subset minimizing a given fitness function. The proposed fitness function used incorporate both classification accuracy and feature reduction size. The proposed system is applied on a set of the UCI machine learning data sets and proves good performance in comparison with the GA and PSO optimizers commonly used in this context.

P151 Alarm prediction in industrial machines using autoregressive LS-SVM models [#14072]

Rocco Langone, Carlos Alzate, Abdellatif Bey-Temsamani and Johan Suykens, KU LEUVEN (ESAT-STADIUS), Belgium; Smarter Cities Technology Center, IBM Research-Ireland, Ireland; Flanders Mechatronics Technology Centre (FMTC vzw), Belgium

In industrial machines different alarms are embedded in machines controllers. They make use of sensors and machine states to indicate to end-users various information (e.g. diagnostics or need of maintenance) or to put machines in a specific mode (e.g. shut-down when thermal protection is activated). More specifically, the alarms are often triggered based on comparing sensors data to a threshold defined in the controllers software. In batch production machines, triggering an alarm (e.g. thermal protection) in the middle of a batch production is crucial for the quality of the produced batch and results into a high production loss. This situation can be avoided if the settings of the production machine (e.g. production speed) is adjusted accordingly based on the temperature monitoring. Therefore, predicting a temperature alarm and adjusting the production speed to avoid triggering the alarm seems logical. In this paper we show the effectiveness of Least Squares Support Vector Machines (LS-SVMs) in predicting the evolution of the temperature in a steel production machine and, as a consequence, possible alarms due to overheating. Firstly, in an offline fashion, we develop a nonlinear autoregressive (NAR) model, where a systematic model selection procedure allows to carefully tune the model parameters. Afterwards, the NAR model is used online to forecast the future temperature trend. Finally, a classifier which uses as input the outcomes of the NAR model allows to foresee future alarms.

P152 Sensor dynamics in high dimensional phase spaces via nonlinear transformations: Application to helicopter loads monitoring [#14137]

Julio Valdes, Catherine Cheung and Matthew Li, National Research Council Canada, Canada

Accurately determining component loads on a helicopter is an important goal in the helicopter structural integrity field, with repercussions on safety, component damage, maintenance schedules and other operations. Measuring dynamic component loads directly is possible, but these measurement methods are costly and are difficult to maintain. While the ultimate goal is to estimate the loads from flight state and control system parameters available in most helicopters, a necessary step is understanding the behavior of the loads under different flight conditions. This paper explores the behavior of the main rotor normal bending loads in level flight, steady turn and rolling pullout flight conditions, as well as the potential of computational intelligence methods in understanding the dynamics. Time delay methods, residual variance analysis (gamma test) using genetic algorithms, unsupervised non-linear mapping and recurrence plot and quantification analysis were used. The results from this initial work demonstrate that there are important differences in the load behavior of the main rotor blade under the different flight conditions which must be taken into account when working with machine learning methods for developing prediction models.

P153 Automatic Text Categorization Using a System of High-Precision and High-Recall Models [#15075]

Dai Li, Yi Murphey and Huang Yinghao, University of Michigan-Dearborn, United States

This paper presents an automatic text document categorization system, HPHR. HPHR contains high precision, high recall and noise-filtered text categorization models. The text categorization models are generated through a suite of machine learning algorithms, a fast clustering algorithm that efficiently and effectively group documents into subcategories, and a text category generation algorithm that automatically generates text subcategories that represent high precision, high recall and noise-filtered text categorization models from a given set of training documents. The

HPHR system was evaluated on documents drawn from two different applications, vehicle fault diagnostic documents, which are in a form of unstructured and verbatim text descriptions, and Reuters corpus. The performance of the proposed system, HPHR, on both document collections showed superiority over the systems commonly used in text document categorization.

P154 Simplified firefly algorithm for 2D image key-points search [#14840]

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In order to identify an object, human eyes firstly search the field of view for points or areas which have particular properties. These properties are used to recognise an image or an object. Then this process could be taken as a model to develop computer algorithms for images identification. This paper proposes the idea of applying the simplified firefly algorithm to search for key-areas in 2D images. For a set of input test images the proposed version of firefly algorithm has been examined. Research results are presented and discussed to show the efficiency of this evolutionary computation method.

P155 Human-Mobile Agents Partnerships in Complex Environment [#15094]

Oleksandr Sokolov, Sebastian Meszynski, Gernot Groemer, Birgit Sattler, Franco Carbognani, Jean-Marc Salotti and Mateusz Jozefowicz, Faculty of Physics, Astronomy and Informatics, Nicolaus Copernicus University, Poland; Austrian Space Forum, Austria; University of Innsbruck, Austria; Italian Mars Society, Italy; Laboratoire de l'Integration du Materiau au Systeme, Bordeaux University, France; Polish Mars Society, Poland

This article shall explore the robotic and software support strategies based on a sample activity providing optimum inputs, namely a simulated human missions. This mission will be treated as a clean-sheet approach for operating multiple, diverse and adaptive agents in complex environments. Building upon existing state-of-the-art hardware, like mobile robots, astrobiological instruments and software architectures, results and experiences from previous missions involving the partners, high-fidelity analog field tests shall demonstrate the added value, potential and limitations of adaptive machines supporting humans in a challenging environment.

P156 K-means based Double-bit Quantization For Hashing [#14406]

Zhu Hao, 3M Cogent Beijing Research and development Center, China

Hashing function is an efficient way for nearest neighbor search in massive dataset because of low storage cost and low computational cost. However, it is NP hard problem to transform data points from the original space into a new hypercube space directly. Typically, the most of hashing methods choose a two-stage strategy. In the first stage, dimension reduction methods are used to project original data into desired dimensionality with real values. Then in the second stage, the real values are simply quantized into binary codes by thresholding for the most of existing methods. Although there is double-bit quantization (DBQ) strategy to improve quantization results. The existing solutions assume that the input data subject to gaussian distribution. In this paper, we propose a novel approach based on DBQ strategy, which can efficiently handle the situation under non-Gaussian distribution input. In the experiments, we demonstrate that our method is an efficient alternative to other methods based on DBQ strategy.

P157 Fast Overcomplete Topographical Independent Component Analysis (FOTICA) and its Implementation using GPUs [#14810]

Chao-Hui Huang, Bioinformatics Institute, Agency for Science, Technology and Research, Singapore

Overcomplete and topographic representation of natural images is an important concept in computational neuroscience due to its similarity to the anatomy of visual cortex. In this paper, we propose a novel approach, which applies the fixed-point technique of the method called FastICA \cite{Hyvarinen:99:626} to the ICA model with the properties of overcomplete and topographic representation, named Fast Overcomplete Topographic ICA (FOTICA). This method inherits the features of FastICA, such as faster time to convergence, simpler structure, and less parameters. The proposed FOTICA can easily be implemented in GPUs. In this paper, we also compare the performances with different system configurations. Through the comparison, we will show the performance of the proposed FOTICA and the power of implementing FOTICA using GPUs.

P158 Toward an under specified queries enhancement using retrieval and classification platforms [#14412]

Mustapha Aouache, Aini Hussain, Abdul Samad Salina and Zulkifley Mohd Asyraf, Univeristi Kebangsaan Malaysia, Malaysia

Radiography images are used usually for diseases detection and fracture that can be visible on lateral view. Magnification of the contrast and sharpness of the x-ray image will afford plenty and satisfactory visual information to the radiologist and clinician. In addition, increasing the accuracy of the segmentation and indexing subsequent modules in the CADs system for an autonomous disease diagnosis. Therefore, this paper describes a new strategy toward an under-specified queries enhancement using retrieval and classification platforms. In the retrieval platform, employing gamma correction (GC) function on under specified query image to generate DL descriptor that measures the relationship between the local contrast and the local brightness, measured respectively with the help of estimators of location and dispersion. Subsequently, it employs appropriate searching nearly optimal between the DL features of the query image and their corresponding similarity measurement in the archive database. In the classification platform, an approach was examined to predict gain value of GC function using statistical pixel-level (SPL) features extracted from the radiography images along with ANN's model classifier. The quality of the retrieved images is obtained with referring to their under-specified query images. In addition, the problem of gain value estimation is transformed to a classification problem solved using ANN's model with three different modes measurement. Results indicate that the proposed approach significantly improve the image quality with revealed under imbalance condition that can help in image segmentation for vertebral detection and mobility analysis.

P159 A Multi-modal Moving Object Detection Method Based on GrowCut Segmentation [#14494]

Xiuwei Zhang, Yanning Zhang, Stephen Maybank and Jun Liang, Northwestern Polytechnical University, China; Birkbeck College, United Kingdom

Commonly-used motion detection methods, such as background subtraction, optical flow and frame subtraction are all based on the differences between consecutive image frames. There are many difficulties, including similarities between objects and background, shadows, low illumination, thermal halo. Visible light images and thermal images are complementary. Many difficulties in motion detection do not occur simultaneously in visible and thermal images. The proposed multimodal detection method combines the advantages of multi-modal image and

GrowCut segmentation, overcomes the difficulties mentioned above and works well in complicated outdoor surveillance environments. Experiments showed our method yields better results than commonly-used fusion methods.

P160 Inertial-Visual Pose Tracking Using Optical Flow-aided Particle Filtering [#15011]

Armaghan Moemeni and Eric Tatham, Centre for Computational Intelligence, De Montfort University, United Kingdom

This paper proposes an algorithm for visual-inertial camera pose tracking, using adaptive recursive particle filtering. The method benefits from the agility of inertial-based and robustness of vision-based tracking. A proposal distribution has been developed for the selection of the particles, which takes into account the characteristics of the Inertial Measurement Unit (IMU) and the motion kinematics of the moving camera. A set of state-space equations are formulated, particles are selected and then evaluated using the corresponding features tracked by optical flow. The system state is estimated using the weighted particles through an iterative sequential importance resampling algorithm. For the particle assessment, epipolar geometry, and the characteristics of focus of expansion (FoE) are considered. In the proposed system the computational cost is reduced by excluding the rotation matrix from the process of recursive state estimations. This system implements an intelligent decision making process, which decides on the best source of tracking whether IMU only, hybrid only or hybrid with past state correction. The results show a stable tracking performance with an average location error of a few centimeters in 3D space.

P161 A Distance Based Variable Neighborhood Search for Parallel Machine Scheduling [#14620]

Andre Batista and Lucas Batista, Universidade Federal de Minas Gerais, Brazil

Throughout the years, scheduling problems have been broadly addressed in the literature due to their wide application in practice. Some examples include the production line optimization, the scheduling aircraft landing, the daily nurse care, among others. In this work one investigate the efficiency of applying geometric-based operators in a version of this problem that deals with the schedule of n independent tasks for m parallel machines, which can be either identical or unrelated. In order to validate this study, a Variable Neighborhood Search approach is proposed and applied to a specific scheduling problem regarding the minimization of the weighted sum of the earliness/tardiness task, a well-known NP-Hard problem. The test instances are solved for either a due date known a priori or not. The algorithm is compared with two other methods from the literature and the results show promising.

P162 GPU Accelerated NEH Algorithm [#14722]

Magdalena Metlicka, Donald Davendra, Frank Hermann, Markus Meier and Matthias Amann, VSB-Technical University of Ostrava, Czech Republic; Technical University of Applied Sciences, Germany

This research aims to develop a CUDA accelerated NEH algorithm for the permutative flowshop scheduling problem with makespan criterion. NEH has been shown in the literature as the best constructive heuristic for this particular problem. The CUDA based NEH aims to speed up the processing time by utilising the GPU cores for parallel evaluation. In order to show the versatility and scalability of the CUDA based NEH, four new higher dimensional Taillard sets are generated. The experiments are conducted on the CPU and GPU and pairwise compared. Percentage relative difference and paired t-test both confirm that the GPU based NEH significantly improves on the execution time compared to the sequential CPU version for all the high dimensional problem instances.

P163 A Two-Layer Optimization Framework for UAV Path Planning with Interval Uncertainties [#15023]

Bai Li, Raymond Chiong and Mu Lin, Zhejiang University, China; The University of Newcastle, Australia

We propose a two-layer optimization framework for the unmanned aerial vehicle path planning problem to handle interval uncertainties that exist in the combat field. When evaluating a candidate flight path, we first calculate the interval response (i.e., the upper and lower bounds) of the candidate flight path within the inner layer of the framework using a collocation interval analysis method (CIAM). Then, in the outer layer, we introduce a novel criterion for interval response comparison. The artificial bee colony algorithm is used to search for the optimal flight path according to this new criterion. Our experimental results show that the CIAM adopted is a feasible option, which largely eases the computational burden. Moreover, our derived flight paths can effectively handle bounded uncertainties without knowing the corresponding uncertainty distributions.

P164 Realtime Dynamic Clustering for Interference and Traffic Adaptation in Wireless TDD System [#15034]

Mingliang Tao, Qimei Cui, Xiaofeng Tao and Haihong Xiao, Beijing University of Posts and Telecommunications, China; HEC, School of Management, Paris, France

The dynamic time-division duplex (TDD) system is a recently proposed technology that can accommodate downlink (DL)/uplink (UL) traffic asymmetry and sufficiently utilize the spectrum resource. Its feature of sufficiency and flexibility will also induce a more sophisticated interference environment, which is known as interference mitigation and traffic adaptation (IMTA) problem. Clustering is a new idea which has been widely accepted to solve IMTA problem. However, most previous works just took large-scale path loss or coupling loss as criteria of the clustering schemes, thus the throughput performance would be limited by the varying traffic requirements among different small cells within one cluster. In this paper, a realtime dynamic cluster-based IMTA scheme is proposed and evaluated with dense deployment of small cells (SCs). Firstly, a new clustering criterion named Differentiating Metric (DM) is defined. Based on the defined DM value, a DM matrix is formed and further presented by a clustering graph. In the clustering graph, the dynamic clustering strategy is mapped to a MAX N-CUT problem, which is addressed in polynomial time by a proposed heuristic clustering algorithm. Furthermore, the system level simulation results demonstrate a promising improvement on uplink traffic throughput (UTP) in our proposed scheme compared with traditional clustering schemes.

P165 Optimization of Material Supply Model in an Emergent Disaster Using Differential Evolution [#14094]

Qi Cao and K. M. Leung, Logistical Engineering University, China; New York University, United States

At present, optimization modeling has become a powerful tool to tackle emergency logistics problems. A multi-objective material supply model in an emergent disaster is first constructed in the paper. The differential evolution (DE) algorithm with constraint handling methods, specialized for the material supply model, is then presented. Finally, a simulation experiment is performed and our results are compared with those obtained using a different method. We found that the proposed algorithm can quickly and robustly approach the best solution for both the single objective function and the multi-objective model. It is a more feasible and efficient way to handle material supply optimization in emergency logistics problems.

P166 Determining the Cost Impact of SCM System Errors [#14768]

John Medellin, Southern Methodist University Lyle School of Engineering, United States

Software Configuration Management (SCM) auditing is the fourth of four sub processes recommended by the IEEE and the ACM in this area. This research is the continuation of ongoing experiments in the use of heuristics for predicting fault rates in systems that support SCM. This paper allocates financial indicators to the business model for a hypothetical Telecommunications company and predicts the potential financial error impact due to Configuration Management errors in the SCM system. This paper focuses on sampling first Use Cases in order to determine the error rates by Operating Profile and then using that knowledge in drawing samples of Test Cases. The 5,388 Test Cases were generated from sources available in open forums and they were injected with 4% of faults; 2.1% carried from Use Cases and 2% added. A total sampling of 492 items was conducted and was able to approximate the financial error rate in 6,006 items at an acceptable level with a 92% reduction in effort. The two stage sampling technique performed better than straight random sampling. When applied to the contribution from each Test Case, random sampling produced above a 6.87% error in the value chain estimate while two stage sampling produced under a 2.72% error in the same estimate.

P167 Comparing a Hybrid Branch and Bound Algorithm with Evolutionary Computation Methods, Local Search and their Hybrids on the TSP [#14649]

Yan Jiang, Thomas Weise, Joerg Laessig, Raymond Chiong and Rukshan Athauda, University of Science and Technology of China (USTC), China; University of Applied Sciences Zittau/Goerlitz, Germany; The University of Newcastle, Australia

Benchmarking is one of the most important ways to investigate the performance of metaheuristic optimization algorithms. Yet, most experimental algorithm evaluations in the literature limit themselves to simple statistics for comparing end results. Furthermore, comparisons between algorithms from different "families" are rare. In this study, we use the TSP Suite - an open source software framework - to investigate the performance of the Branch and Bound (BB) algorithm for the Traveling Salesman Problem (TSP). We compare this BB algorithm to an Evolutionary Algorithm (EA), an Ant Colony Optimization (ACO) approach, as well as three different Local Search (LS) algorithms. Our comparisons are based on a variety of different performance measures and statistics computed over the entire optimization process. The experimental results show that the BB algorithm performs well on very small TSP instances, but is not a good choice for any medium to large-scale problem instances. Subsequently, we investigate whether hybridizing BB with LS would give rise to similar positive results like the hybrid versions of EA and ACO have. This turns out to be true - the "Memetic" BB algorithms are able to improve the performance of pure BB algorithms significantly. It is worth pointing out that, while the results presented in this paper are consistent with previous findings in the literature, our results have been obtained through a much more comprehensive and solid experimental procedure.

P168 Multivariate Gaussian Copula in Estimation of Distribution Algorithm with Model Migration [#14181]

Martin Hyrs and Josef Schwarz, Brno University of Technology, Czech Republic

The paper presents a new concept of an islandbased model of Estimation of Distribution Algorithms (EDAs) with a bidirectional topology in the field of numerical optimization in continuous domain. The traditional migration of individuals is replaced by the probability model migration. Instead of a classical joint probability distribution model, the multivariate Gaussian copula is used which must be specified by correlation coefficients and parameters of a univariate marginal distributions. The idea of the proposed Gaussian Copula EDA algorithm with model migration (GC-mEDA) is to modify the parameters of a resident model respective to each island by the immigrant model of the neighbour island. The performance of the proposed algorithm is tested over a group of five well-known benchmarks.

P169 The Impact of Agent Size and Number of Rounds on Cooperation in the Iterated Prisoner's Dilemma [#14897]

Lee-Ann Barlow, University of Guelph, Canada

The chance that a population of iterated Prisoner's Dilemma playing agents will evolve to a cooperative state is strongly influenced by the duration of the encounter. With only one round of Prisoner's Dilemma, the populations rapidly evolve to the always-defect Nash equilibrium. Durations exceeding the number of rounds to which the agent representation could conceivably count are most likely to yield cooperation but require more computer resources. Reported here is a careful study of different encounter lengths and their impact on cooperation using finite state machines, which are known to yield high levels of cooperation for long encounter durations. Agents with different numbers of states are used. This research, in addition to highlighting one of the boundaries of the evolution of cooperation for evolving agents, serves as a parameter setting study for future research that permits a reduction in the computational resources required. A recently developed tool known as a play profile is used to determine the distribution of agent behaviour by sorting the final fitness scores achieved in each important epoch of evolution. It was found that only 41 to 64 rounds are required to achieve the same level of cooperation as that achieved in 150 rounds, with conservative estimates lying between 60 and 85 rounds. Even the conservative estimates include approximately half as many rounds of play as the current standard.

P170 Optimization of Feedforward Neural Network by Multiple Particle Collision Algorithm [#14884]

Juliana Anochi and Haroldo Campos Velho, Instituto Nacional de Pesquisas Espaciais, Brazil

Optimization of neural network topology, weights and neuron activation functions for given data set and problem is not an easy task. In this article, a technique for automatic configuration of parameters topology for feedforward artificial neural networks (ANN) is presented. The determination of optimal parameters is formulated as an optimization problem, solved with the use of meta-heuristic Multiple Particle Collision Algorithm (MPCA). The self-configuring networks are applied to predict the mesoscale climate for the precipitation field. The results obtained from the neural network using the method of data reduction by the Theory of Rough Sets and the self-configuring network by MPCA were compared.

P171 The Evolution of Exploitation [#14941]

Wendy Ashlock, Jeffrey Tsang and Daniel Ashlock, York University, Canada; University of Guelph, Canada

The evolution of cooperation has been much studied in the context of the game of iterated prisoner's dilemma. This paper examines, instead, the evolution of exploitation, strategies that succeed at the expense of their opponent. Exploitation is studied when opponents are close kin, against other evolved strategies, and against arbitrary strategies. A representation for strategies, called shaped prisoner's dilemma automata, is used to find exploitative strategies using a co-evolutionary algorithm. This representation alters both the space of strategies searched and the connectivity of that space. Eight different shapes are studied in the context of their ability to find exploitative strategies.

P172 A Privacy and Authentication Protocol for Mobile RFID System [#14447]

Huang Hui-Feng, Yu Po-Kai and Liu Kuo-Ching, National Taichung University of Science and Technology, Taichung 404, Taiwan, Taiwan; China Medical University, Taichung 404, Taiwan, Taiwan

Since information communication via radio transmission can be easily eavesdropped, therefore, many radio frequency identification (RFID) security mechanisms for location privacy protection have been proposed recently. However, most of previously proposed schemes do not conform to the EPC Class-1 GEN-2 standard for passive RFID tags as they require the implementation of hash functions on the tags. In 2013, Doss et al. proposed the mutual authentication for the tag, the reader, and the back-end server in the RFID system. Their scheme is the first quadratic residues based to achieve compliance to EPC Class- 1 GEN-2 specification and the security of the server-reader channel may not be guaranteed. However, this article will show that the computational requirements and bandwidth consumption are quite demanding in Doss et al.'s scheme. To improve Doss et al.'s protocol, this article proposes a new efficient RFID system where both the tag-reader channel and the reader-server channel are insecure. The proposed method is not only satisfies all the security requirements for the reader and the tag but also achieve compliance to EPC Class-1 GEN-2 specifications. Moreover, the proposed scheme can be used in a large-scale RFID system.

P173 Adaptive Fast Image Dehazing Algorithm [#14576]

Cheng-Hsiung Hsieh, Chih-Tsung Chen and Yu-Sheng Lin, Chaoyang University of Technology, Taiwan; Asia-Pacific Institute of Creativity, Taiwan

Recently, a single image haze removal scheme based on dark channel prior (DCP) is presented in [1] and is getting popular because of its satisfactory performance for most of cases. However, the DCP scheme has at least three problems: halos, high computational cost and over-exposure. In our previous paper [2], a dehazing algorithm with dual dark channels was presented where high computational cost and over-exposure problems are relieved. In this paper, the objective of proposed dehazing algorithm (PDA) is to relieve the three problems in [1] simultaneously. Four examples are given to verify the PDA where comparison with the DCP scheme is made as well. The simulation results indicate that the PDA is 87.87 times, on average, faster than the DCP in the given examples. Besides, in general better color situation is found for the PDA with similar visual quality and without the three problems in the DCP scheme.

P174 A TAIEX Forecasting Model based on Changes of Keyword Search Volume on Google Trends [#14596]

Min-Hsuan Fan, Mu-Yen Chen and En-Chih Liao, National Taichung University of Science and Technology, Taiwan

In this study, we used the Google Trends as a prediction tool to predict the investors' behavior and its impact on stock market. In the behavior and social perspective, more and more Internet users use Google Trends as the search engine to surf on the websites every day. Therefore, these search actions can be seen as personal votes because Internet users often search items they are interested in. Based on this motivation, this study wanted to investigate the relationship between Internet search and Taiwan Stock Exchange Weighted Index. Finally, this study provides the investors a different approach from fundamental analysis and technical analysis. It offers a more understandable reference standard to investors new to the stock market. For investors who are good at fundamental analysis and technical analysis, it can be also used as a reference subject.

P175 Using Data Mining Technology to Explore Internet Addiction Behavioral Patterns [#14617]

Mu-Jung Huang, Mu-Yen Chen and Chin-Chun Cheng, National Changhua University of Education, Taiwan; National Taichung University of Science and Technology, Taiwan

The purposes of this study were to explore psychological satisfaction and emotional reaction of Internet users through emotional perspectives and to discuss whether Internet use behaviors would lead to addiction to the Internet. From previous literature and studies, it was found that most studies explored this topic by testing hypotheses. The study used data mining to identify association rules among affective ambivalence, Internet use behavior and Internet addiction. Online and paper questionnaires were distributed for this study. Online questionnaires were put on BBS, Facebook and major forums; paper questionnaires were distributed via convenience sampling. A total of 565 questionnaires were recovered. Among these, 502 copies of the questionnaires were valid, making the effective response rate about 88%. It was found from the affective ambivalence that different use behaviors would result in different affective states. Different individuals would also show different behavior and creativity.

P176 A CMA-ES-based 2-Stage Memetic Framework for Solving Constrained Optimization Problems [#14509]

Vinicius Veloso de Melo and Giovanni Iacca, Universidade Federal de Sao Paulo, UNIFESP, Brazil; INCAS3, Netherlands

Constraint optimization problems play a crucial role in many application domains, ranging from engineering design to finance and logistics. Specific techniques are therefore needed to handle complex fitness landscapes characterized by multiple constraints. In the last decades, a number of novel meta- heuristics have been applied to constraint optimization. Among these, the Covariance Matrix Adaptation Evolution Strategy (CMA-ES) has been attracting lately the most attention of researchers. Recent variants of CMA-ES showed promising results on several benchmarks and practical problems. In this paper, we attempt to improve the performance of an adaptive penalty CMA-ES recently proposed in the literature. We build upon it a 2-stage memetic framework, coupling the CMA-ES scheme with a local optimizer, so that the best solution found by CMA-ES is used as starting point for the local search. We test, separately, the use of three classic local search algorithms (Simplex, BOBYQA, and L-BFGS-B), and we compare the baseline scheme (without local search) and its three memetic variants with some of the state-of-the-art methods for constrained optimization.

P177 Cluster Restarted Differential Migration [#14460]

Marek Dlapa, Tomas Bata University in Zlin, Czech Republic

The paper deals with a new evolutionary algorithm - Differential Migration, and provides comparison with other algorithms of this type. Cluster Restarted Differential Migration is examined with standard benchmark test functions for performance comparison. Standard Differential Migration and Restart Covariance Matrix Adaptation Evolution Strategy With Increasing Population Size (IPOP-CMA-ES) are used as reference and the results are compared with Cluster Restarted Differential Migration. The main feature of the algorithm is the fact that it is a generalization of SOMA (Self-Organizing Migration Algorithm) giving a general scheme incorporating both strategies of SOMA, i.e. all-to-one and all-to-all, into one general algorithm using clusters and a parameter specifying the measure of trade-off between all-to-one and all-to-all strategy. Besides this,

some principles from Differential Evolution are adopted implying higher speed of search than SOMA for most of benchmarks and real-world applications. In this paper, Cluster Restarted Differential Migration is presented providing some new features compared to its standard form.

P178 Bipolar Choquet integral of fuzzy events [#14695]

Jabbar Ghafil, Department of Applied Sciences, University of Technology, Baghdad, IRAQ, Iraq

The aim of this paper is to propose the concept of bi-capacities and its integrals of fuzzy events. First, we introduce a approach for studying bi-capacities of fuzzy events. Then, we propose a model of bipolar Choquet integral with respect to bi-capacities of fuzzy events, and we give some basic properties of this model.

P179 Interval Linear Optimization Problems with Fuzzy Inequality Constraints [#14165]

Ibraheem Alolyan, King Saud University, Saudi Arabia

In many real-life situations, we come across problems with imprecise input values. Imprecisions are dealt with by various ways. One of them is interval based approach in which we model imprecise quantities by intervals, and suppose that the quantities may vary independently and simultaneously within their intervals. In most optimization problems, they are formulated using imprecise parameters. Such parameters can be considered as fuzzy intervals, and the optimization tasks with interval cost function are obtained. When realistic problems are formulated, a set of intervals may appear as coefficients in the objective function or the constraints of a linear programming problem. In this paper, we introduce a new method for solving linear optimization problems with interval parameters in the objective function and the inequality constraints, and we show the efficiency of the proposed method by presenting a numerical example.

P180 Evolutionary Fixed-Structure Mu-Synthesis [#14008]

Philippe Feyel, Gilles Duc and Guillaume Sandou, Sagem Defense and Security, France; Supelec E3S, France

This paper proposes to shed a new light on the Mu-synthesis problem using the differential evolution algorithm. This algorithm allows optimizing simultaneously the structured controller and the dynamic (or static) D- scalings, which leads to robust performance controllers. This method has been applied successfully to a classical flexible plant control problem. A comparison between the evolutionary approach and the non-smooth optimization one has been envisaged proving the high potential of the proposed method.

P181 An Algorithm of Polygonal Approximation Constrained by The Offset Direction [#14400]

Fangmin Dong, Xiaojing Xuan, Shuifa Sun and Bangjun Lei, College of Computer and Information Technology, China Three Gorges University, China

In view of the existing polygonal approximation algorithm of digital curves can't effectively solve the problem of polygonal approximation constrained by the offset direction, this paper proposes an algorithm of polygonal approximation constrained by the offset direction. First, the offset polygon of the original digital curve is calculated under the control of offset direction and distance. Second, the summation of the squared Euclidean distances between the vertices on the offset polygon and its corresponding segment in the approximated polygon is selected as the fitness function. Finally, under the control of the offset distance and fitness function, this paper implements a PSO-based polygonal approximation algorithm to approximate the offset polygon. Experiments show that the proposed method can not only satisfy the polygonal approximation with directional requirements, but also can greatly improve the operating efficiency.

Thursday, December 11, 7:00PM-9:30PM

Banquet

Thursday, December 11, 7:00PM-9:30PM, Room: Grand Sierra A, B, C & D

Friday, December 12, 8:00AM-9:00AM

Plenary Talk: Blast from the Past - Revisiting Evolutionary Strategies for the Design of Engineered Systems

Friday, December 12, 8:00AM-9:00AM, Room: Grand Sierra D, Speaker: Alice E. Smith, Chair: Robert G. Reynolds

CICA'14 Session 4: Evolutionary Computation in Control and Automation

Friday, December 12, 9:30AM-10:30AM, Room: Antigua 2, Chair: Alok Kanti Deb and Chixin Xiao

9:30AM Constrained Multi-objective Evolutionary Algorithm Based on Decomposition for Environmental/Economic Dispatch [#14408]

Yin Jianping, Xiao Chixin and Zhou Xun, National University of Defence Technology, China; Xiangtan University, China; University of Newcastle, Australia

The Environmental/Economic Dispatch EED puzzle of power system is actually a classic constrained multi-objective optimization problem in evolutionary optimization category. However, most of its properties have not been researched by its aboriginal Pateto Front. In a meanwhile, the multi-objective evolutionary algorithm based on decomposition(MOEA/D) is a well-known new rising yet powerful method in multi-objective evolutionary optimization domain, but how to run it under constrained conditions has not been testified sufficiently because it is not easy to embed traditional skills to process constraints in such special frame as MOEA/D. Different from non-dominated sorting relationship as well as simply aggregation, this paper proposes a new multi-objective evolutionary approach motivated by decomposition idea and some equality constrained optimization approaches to handle EED problem. The standard IEEE 30 bus six-generator test system is adopted to test the performance of the new algorithm with several simple parameter setting. Experimental results have shown the new method surpasses or performs similarly to many state-of-the-art multi-objective evolutionary algorithms. The high-quality experimental results have validated the efficiency and applicability of the proposed approach. It has good reason to believe that the new algorithm has a promising space over the real-world multi-objective optimization problems.

9:50AM Grasping Novel Objects with a Dexterous Robotic Hand through Neuroevolution [#14358]

Pei-Chi Huang, Joel Lehman, Aloysius K. Mok, Risto Miikkulainen and Luis Sentis, Department of Computer Science, The University of Texas at Austin, United States; Department of Mechanical Engineering, The University of Texas at Austin, United States

Robotic grasping of a target object without advance knowledge of its three-dimensional model is a challenging problem. Many studies indicate that robot learning from demonstration (LfD) is a promising way to improve grasping performance, but complete automation of the grasping task in unforeseen circumstances remains difficult. As an alternative to LfD, this paper leverages limited human supervision to achieve robotic grasping of unknown objects in unforeseen circumstances. The technical question is what form of human supervision best minimizes the effort of the human supervisor. The approach here applies a human-supplied bounding box to focus the robot's visual processing on the target object, thereby lessening the dimensionality of the robot's computer vision processing. After the human supervisor defines the bounding box through the man-machine interface, the rest of the grasping task is automated through a vision-based feature-extraction approach where the dexterous hand learns to grasp objects without relying on pre-computed object models through the NEAT neuroevolution algorithm. Given only low-level sensing data from a commercial depth sensor Kinect, our approach evolves neural networks to identify appropriate hand positions and orientations for grasping novel objects. Further, the machine learning results from simulation have been validated by transferring the training results to a physical robot called Dreamer made by the Meka Robotics company. The results demonstrate that grasping novel objects through exploiting neuroevolution from simulation to reality is possible.

10:10AM New Multiagent Coordination Optimization Algorithms for Mixed-Binary Nonlinear Programming with Control Applications [#14180]

Haopeng Zhang and Qing Hui, Texas Tech University, United States

Mixed-binary nonlinear programming (MBNP), which can be used to optimize network structure and network parameters simultaneously, has been seen widely in applications of cyber-physical network systems. However, it is quite challenging to develop efficient algorithms to solve it practically. On the other hand, swarm intelligence based optimization algorithms can simulate the cooperation and interaction behaviors from social or nature phenomena to solve complex, nonconvex nonlinear problems with high efficiency. Hence, motivated by this observation, we propose a class of new computationally efficient algorithms called coupled spring forced multiagent coordination optimization (CSFMCO), by exploiting the chaos-like behavior of two-mass two-spring mechanical systems to improve the ability of algorithmic exploration and thus to fast solve the MBNP problem. Together with the continuous version of CSFMCO, a binary version of CSFMCO and a switching version between continuous and binary versions are presented. Moreover, to numerically illustrate our proposed algorithms, a formation control problem and resource allocation problem for cyber-physical networks are investigated by using the proposed algorithms.

ICES'14 Session 4: Evolvable Hardware I

Friday, December 12, 9:30AM-10:30AM, Room: Antigua 3, Chair: Kyrre Glette

9:30AM Supervised Learning of DPLL Based Winner-Take-All Neural Network [#14307]

Masaki Azuma and Hiroomi Hikawa, Kansai University, Japan

Due to superior learning ability, neural network is widely used in various fields. This paper proposes a hardware winner-take-all neural network (WTANN) which has a new winner-take-all (WTA) circuit with phase-modulated pulse signal and digital phase-locked loops (DPLLs). The system uses DPLL as a computing element, so all input values are expressed by phases of rectangular signals. In hardware WTANN, the proposed winner search method is implemented with simple circuit. The proposed WTANN architecture is described by VHSIC Hardware Description Language (VHDL) and its feasibility is verified by simulation. In VHDL simulation, vector classifications by WTANN using two kinds of data sets, Iris and Wine, are performed. Then its circuit size and speed are evaluated by applying the VHDL description to logic synthesis tool. In addition, FPGA implementation is performed. Results show that the proposed WTANN has valid learning performance.

9:50AM How Evolvable is Novelty Search? [#14391]

David Shorten and Geoff Nitschke, University of Cape Town, South Africa

This research compares the efficacy of novelty versus objective based search for producing evolvable populations in the maze solving task. Populations of maze solving simulated robot controllers were evolved to solve a variety of different, relatively easy, mazes. This evolution took place using either novelty or objective-based search. Once a solution was found, the simulation environment was changed to one of a variety of

more complex mazes. Here the population was evolved to find a solution to the new maze, once again with either novelty or objective based search. It was found that, regardless of whether the search in the second maze was directed by novelty or fitness, populations that had been evolved under a fitness paradigm in the first maze were more likely to find a solution to the second. These results suggest that populations of controllers adapted under novelty search are less evolvable compared to objective based search in the maze solving task.

10:10AM How to Evolve Complex Combinational Circuits From Scratch? [#14496]

Zdenek Vasicek and Lukas Sekanina, Brno University of Technology, Czech Republic

One of the serious criticisms of the evolutionary circuit design method is that it is not suitable for the design of complex large circuits. This problem is especially visible in the evolutionary design of combinational circuits, such as arithmetic circuits, in which a perfect response is requested for every possible combination of inputs. This paper deals with a new method which enables us to evolve complex circuits from a randomly seeded initial population and without providing any information about the circuit structure to the evolutionary algorithm. The proposed solution is based on an advanced approach to the evaluation of candidate circuits. Every candidate circuit is transformed to a corresponding binary decision diagram (BDD) and its functional similarity is determined against the specification given as another BDD. The fitness value is the Hamming distance between the output vectors of functions represented by the two BDDs. It is shown in the paper that the BDD-based evaluation procedure can be performed much faster than evaluating all possible assignments to the inputs. It also significantly increases the success rate of the evolutionary design process. The method is evaluated using selected benchmark circuits from the LGSynth91 set. For example, a correct implementation was evolved for a 28-input frg1 circuit. The evolved circuit contains less gates (a 57% reduction was obtained) than the result of a conventional optimization conducted by ABC.

CIBIM'14 Session 4: Iris Recognition

Friday, December 12, 9:30AM-10:30AM, Room: Antigua 4, Chair: Gelson da Cruz Junior and Norman Poh

9:30AM Gaze Angle Estimate and Correction in Iris Recognition [#14853]

Tao Yang, Joachim Stahl, Stephanie Schuckers, Fang Hua, Chris Boehnen and Mahmut Karakaya, Clarkson University, United States; Oak Ridge National Laboratory, United States; Meliksah University, Turkey

Conventional iris recognition using a full frontal iris image has reached a very high accuracy rate. In this paper, we focus on processing off-angle iris images. Previous research has shown that it is possible to correct off-angle iris images, but knowledge of the angle was needed. Very little work has focused on iris angle estimation which can be used for angle correction. In this paper, we describe a two-phase angle estimation based on the geometric features of the ellipse. Angle correction is accomplished by projective transformation. Evaluation of this angle estimation and correction method includes a 3D eyeball simulator, and performance test on the West Virginia University Off-Angle Dataset.

9:50AM Subregion Mosaicking Applied to Nonideal Iris Recognition [#14868]

Tao Yang, Joachim Stahl, Stephanie Schuckers and Fang Hua, Clarkson University, United States

Image mosaicking technology, as an image processing technology that can aggregate the information from a sequence of images, has been used to process large size images. In this paper, we are trying to apply the mosaicking technology to nonideal iris recognition study. The proposed algorithm composes the information from a collection of iris images, and generates a "composite" image. The experiment includes the partial blinking iris and subregion of off angle iris images. The contribution of this paper is to show the image mosaicking technology is an effective technique for non ideal iris recognition at the condition of limited pattern information.

10:10AM Gender Inference within Turkish Population by Using Only Fingerprint Feature Vectors [#14924]

Eyup Burak Ceyhan and Seref Sagiroglu, Gazi University, Turkey

In the literature, there are some studies which investigate if there is a relationship between fingerprint and gender or not. In these studies, this relationship is examined based on some vectorial parts of fingerprints. The main problem in these studies is the lack of data, depending on ethnical background and country, and there is not an exact finding of true classification results. It is known that fingerprints show difference in males and females, and it is explained that women's line details are thin whereas men's line details are thick. However, the statistical studies, which have been made to prove the relationship between fingerprint and gender, have not investigated if the hypothesis is true for all ethnical backgrounds. In this study, we have examined if gender inference can be made only through fingerprint feature vectors, which belong to Turkish subjects, by using our database consisting of Naive Bayes, kNN, Decision Tree and Support Vector Machine learning algorithms. By using Naive Bayes algorithm, the success of the gender classification is found as 95.3%. This ratio has not been obtained before for "gender inference from fingerprint" in the literature. Therefore, this study can be useful for criminal cases.

Special Session: MCDM'14 Session 4: Optimization Methods in Bioinformatics and Bioengineering (OMBB) I

Friday, December 12, 9:30AM-10:30AM, Room: Bonaire 1, Chair: Anna Lavygina, Richard Allmendinger and Sanaz Mostaghim

9:30AM Visualization and Classification of Protein Secondary Structures using Self-Organizing Maps [#14711]

Christian Grevisse, Ian Muller, Juan Luis Jimenez Laredo, Marek Ostaszewski, Gregoire Danoy and Pascal Bouvry, University of Luxembourg, Luxembourg

In molecular biology, it is estimated that there is a correlation between the secondary structure of a protein and its functionality. While secondary structure prediction is ultimately possible in wet lab, determining a correlation with the functionality is a hard task which can be facilitated by a computational model. In that context, this paper presents an automated algorithm for the visualization and classification of enzymatic proteins with the aim of examining whether the functionality is correlated to the secondary structure. To that end, up-to-date protein data was acquired from publicly accessible databases in order to construct their secondary structures. The resulting data were injected into a tailored version of a Kohonen Self- Organizing Map (SOM). Part of the work was to determine a proper way of reducing large secondary structures to a common length in order to be able to cope with the constant dimensionality requirement of SOMs. The final contribution consisted in the labeling of the trained nodes. Eventually, we were able to get a visual intuition and some quantified assessment on the nature of this correlation.

9:50AM The Coxlogit model : feature selection from survival and classification data [#14785]

Samuel Branders, Roberto D'Ambrosio and Pierre Dupont, Universite catholique de Louvain, Belgium

This paper proposes a novel approach to select features that are jointly predictive of survival times and classification within subgroups. Both tasks are common but generally tackled independently in clinical data analysis. Here we propose an embedded feature selection to select common markers, i.e. genes, for both tasks seen as a multi-objective optimization. The Coxlogit model relies on a Cox proportional hazard model and a logistic regression that are constrained to share the same weights. Such model is further regularized through an elastic net penalty to enforce a common sparse support and to prevent overfitting. The model is estimated through a coordinate ascent algorithm maximizing a regularized log-likelihood. This Coxlogit approach is validated on synthetic and real breast cancer data. Those experiments illustrate that the proposed approach offers similar predictive performances than a Cox model for survival times or a logistic regression for classification. Yet the proposed approach is shown to outperform those standard techniques at selecting discriminant features that are informative for both tasks simultaneously.

10:10AM Gene interaction networks boost genetic algorithm performance in biomarker discovery [#14319]

Charalampos Moschopoulos, Dusan Popovic, Rocco Langone, Johan Suykens, Bart De Moor and Yves Moreau, Department of Electrical Engineering (ESAT), STADIUS Center for Dynamical Systems, Signal Processing and Data Analytics / iMinds Medical IT, KU Leuven, Leuven, Belgium, Belgium

In recent years, the advent of high-throughput techniques led to significant acceleration of biomarker discovery. In the same time, the popularity of machine learning methods grown in the field, mostly due to inherit analytical problems associated with the data resulting from these massively parallelized experiments. However, learning algorithms are very often utilized in their basic form, hence sometimes failing to consider interactions that are present between biological subjects (i.e. genes). In this context, we propose a new methodology based on genetic algorithms that integrates prior information through a novel genetic operator. In this particular application, we rely on a biological knowledge that is captured by the gene interaction networks. We demonstrate the advantageous performance of our method compared to a simple genetic algorithm by testing it on several microarray datasets containing samples of tissue from cancer patients. The obtained results suggest that inclusion of biological knowledge into genetic algorithm in the form of this operator can boost its effectiveness in the biomarker discovery problem.

Special Session: RiiSS'14 Session 4: Computational Intelligence for Cognitive Robotics II

Friday, December 12, 9:30AM-10:30AM, Room: Bonaire 2, Chair: Chu Kiong Loo

9:30AM Self-generation of reward in reinforcement learning by universal rules of interaction with the external environment [#14732]

Kentarou Kurashige and Kaoru Nikaido, Muroran Institute of Tehnology, Japan

Various studies related to machine learning have been performed. In this study, we focus on reinforcement learning, one of the methods used in machine learning. In conventional reinforcement leaning, the design of the reward function is difficult, because it is a complex and laborious task and requires expert knowledge. In previous studies, the robot learned from external sources, not autonomously. To solve this problem, we propose a method of robot learning through interactions with humans using sensor input. The reward is also generated through interactions with humans. However, the method does not require additional tasks that must be performed by the human. Therefore, the user does not need expert knowledge, and anyone can teach the robot. Our experiment confirmed that robot learning is possible through the proposed method.

9:50AM Facial Pose Estimation via Dense and Sparse Respresentation [#15097]

Hui Yu and Honghai Liu, University of Portsmouth, United Kingdom

Facial pose estimation is an important part for facial analysis such as face and facial expression recognition. In most existing methods, facial features are essential for facial pose estimation. However, occluded key features and uncontrolled illumination of face images make the facial feature detection vulnerable. In this paper, we propose methods for facial pose estimation via dense reconstruction and sparse representation but avoid localizing facial features. Sparse Representation Classifier (SRC) has achieved successful results in face recognition. In this paper, we explore SRC in pose estimation. Sparse representation learns a dictionary of base functions, so each input pose can be approximated by a linear

combination of just a sparse subset of the bases. The experiment conducted on the CMU MultiPIE face database has shown the effectiveness of the proposed method.

10:10AM Affective Communication Robot Partners using Associative Memory with Mood Congruency Effects [#15057]

Naoki Masuyama, MD. Nazrul Islam and Chu Loo, University of Malaya, Malaysia

Associative memory is one of the significant and effective functions in communication. Conventionally, several types of artificial associative memory models have been developed. In the field of psychology, it is known that human memory and emotions are closely related each other, such as the mood-congruency effects. In addition, emotions are sensitive to sympathy for facial expressions of communication partners. In this paper, we develop the emotional models for the robot partners, and propose an interactive robot system with complex-valued bidirectional associative memory model that associations are affected by emotional factors. We utilize multi-modal information such as gesture and facial expressions to generate emotional factors. The results of interactive communication experiment show the possibility of proposed system that can be provided the suitable information for the atmosphere of interactive space.

CIVTS'14 Session 4

Friday, December 12, 9:30AM-10:30AM, Room: Bonaire 3, Chair: Justin Dauwels, Dipti Srinivasan and Ana Bazzan

9:30AM Fitness function for evolutionary computation applied in dynamic object simulation and positioning [#14544]

Marcin Wozniak, Institute of Mathematics, Silesian University of Technology, Poland

In the paper an idea to apply evolutionary computation method with dedicated fitness function in dynamic system simulation and positioning is presented. Dedicated evolutionary system's efficiency in simulation, optimization and positioning of examined object is discussed. Presented experiments show common duty as well as extensive, overloading and dangerous situations at work. Research results are presented to discuss applied method.

9:50AM Autonomous Running Control System of an AGV by a Tablet PC based on the Wall-floor Boundary Line [#14232]

Anar Zorig, Haginiwa Atsushi and Sato Hiroyuki, Software and Information Science, Iwate Perfectural University, Japan

In our research, we have studied the autonomous running control system of the automatic guided vehicle (AGV) used in the manufacturing facility using the tablet PC. The moving direction of automatic vehicle is controlled by the results of image processing methods on captured images of the tablet PC. In the image processing step, after detecting edges we obtain wall-floor boundaries by analyzing those edges. By applying the least square method on the wall-floor boundaries, we calculate the moving direction of the AGV. To improve the accuracy of the moving direction, we divide the edge detection image into grid cells and remove all edges in cells with sparse edges. Furthermore, we divided all boundary points into vertical subdivisions, estimated unusual small boundaries and discarded them. As the result of our research, the running distance of the AGV was improved from 10 meters to the whole length of the testing course. The distance of testing course is 100 meters long.

10:10AM Fuzzy Logic Based Localization for Vehicular Ad Hoc Networks [#14197]

Lina Altoaimy and Imad Mahgoub, Florida Atlantic University, United States

Recent advances in wireless communications have led to the development of vehicular ad hoc networks (VANETs). It has attracted the interest of both industrial and academic communities due to its potential in reducing accidents and saving lives. In VANETs, vehicles can communicate with each other to exchange traffic and road information. One of the challenges in VANETs is to determine the location of a vehicle in the network. In this paper, we propose an intelligent localization method, which is based on fuzzy logic and neighbors' location information. The main objective of our proposed method is to estimate the location of a vehicle by utilizing the location information of its neighboring vehicles. To achieve accurate localization, we model vehicles' weights using fuzzy logic system, which utilizes the distance and heading information in order to obtain the weight values. By assigning weights to neighboring vehicles' coordinates, we expand the concept of centroid localization (CL). We evaluate our proposed method via simulation and compare its performance against CL. Results obtained from the simulation are promising and demonstrate the effectiveness of the proposed method in varying traffic densities.

CIES'14 Session 4: Applications II

Friday, December 12, 9:30AM-10:30AM, Room: Bonaire 4, Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse

9:30AM Finding longest paths in hypercubes, snakes and coils [#14859]

Seth Meyerson, Whiteside William, Thomas Drapela and Walter Potter, Computer Science Department, University of Georgia, United States; Institute for Artificial Intelligence, University of Georgia, United States

Since the problem's formulation by Kautz in 1958 as an error detection tool, diverse applications for long snakes and coils have been found. These include coding theory, electrical engineering, and genetics. Over the years, the problem has been explored by many researchers in different fields using varied approaches, and has taken on additional meaning. The problem has become a benchmark for evaluating search techniques in combinatorially expansive search spaces (NP-complete Optimizations). We present an effective process for searching for long achordal open paths (snakes) and achordal closed paths (coils) in n-dimensional hypercube graphs. Stochastic Beam Search provides the overall structure for the search while graph theory based techniques are used in the computation of a generational fitness value. This novel fitness value is used in guiding the search. We show that our approach is likely to work in all dimensions of the SIB problem and we present new lower bounds for a snake in dimension 11 and coils in dimensions 10, 11, and 12. The best known solutions of the unsolved dimensions of this

problem have improved over the years and we are proud to make a contribution to this problem as well as the continued progress in combinatorial search techniques.

9:50AM Solar Irradiance Forecasting by Using Wavelet Based Denoising [#14525]

Lingyu Lyu, Kantardzic Mehmed and Arabmakki Elaheh, University of Louisville, United States

Predicting of global solar irradiance is very important in applications using solar energy resources. This research introduces a new methodology to estimate the solar irradiance. Denoising based on wavelet transformation as a preprocessing step is applied to the time series meteorological data. Artificial neural network and support vector machine are then used to make predictive model on Global Horizontal Irradiance (GHI) for the three cities located in California, Kentucky and New York, individually. Detailed experimental analysis is presented for the developed predictive models and comparisons with existing methodologies show that the proposed approach gives a significant improvement with increased generality.

10:10AM Compressive sensing based power spectrum estimation from incomplete records by utilizing an adaptive basis [#14199]

Liam Comerford, Ioannis Kougioumtzoglou and Michael Beer, University of Liverpool, United Kingdom; Columbia University, United States

A compressive sensing (CS) based approach is developed in conjunction with an adaptive basis reweighting procedure for stochastic process power spectrum estimation. In particular, the problem of sampling gaps in stochastic process records, occurring for reasons such as sensor failures, data corruption, and bandwidth limitations, is addressed. If data records are not evenly sampled without gaps (some data is missing), there arise significant difficulties with standard spectral analysis techniques, i.e. Fourier or wavelet transforms. However, due to the fact that many stochastic process records such as wind, sea wave and earthquake excitations can be represented with relative sparsity in the frequency or joint time- frequency domains (as well as system responses to these effects), a CS framework can be applied for power spectrum estimation. To this aim, an ensemble of stochastic process realizations is often assumed to be available. Relying on this attribute an adaptive data mining procedure is introduced to modify harmonic basis coefficients to promote sparsity across the ensemble, vastly improving on standard CS reconstructions. The procedure is shown to perform well with stationary and non-stationary processes even with up to 75% missing data. Several numerical examples featuring both Fourier and harmonic wavelet bases demonstrate the effectiveness of the approach when applied to noisy, gappy signals.

ISIC'14 Session 4: Independent Computing IV

Friday, December 12, 9:30AM-10:30AM, Room: Bonaire 5, Chair: Lei Jing

9:30AM 3D Topographic Map Generation of Fukushima Daiichi Power Plant [#15048]

Akio Doi, Kenji Oshida, Sachio Kurose, Kaichi Matsui, Tomoya Ito and Sachio Kurose, Iwate Prefectural University, Japan; wate Digital Engineer Training Center, Japan; Hachinohe Institue of Technology, Japan; Iwate Digital Engineer Training Center, Japan

The Great East Japan Earthquake that occurred on March 11, 2011 resulted in unprecedented damage in various parts of Japan. In particular, the Fukushima Daiichi Nuclear Power Plant of Tokyo Electric Power Company received extensive damage due to the tsunami generated by the earthquake. In our paper, we propose the creation of a 3D virtual map that is a combination of a CAD topographic map near the Fukushima Daiichi plant, aerial photographs, and topographs.

9:50AM A System for Controlling Personal Computers by Hand Gestures using a Wireless Sensor Device [#15053]

Kaoru Yamagishi, Lei Jing and Zixue Cheng, University of Aizu, Japan

There are a lot of home appliances and personal computers around us. However, few of the user interfaces are designed on user-centric approaches. In this study, as an interface focusing on the ease of use, we develop a system to control personal computer by applying the natural behavior of human. Research issues include the definition of the association between the PC operations and gestures, the recognition of hand gestures, the adjustment of the error of the gestures, and how to realize the system. We define the association of the PC operations used very often with hand gesture of human. Dynamic Time Warping (DTW) algorithm is used to recognize gestures. Magic Ring (MR) is a finger-worn ring type sensor used to collect data of gestures. The MR collects the acceleration value of a gesture by acceleration sensor installed in the MR and transmits the value to a PC through wireless sensor installed in the MR. On the PC side, control commands of gestures are managed. In order to perform the correct PC operations by the gestures avoiding malfunction, a bending sensor which is used for detecting the start of gesture is employed. In this system, more than 20 kinds of hand gestures can be recognized by DTW-based method. We have experimented with controlling typical applications installed in a PC, by hand gestures for evaluating our system.

10:10AM Exercise Prescription Formulating Scheme Based on a Two-Layer K-means Classifier [#14010]

Shyr-Shen Yu, Chan Yung-Kuan, Chiu Ching-Hua, Liu Chia-Chi and Tsai Meng-Hsiun, National Chung Hsing University, Taiwan

An excersice prescription is a professionally designed excersice plan for improving one's health according to the results of his health-related physical fitness (HRPF) tests. Traditionally, an excersice prescription is formulated by manually checking the norm-referenced chart of HRPF; however, it is time consuming and a highly specialized and experienced expert on health-related physical fitness testing is needed to formulate this prescription. To solve above problems, it is necessary to develope an automatic excersice prescription formulating scheme for categorizing the measured data of HRPF tests and then assign the best appopriate excersice prescription for each class. In this study, a two-layer classifier, integrating the techiques of K-means clustering algorithm and genetic algorithm, is hence propsed to classify the measured data of HRPF tests and provide the best appopriate excersice prescription for each class. When the data variance within one class is very large, the centroid of the class cannot effectively represent each datum in the class. The two-layer classifier therefore partitions each class into several clusters (subclasses) and then classifiy the measured data of HRPF tests into clusters. In this study, a genetic algorithm is provided to determine the number of clusters, which each class should be separated into, and the best suitable values of the parameters used in the two-layer classifier. The experimental results demonstrate that the two-layer classifier can effectively and efficiently classify the measured data of HRPF tests and design excersice plan.

CIDUE'14 Session 1

Friday, December 12, 9:30AM-10:30AM, Room: Bonaire 6, Chair: Yaochu Jin and Shengxiang Yang

9:30AM Analysis of Hyper-heuristic Performance in Different Dynamic Environments [#14226]

Stefan van der Stockt and Andries Engelbrecht, University of Pretoria, South Africa

Optimisation methods designed for static environ- ments do not perform as well on dynamic optimisation prob- lems as purpose-built methods do. Intuitively, hyper-heuristics show great promise in handling dynamic optimisation problem dynamics because hyper-heuristics can select different search methods to employ at different times during the search based on performance profiles. Related studies use simple heuristics in dynamic environments and do not evaluate heuristics that are purpose-built to solve dynamic optimisation problems. This study analyses the performance of a random-based selection hyper-heuristic that manages meta-heuristics that specialise in solving dynamic optimisation problems. The performance of the hyper-heuristic across different types of dynamic environments is investigated and compared with that of the heuristics running in isolation and the same hyper-heuristic managing simple Gaussian mutation heuristics.

9:50AM Multi-Colony Ant Algorithms for the Dynamic Travelling Salesman Problem [#14427]

Michalis Mavrovouniotis, Shengxiang Yang and Xin Yao, De Montfort University, United Kingdom; University of Birmingham, United Kingdom

A multi-colony ant colony optimization (ACO) algorithm consists of several colonies of ants. Each colony uses a separate pheromone table in an attempt to maximize the search area explored. Over the years, multi-colony ACO algorithms have been successfully applied on different optimization problems with stationary environments. In this paper, we investigate their performance in dynamic environments. Two types of algorithms are proposed: homogeneous and heterogeneous approaches, where colonies share the same properties and colonies have their own (different) properties, respectively. Experimental results on the dynamic travelling salesman problem show that multi-colony ACO algorithms have promising performance in dynamic environments when compared with single colony ACO algorithms.

10:10AM Real-World Dynamic Optimization Using An Adaptive-mutation Compact Genetic Algorithm [#14672]

Chigozirim Uzor, Mario Gongora, Simon Coupland and Benjamin Passow, De Montfort University, United Kingdom

While the interest in nature inspired optimization in dynamic environments has been increasing constantly over the past years and evaluations of some of these optimization algorithms are based on artificial benchmark problems. Little has been done to carry-out these evaluation using a real-world dynamic optimization problems. This paper presents a compact optimization algorithms for controllers in dynamic environments. The algorithm is evaluated using a real world dynamic optimization problem instead of an artificial benchmark problem, thus avoiding the reality gap. The experimental result shows that the algorithm has an impact on the performance of a controller in a dynamic environment. Furthermore, results suggest that evaluating the algorithm's candidate solution using an actual real-world problem increases the controller's robustness.

EALS'14 Session 4: Evolving Clustering and Classifiers

Friday, December 12, 9:30AM-10:30AM, Room: Bonaire 7, Chair: Orlando Filho

9:30AM A Fully Autonomous Data Density Based Clustering Technique [#15080]

Richard Hyde and Plamen Angelov, Lancaster University, United Kingdom

A recently introduced data density based approach to clustering, known as Data Density based Clustering has been presented which automatically determines the number of clusters. By using the Recursive Density Estimation for each point the number of calculations is significantly reduced in offline mode and, further, the method is suitable for online use. The Data Density based Clustering method however requires an initial cluster radius to be entered. A different radius per feature/ dimension creates hyper-ellipsoid clusters which are axis-orthogonal. This results in a greater differentiation between clusters where the clusters are highly asymmetrical. In this paper we update the DDC method to automatically derive suitable initial radii. The selection is data driven and requires no user input. We compare the performance of DDCAR with DDC and other standard clustering techniques by comparing the results across a selection of standard datasets and test datasets designed to test the abilities of the technique. By automatically estimating the initial radii we show that we can effectively cluster data with no user input. The results demonstrate the validity of the proposed approach as an autonomous, data driven clustering technique. We also demonstrate the speed and accuracy of the method on large datasets.

9:50AM An Ensemble Method Based on Evolving Classifiers: eStacking [#14171]

Jose Iglesias, Agapito Ledezma and Araceli Sanchis, Carlos III University of Madrid, Spain

An ensemble can be defined as a set of separately trained classifiers whose predictions are combined in order to achieve better accuracy. It is proved that ensemble methods improve the performance of individual classifiers as long as the members of the ensemble are sufficiently diverse. There are many different researches which propose different approaches in order to obtain successful ensembles. One of the most used techniques for combining classifiers and improving prediction accuracy is stacking. In this paper, we present a schema based on the stacked generalization. The main contribution of this research is that the base-classifiers of the proposed schema are self-developing (evolving) Fuzzy-rule-based (FRB) classifiers. Since the proposed stacking schema is based on evolving classifiers, it keeps the properties of the evolving classifiers of streaming data. The proposed schema has been successfully tested and their results have been extensively analyzed.

10:10AM A Recurrent Meta-Cognitive-Based Scaffolding Classifier from Data Streams [#14437]

Mahardhika Pratama, Jie Lu, Sreenatha Anavatti and Jose Antonio Iglesias, University of technology sydney, Australia; University of New South Wales, Australia; Carlos III University of Madrid, Spain

a novel incremental meta-cognitive-based Scaffolding algorithm is proposed in this paper crafted in a recurrent network based on fuzzy inference system termed recurrent classifier (rClass). rClass features a synergy between schema and scaffolding theories in the how-to-learn part, which constitute prominent learning theories of the cognitive psychology. In what-to-learn component, rClass amalgamates the new online active learning concept by virtue of the Bayesian conflict measure and dynamic sampling strategy, whereas the standard sample reserved strategy is

incorporated in the when-to-learn constituent. The inference scheme of rClass is managed by the local recurrent network, sustained by the generalized fuzzy rule. Our thorough empirical study has ascertained the efficacy of rClass, which is capable of producing reliable classification accuracies, while retaining the amenable computational and memory burdens.

CIBCI'14 Session 1

Friday, December 12, 9:30AM-10:30AM, Room: Bonaire 8, Chair: Damien Coyle and Robert Kozma

9:30AM Development of an Autonomous BCI Wheelchair [#14362]

Danny Wee-Kiat Ng, Ying-Wei Soh and Sing-Yau Goh, UTAR, Malaysia

Restoration of mobility for the movement impaired is one of the important goals for numerous Brain Computer Interface (BCI) systems. In this study, subjects used a steady state visual evoked potential (SSVEP) based BCI to select a desired destination. The selected destination was communicated to the wheelchair navigation system that controlled the wheelchair autonomously avoiding obstacles on the way to the destination. By transferring the responsibility of controlling the wheel chair from the subject to the navigation software, the number of BCI decisions needed to be completed by the subject to move to the desired destination is greatly reduced.

9:50AM Across-subject estimation of 3-back task performance using EEG signals [#14926]

Jinsoo Kim, Min-Ki Kim, Christian Wallraven and Sung-Phil Kim, Department of Brain and Cognitive Engineering, Korea University, Korea (South); Department of Human and Systems Engineering, Ulsan National Institute of Science and Technology, Korea (South)

This study was aimed at estimating subjects' 3-back working memory task error rate using electroencephalogram (EEG) signals. Firstly, spatio-temporal band power features were selected based on statistical significance of across- subject correlation with the task error rate. Method-wise, ensemble network model was adopted where multiple artificial neural networks were trained independently and produced separate estimates to be later on aggregated to form a single estimated value. The task error rate of all subjects were estimated in a leave-one-out cross-validation scheme. While a simple linear method underperformed, the proposed model successfully obtained highly accurate estimates despite being restrained by very small sample size.

10:10AM Abnormal Event Detection in EEG Imaging - Comparing Predictive and Model-based Approaches [#15088]

Jayanta Dutta, Banerjee Bonny, Ilin Roman and Kozma Robert, U of Memphis, United States; Air Force Research Lab, United States

The detection of abnormal/unusual events based on dynamically varying spatial data has been of great interest in many real world applications. It is a challenging task to detect abnormal events as they occur rarely and it is very difficult to predict or reconstruct them. Here we address the issue of the detection of propagating phase gradient in the sequence of brain images obtained by EEG arrays. We compare two alternative methods of abnormal event detection. One is based on prediction using a linear dynamical system, while the other is a model-based algorithm using expectation minimization approach. The comparison identifies the pros and cons of the different methods, moreover it helps to develop an integrated and robust algorithm for monitoring cognitive behaviors, with potential applications including brain-computer interfaces (BCI).

ADPRL'14 Reinforcement Learning 2: Interdisciplinary Connections and Applications

Friday, December 12, 9:30AM-10:30AM, Room: Curacao 1, Chair: Abjhijit Gosavi

9:30AM Closed-Loop Control of Anesthesia and Mean Arterial Pressure Using Reinforcement Learning [#14253]

Regina Padmanabhan, Nader Meskin and Wassim Haddad, Qatar University, Qatar; Georgia Institute of Technology, United States

General anesthesia is required for patients undergoing surgery as well as for some patients in the intensive care units with acute respiratory distress syndrome. However, most anesthetics disturb cardiac and respiratory functions. Hence, it is important to monitor and control the infusion of anesthetics to meet sedation requirements while keeping patient vital parameters within safe limits. The critical task of anesthesia administration also necessitates that drug dosing be optimal, patient specific, and robust. In this paper, the concept of reinforcement learning (RL) is used to develop a closedloop anesthesia controller using the bispectral index (BIS) as a control variable while concurrently accounting for mean arterial pressure (MAP). In particular, the proposed framework uses these two parameters to control propofol infusion rates to regulate the BIS and the MAP within a desired range. Specifically, a weighted combination of the error of the BIS and MAP signals is considered in the proposed RL algorithm. This reduces the computational complexity of the RL algorithm and consequently the controller processing time.

9:50AM Beyond Exponential Utility Functions: A Variance-Adjusted Approach for Risk-Averse Reinforcement Learning [#14277]

Abhijit Gosavi, Sajal Das and Susan Murray, Missouri University of Science and Technology, United States

Utility theory has served as a bedrock for modeling risk in economics. Where risk is involved in decision-making, for solving Markov decision processes (MDPs) via utility theory, the exponential utility (EU) function has been used in the literature as an objective function for capturing risk-averse behavior. The EU function framework uses a so-called risk-averseness coefficient (RAC) that seeks to quantify the risk appetite of the decision-maker. Unfortunately, as we show in this paper, the EU framework suffers from computational deficiencies that prevent it from being useful in practice for solution methods based on reinforcement learning (RL). In particular, the value function becomes very large and typically the computer overflows. We provide a simple example to demonstrate this. Further, we show empirically how a variance-adjusted (VA) approach, which approximates the EU function objective for reasonable values of the RAC, can be used in the RL algorithm. The VA framework in a sense has two objectives: maximize expected returns and minimize variance. We conduct empirical studies on a VA-based RL algorithm on the semi-MDP (SMDP), which is a more general version of the MDP. We conclude with a mathematical proof of the boundedness of the iterates in our algorithm.

10:10AM Tunable and Generic Problem Instance Generation for Multi-objective Reinforcement Learning [#14821]

Deon Garrett, Jordi Bieger and Kristinn Thorisson, Icelandic Institute for Intelligent Machines, Iceland; Reykjavik University, Iceland

A significant problem facing researchers in reinforcement learning, and particularly in multi-objective learning, is the dearth of good benchmarks. In this paper, we present a method and software tool enabling the creation of random problem instances, including multi-objective learning problems, with specific structural properties. This tool, called Merlin (for Multi-objective Environments for Reinforcement LearnINg), provides the ability to control these features in predictable ways, thus allowing researchers to begin to build a more detailed understanding about what features of a problem interact with a given learning algorithm to improve or degrade the algorithm's performance. We present this method and tool, and briefly discuss the controls provided by the generator, its supported options, and their implications on the generated benchmark instances.

Special Session: CIDM'14 Session 7: Business Process Mining, Market Analysis and Process Big Data

Friday, December 12, 9:30AM-10:30AM, Room: Curacao 2, Chair: Andrea Burattin

9:30AM The Use of Process Mining in a Business Process Simulation Context: Overview and Challenges [#14876]

Niels Martin, Benoit Depaire and An Caris, Hasselt University, Belgium; Hasselt University / Research Foundation Flanders (FWO), Belgium

This paper focuses on the potential of process mining to support the construction of business process simulation (BPS) models. To date, research efforts are scarce and have a rather conceptual nature. Moreover, publications fail to explicit the complex internal structure of a simulation model. The current paper outlines the general structure of a BPS model. Building on these foundations, modeling tasks for the main components of a BPS model are identified. Moreover, the potential value of process mining and the state of the art in literature are discussed. Consequently, a multitude of promising research challenges are identified. In this sense, the current paper can guide future research on the use of process mining in a BPS context.

9:50AM Discovering Cross-Organizational Business Rules from the Cloud [#15045]

Mario Luca Bernardi, Marta Cimitile and Fabrizio Maggi, University of Sannio, Italy; Unitelma Sapienza University, Italy; University of Tartu, Estonia

Cloud computing is rapidly emerging as a new information technology that aims at providing improved efficiency in the private and public sectors, as well as promoting growth, competition, and business dynamism. Cloud computing represents, today, an opportunity also from the perspective of business process analytics since data recorded by process- centered cloud systems can be used to extract information about the underlying processes. Cloud computing architectures can be used in cross- organizational environments in which different organizations execute the same process in different variants and share information about how each variant is executed. If the process is characterized by low predictability and high variability, business rules become the best way to represent the process variants. The contribution of this paper consists in providing: (i) a cloud computing multi-tenancy architecture to support cross-organizational process executions; (ii) an approach for the systematic extraction/composition of distributed data into coherent event logs carrying process-related information of each variant; (iii) the integration of online process mining techniques for the runtime extraction of business rules from event logs representing the process variants running on the infrastructure. The proposed architecture has been implemented and applied for the execution of a real-life process for acknowledging an unborn child performed in four different Dutch municipalities.

10:10AM GoldMiner: A Genetic Programming based algorithm applied to Brazilian Stock Market [#14674]

Alexandre Pimenta, Eduardo Carrano, Ciniro Nametala, Frederico Guimaraes and Ricardo Takahashi, IFMG, Brazil; UFMG, Brazil

The possibility of obtaining financial gain by investing in the Stock Markets is a hard task since it is under constant influence of economical, political and social factors. This paper aims to address the financial technical analysis of Stock Markets, focusing on time series data instead of subjective parameters. An algorithm based on genetic programming, named GoldMiner, has been proposed to perform retrospective study in order to get predictions about the best time for trading top stocks on the BOVESPA, the Brazilian stock exchange market.

Special Session: SIS'14 Session 7: Theory and Applications of Nature-Inspired Optimization Algorithms II

Friday, December 12, 9:30AM-10:30AM, Room: Curacao 3, Chair: Xin-She Yang and Xingshi He

9:30AM A Discontinuous Recurrent Neural Network with Predefined Time Convergence for Solution of Linear Programming [#14913]

Juan Diego Sanchez-Torres, Edgar Sanchez and Alexander G. Loukianov, CINVESTAV Guadalajara, Mexico

The aim of this paper is to introduce a new recurrent neural network to solve linear programming. The main characteristic of the proposed scheme is its design based on the predefined-time stability. The predefined-time stability is a stronger form of finite-time stability which allows the a priori definition of a convergence time that does not depend on the network initial state. The network structure is based on the Karush-Kuhn-Tucker (KKT) conditions and the KKT multipliers are proposed as sliding mode control inputs. This selection yields to an one-layer recurrent neural network in which the only parameter to be tuned is the desired convergence time. With this features, the network can be easily scaled from a small to a higher dimension problem. The simulation of a simple example shows the feasibility of the current approach.

9:50AM A Biogeography-based Optimization Algorithm for Energy Efficient Virtual Machine Placement [#15038]

Hafiz Munsub Ali and Daniel Lee, Simon Fraser University, Canada

Recently, high levels of energy consumption in datacenters has become a concern not only due to operational costs, but also due to adverse effects on the environment (i.e., carbon emission, climate change, etc.) Virtualization technology can provide better management of physical servers/machines (PM) and may help reduce power consumption. The purpose of this study is to minimize the total energy consumption through good virtual machine (VM) placement. The VM placement problem has a large search space. Finding an optimal solution of such problems using an exhaustive search is impractical. Heuristic algorithms can provide high-quality solutions with limited computing resources in acceptable time. Evolutionary Algorithms (EAs) can be considered as heuristic tools that can provide high-quality solutions to this type of problems. We propose a Biogeography Based Optimization (BBO) Algorithm for energy-efficient VM placement. We compare the BBO results with the Genetic Algorithm (GA). Overall, simulation results show that BBO outperforms GA.

10:10AM Improved Particle Swarm Optimization based on Greedy and Adaptive Features [#14014]

Aderemi Oluyinka Adewumi and Martins Akugbe Arasomwan, School of Mathematics, Statistics and Computer Science University of Kwazulu-Natal, South Africa

From the inception of Particle Swarm Optimization (PSO) technique, a lot of work has been done by researchers to enhance its efficiency in handling optimization problems. However, one of the general operations of the algorithm still remains - obtaining global best solution from the personal best solutions of particles in a greedy manner. This is very common with many of the existing PSO variants. Though this method is promising in obtaining good solutions to optimization problems, it could make the technique susceptible to premature convergence in handling some multimodal optimization problems. In this paper, the basic PSO (Linear Decreasing Inertia Weight PSO algorithm) is used as case study. An adaptive feature is introduced into the algorithm to complement the greedy method towards enhancing its effectiveness in obtaining optimal solutions for optimization problems. The enhanced algorithm is labeled Greedy Adaptive PSO (GAPSO) and some typical continuous global optimization problems were used to validate its effectiveness through empirical studies in comparison to the basic PSO. Experimental results show that GAPSO is more efficient.

CICARE'14 Session 1: Applications of Computational Intelligence and Informatics in Brain Disorders

Friday, December 12, 9:30AM-10:30AM, Room: Curacao 4, Chair: Mufti Mahmud and Amir Hussain

9:30AM An Intelligent System for Assisting Family Caregivers of Dementia People [#14099]

Vasily Moshnyaga, Osamu Tanaka, Toshin Ryu and Akira Hayashida, Fukuoka University, Japan

Caregiving a person suffering from dementia or loss of brain cognitive ability due to aging is a big physical, mental and emotional burden to family members. In this paper we present a novel system for assisting caregivers at home. The system employs heterogeneous sensing and artificial intelligence technologies to automatically and unobtrusively monitor the dementia person; assess possible risks that the person may face in current situation and alert the caregiver on emergency by delivering video, audio and text to his mobile phone or PC. We discuss the system architecture and technologies applied for sensing, communication, risk assessment, user-interface, and present a prototype system implementation.

9:50AM Towards a Personal Health Records System for Patients with Autism Spectrum Disorders [#14170]

Giovanni Paragliola and Antonio Coronato, National Research Council (CNR) - Institute for High Performance Computing and Networking (ICAR), Italy

Patients with Autism Spectrum Disorders (ASD) show symptoms that in general fall into three areas: 1) social impairment; 2) communication difficulties; and, 3) repetitive and stereotyped behaviors. The growing of people affected by such as diseases increases the need of technologies able to help better clinicians in the medical treatment. In this paper we present the designing and the developing of a Personal Health Records (PHR) system to assist clinicians and caregivers in the analyzing of clinical data and monitoring of anomalous gestures of patients with autism diseases. The detecting of anomalous gesture is made by using both Artificial Intelligence (AI) techniques and a framework based on formal methods. The research activity has been conducted in cooperation with clinicians of the Department of Child Psychiatry at Children's Hospital Santobono-Pausilipon in Naples.

10:10AM A Comparison of Syntax, Semantics, and Pragmatics in Spoken Language among Residents with Alzheimer's Disease in Managed-Care Facilities [#14448]

Curry Guinn, Ben Singer and Anthony Habash, UNC Wilmington, United States

This research is a discriminative analysis of conversational dialogues involving individuals suffering from dementia of Alzheimer's type. Several metric analyses are applied to the transcripts of the Carolina Conversation Corpus in order to determine if there are significant statistical differences between individuals with and without Alzheimer's disease. Our prior research suggests that there exist measurable linguistic differences between managed-care residents diagnosed with Alzheimer's disease and their caregivers. This paper presents results comparing managed-care residents diagnosed with Alzheimer's disease to other managed-care residents. Results from the analysis indicate that part-of-speech and lexical richness statistics may not be good distinguishing attributes. However, go-ahead utterances and certain fluency measures provide defensible means of differentiating the linguistic characteristics of spontaneous speech between individuals that are and are not diagnosed with Alzheimer's disease. Two machine learning algorithms were able to classify the speech of individuals with and without dementia of the Alzheimer's type with accuracy up to 80%.

CICA'14 Session 5: Neural Network Systems and Control with Applications II

Friday, December 12, 11:00AM-12:00PM, Room: Antigua 2, Chair: Jose Mario Araujo Daniel Yuh Chao

11:00AM Enumeration of Reachable, Forbidden, Live States of Gen-Left K-net System (with a non-sharing resource place) of Petri Nets [#14477]

Daniel Yuh Chao and Tsung Hsien Yu, National Cheng Chi University, Taiwan

Earlier, Chao pioneered the very first closed-form solution of the number of reachable and other states for marked graphs (MG) and k-th order system which is the simplest class of S3PR (Systems of Simple Sequential Processes with Resources). This paper progresses one step further on enumerating reachable (forbidden, live, and deadlock) states for general k-net systems (one non- sharing resource place in the general position of the Left-side process) with a formula depending on parameter k for a subclass of nets with k sharing resources. The results are also verified by Top-Left-k-net, Bottom-Left-k-net and Middle- Left-k-net system.

11:20AM Glucose Level Regulation for Diabetes Mellitus Type 1 Patients using FPGA Neural Inverse Optimal Control [#14776]

Jorge C. Romero-Aragon, Edgar Sanchez and Alma Y. Alanis, CINVESTAV, Mexico; CUCEI, Universidad de Guadalajara, Mexico

In this paper, the field programmable gate array (FPGA) implementation of a discrete-time inverse neural optimal control for trajectory tracking is proposed to regulate glucose level for type 1 diabetes mellitus (T1DM) patients. For this controller, a control Lyapunov function (CLF) is proposed to obtain an inverse optimal control law in order to calculate the insulin delivery rate, which prevents hyperglycemia and hypoglycemia levels in T1DM patients. Besides this control law minimizes a cost functional. The neural model is obtained from an on-line neural identifier, which uses a recurrent high-order neural network (RHONN), trained with an extended Kalman filter (EKF). A virtual patient is implemented on a PC host computer, which is interconnected with the FPGA controller. This controller constitutes a step forward to develop an autonomous artificial pancreas.

11:40AM Neural Network Fitting for Input-Output Manifolds of Online Control Laws in Constrained Linear Systems [#14376]

Samarone Nascimento do Carmo, Marconi Oliveira de Almeida, Rafael Campos, Flavio Castro, Jose Mario Araujo and Carlos Eduardo Trabuco Dorea, IFBA, Brazil; UFRN, Brazil

Control techniques for systems with constraints on control and state are somewhat attractive, mainly in cases where these constraints represent safety or critical points of operation. An important approach for control of constrained linear systems is based on the concept of set invariance, whose main advantages are the inclusion of constraints in the whole design, the non- conservative nature of the controllers and the ability to cope with noise measurement and disturbance entering in the system. Some disadvantage are a possibly high complexity of the control law for higher order systems or the absence of an analytical, off-line control law in some cases, as, for instance, in the output feedback case. The online computation of the control input at each step is ever possible, but the computational cost involved may turn the solution impracticable in the case of systems with fast dynamics. Neural networks, on the other hand, is an interesting alternative for function approximation, and works well in capturing the characteristics of the input- output manifold of the online control law, starting from a training set generated by simulation of the control system. In this paper, neural networks are applied to substitute in an efficient way the online control computation. A real case based example is used to verify the effectiveness of the proposed neural controller.

ICES'14 Session 5: Evolvable Hardware II

Friday, December 12, 11:00AM-12:00PM, Room: Antigua 3, Chair: Julian F Miller

11:00AM Evolutionary Growth of Genomes for the Development and Replication of Multicellular Organisms with Indirect Encoding [#14128]

Stefano Nichele and Gunnar Tufte, Norwegian University of Science and Technology, Norway

The genomes of biological organisms are not fixed in size. They evolved and diverged into different species acquiring new genes and thus having different lengths. In a way, biological genomes are the result of a self-assembly process where more complex phenotypes could benefit by having larger genomes in order to survive and adapt. In the artificial domain, evolutionary and developmental systems often have static size genomes, e.g. chosen beforehand by the system designer by trial and error or estimated a priori with complicated heuristics. As such, the maximum evolvable complexity is predetermined, in contrast to open-ended evolution in nature. In this paper, we argue that artificial genomes may also grow in size during evolution to produce high-dimensional solutions incrementally. We propose an evolutionary growth of genome representations for artificial cellular organisms with indirect encodings. Genomes start with a single gene and acquire new genes when necessary, thus increasing the degrees of freedom and expanding the available search-space. Cellular Automata (CA) are used as test bed for two different problems: replication and morphogenesis. The chosen CA encodings are a standard developmental table and an instruction based approach. Results show that the proposed evolutionary growth of genomes' method is able to produce compact and effective genomes, without the need of specifying the full set of regulatory configurations.

11:20AM An Artificial Ecosystem Algorithm Applied to Static and Dynamic Travelling Salesman Problems [#14880]

Manal Adham and Peter Bentley, University College London, United Kingdom

An ecosystem inspired algorithm that aims to take advantage of highly distributed computer architectures is proposed. The motivation behind this work is to grasp the phenomenal properties of ecosystems and use them for large-scale real-world problems. Just as an ecosystem comprises of many separate components that adapt together to form a single synergistic whole, the Artificial Ecosystem Algorithm (AEA) solves a problem by adapting subcomponents of a problem such that they fit together and form a single optimal solution. AEA can be differentiated from typical biology inspired algorithms like GA, PSO, BCO, and ACO where each individual in a population is a candidate solution, because AEA uses populations of solution components that are solved individually such that they combine to form the candidate solution. Like species in an ecosystem, the AEA may have species of components representing sub-parts of the solution that evolve together and cooperate with the other

species. Four versions of this algorithm are illustrated; the basic AEA algorithm, two AEA with Species and a Dynamic AEA with species. These algorithms are evaluated through a series of experiments on symmetric Travelling Salesman Problems that show very promising results compared to existing approaches. Experiments also show very promising results for the Dynamic TSP making this method potentially useful for handling dynamic routing problems.

11:40AM Towards Compositional Coevolution in Evolutionary Circuit Design [#14426]

Michaela Sikulova, Gergely Komjathy and Lukas Sekanina, Brno University of Technology, Czech Republic

A divide and conquer approach is one of the methods introduced to get over the scalability problem of the evolutionary circuit design. A complex circuit is decomposed into modules which are evolved separately and without any interaction. The benefits are in reducing the search space and accelerating the evaluation of candidate circuits. In this paper, the evolution of non-interacting modules is replaced by a coevolutionary algorithm, in which the fitness of a module depends on fitness values of other modules, i.e. the modules are adapted to work together. The proposed method is embedded into Cartesian genetic programming (CGP). The coevolutionary approach was evaluated in the design of a switching image filter which was decomposed into the filtering module and detector module. The filters evolved using the proposed coevolutionary method show a higher quality of filtering in comparison with filters utilizing independently evolved modules. Furthermore, the whole design process was accelerated 1.31 times in comparison with the standard CGP.

CIBIM'14 Session 5: Unconventional and New Biometrics

Friday, December 12, 11:00AM-12:00PM, Room: Antigua 4, Chair: Sanjoy Das and Nhat Quang Huynh

11:00AM A Study of Similarity between Genetically Identical Body Vein Patterns [#14461]

Hengyi Zhang, Chaoying Tang, Xiaojie Li and Adams Wai Kin Kong, School of Computer Engineering, Nanyang Technological University, Singapore; College of Automation, Nanjing University of Aeronautics and Astronautics, China

Vein patterns have been used in commercial biometric systems for many years and are recently considered for criminal authentication. Understanding the similarity between genetically identical vein patterns is important, especially when using them in legal cases involving identical twins. Vein patterns sharing the same Deoxyribonucleic acid (DNA) sequence are generally regarded as vein patterns with maximum similarity. If they are completely distinguishable, it implies that the uniqueness of vein patterns is high. Though the genetic dependence of other biometric traits, including fingerprints, faces, palmprints, and irises, have been studied, genetically identical vein patterns have not been studied systematically. With the help of an automatic vein pattern matching algorithm, this paper analyzes and measures the similarity between genetically identical vein patterns. 234 genetically identical forearm pairs and 204 genetically identical thigh pairs were collected for this study. Experimental results indicate that genetically identical vein patterns have extra similarity, but they are distinguishable.

11:20AM Human Body Part Detection Using Likelihood Score Computations [#14505]

Manoj Ramanathan, Yau Wei-Yun and Teoh Eam Khwang, School of Electrical and Electronics Engineering, Nanyang Technological University, Singapore; Institute of Infocomm Research, A-STAR, Singapore

Detection and labelling of human body parts in videos or images can provide vital clues in analysis of human behaviour and action. Detecting body parts separately is considerably difficult due to the huge amount of intra-class variations exhibited. In most methods, researchers tend to impose some connectivity or shape constraints on the classifier output to obtain the final detected body parts. In this paper, we propose a novel idea to compute likelihood scores for each of the initial classified body parts based on Bayes theorem using Extreme learning machine's (ELM) output value (different from the predicted class label). Also, we do not impose any other constraints on the initially detected body parts. We use Histogram of oriented gradients (HOG) features and ELM for initial classification. We also employ a voting scheme that uses inter-frame detected segments to filter out errors and detect body parts in the current frame. Experiments have been conducted to show our method can identify body parts in different body postures quiet appreciably.

11:40AM A Preliminary Report on a Full-Body Imaging System for Effectively Collecting and Processing Biometric Traits of Prisoners [#14619]

Nhat Quang Huynh, Xingpeng Xu, Adams Wai Kin Kong and Sathyan Subbiah, Nanyang Technological University, Singapore; Indian Institute of Technology Madras, India

Because of recent advances in imaging technology, the use of image-based evidences, such as faces and tattoos, is increasing dramatically. Face and tattoo images of prisoners are collected regularly for suspect image database establishment. New biometric traits such as skin marks, androgenic hairs, and blood vessels hidden in color images are getting more attention because they are shown to be useful for criminal and victim identification, especially when their faces and tattoos are neither observable nor available. The current manual approach of collecting images of prisoners is extremely time consuming and does not record these new biometric traits. To address this problem, an unprecedented full-body imaging system is developed. Furthermore, an automatic and systematic routine based on the system for effectively collecting prisoners' images is proposed. This paper concentrates on the system hardware design as well as its image collecting and processing capability. The system has been used to collect and process more than 30,000 infrared and color images from 188 subjects. Its performance is very encouraging.

Special Session: MCDM'14 Session 5: Optimization Methods in Bioinformatics and Bioengineering (OMBB) II

Friday, December 12, 11:00AM-12:00PM, Room: Bonaire 1, Chair: Anna Lavygina, Richard Allmendinger and Sanaz Mostaghim

11:00AM SARNA-Predict: Using Adaptive Annealing Schedule and Inversion Mutation Operator for RNA Secondary Structure Prediction [#14871]

Peter Grypma and Herbert H. Tsang, Trinity Western University, Canada

Ribonucleic Acid (RNA) plays a crucial role in many cellular functions including the synthesis of proteins. The structure of RNA is essential for it to serve its purposes within the cell. SARNA-Predict, which has previously been implemented using Simulated Annealing (SA), has shown excellent results predicting the secondary structure of RNA molecules. SA is effective in solving many different optimization problems and for being able to approximate global minima in a solution space. SARNA-Predict uses permutation based SA to heuristically search for RNA secondary structures with close to the minimum free energy with given constraints. A key step in the annealing process is the mutation of the predicted secondary structure in order to search for other potentially lower energy structures. The mutation changes the structure so as to avoid a local minimum and subsequently the free energy of the new structure is evaluated. The purpose of this paper is to evaluate the new inversion mutation operator and compare its use in terms of prediction accuracy to the percentage swap mutation operator previously used in SARNA-Predict. Different annealing schedules used in the SA process are also compared to find the optimal annealing schedule to use for each mutation operator.

11:20AM A Bottom-Up implementation of Path-Relinking for Phylogenetic Reconstruction applied to Maximum Parsimony [#14272]

Karla Vazquez-Ortiz, Jean-Michel Richer, David Lesaint and Eduardo Rodriguez-Tello, LERIA, France; CINVESTAV, Mexico

In this article we describe a bottom-up implementation of Path-Relinking for Phylogenetic Trees in the context of the resolution of the Maximum Parsimony problem with Fitch optimality criterion. This bottom-up implementation is compared to two versions of an existing top-down implementation. We show that our implementation is more efficient, more interesting to compare trees and to give an estimation of the distance between two trees in terms of the number of transformations.

11:40AM Bi-objective Support Vector Machine and its Application in Microarray Classification [#14572]

Lizhen Shao, Depeng Zhao, Yinghai Shao, Jiwei Liu and Li Liu, University of Science and Technology Beijing, China; Liaodong University, China

The design of supervised learning systems for classification requires finding a suitable trade-off between several objectives, especially between model complexity and error on a set of training examples. This problem is in nature multi-objective and it is usually tackled by aggregating the objectives into a scalar function and solving it with a single-objective optimization strategy. In this paper, we formulate the learning of SVMs as a bi-objective programming problem in which the empirical error and the model complexity are minimized at the same time. Then we propose an algorithm that enumerates a representative nondominated set. The representative nondominated set reflects the entire trade- off information between the two objectives and it can help a decision maker to choose a final classifier. Finally we apply our algorithm in two microarray data classification problems. The quality of the representative is evaluated by measuring three attributes of representation, i.e., uniformity, cardinality and coverage. We compare our algorithm with the traditional weighted sum method. For both algorithms, the same number of discrete nondominated points are produced, then we measure the uniformity and coverage of the nondominated points. Experimental results show that our algorithm is superior to the traditional weighted sum method in terms of uniformity and coverage. Compared to the weighted sum algorithm, our algorithm avoids the trial and error process and it is easier for a decision maker to make a final decision.

Special Session: RiiSS'14 Session 5: Human-centric Robotics II

Friday, December 12, 11:00AM-12:00PM, Room: Bonaire 2, Chair: Eri Sato-Shimokawara

11:00AM Application of Stretchable Strain Sensor for Pneumatic Artificial Muscle [#14463]

Hiroyuki Nakamoto, Soushi Oida, Hideo Ootaka, Mitsunori Tada, Ichiro Hirata, Futoshi Kobayashi and Fumio Kojima, Kobe University, Japan; Bando Chemical Industries, Japan; National Institute of Advanced Industrial Science and Technology, Japan; Hyogo Prefectural Institute of Technology, Japan

Pneumatic artificial muscles have advantages of lightweight, strong force, and electrical power saving for applications to power-assist systems or care support systems. These applications require precise control of artificial muscles. The artificial muscles have non-linear characteristics because they are mainly composed of elastic materials. The characteristics make the precise control difficult. In this paper, we propose a stretchable strain sensor for an application to pneumatic artificial muscles. This strain sensor has the characteristics of stretchability, length measurement, and lightweight, and can directly measure the contraction of the artificial muscle by attaching the sensor on the muscle. We describe the structure of the sensor and the principle, and show the fundamental characteristics. In addition, we confirm the next two characteristics. The sensor stops the contraction of the muscle at an error of 2.1 mm, and has no hysteresis in a loop of contraction and stretch.

11:20AM Improvement of P-CUBE: Algorithm Education Tool for Visually Impaired [#14686]

Shun Kakehashi, Tatsuo Motoyoshi, Ken'ichi Koyanagi, Toru Oshima, Hiroyuki Masuta and Hiroshi Kawakami, Toyama Prefectural University, Japan; Kyoto University, Japan

We developed P-CUBE which targeted at visually impaired and beginner. Users are able to control the mobile robot using P-CUBE simply by positioning woody blocks on the mat. The purpose of P-CUBE is to teach fundamental programming concepts which consists of three elements which are sequential, branch and loop. P-CUBE consists of a mobile robot, a program mat, programming blocks, and a PC. Programming blocks include only RFID tags and require no precision equipment such as microcomputers. P-CUBE is equipped with tactile information, enabling its

use by the visually impaired. In this paper, we report the system configuration of P-CUBE and programming workshop for visually impaired. Then, we propose the devise improvement of P-CUBE through the subjective assessment from participants of the workshop.

11:40AM Acquiring Personal Keywords from a Conversation for a Human-robot Communication [#14971]

Shun Nomura, Haeyeon Lee, Eri Shimokawara, Kazuyoshi Wada and Toru Yamaguchi, Tokyo Metropolitan University, Japan; Toyota Motor co., Japan

This paper shows acquiring personal keywords and using them for human-robot communication or supporting to human-human communication. Personal keywords are feature of personality. Proposed system acquiring the keywords from a conversation. Authors developed a prototype of the keywords based communication system. First experiment acquired the keywords from the 2 trial conversations and set up the robot dialog based on the conversation. This experiment shows effectiveness of the personal keywords. Second experiment observed 60 conversations which are obtained from the first meeting elderly people. Authors analyzed the keywords which is obtained from the conversation, and found useful keywords for communication with elderly people.

CIVTS'14 Session 5

Friday, December 12, 11:00AM-12:00PM, Room: Bonaire 3, Chair: Justin Dauwels, Dipti Srinivasan and Ana Bazzan

11:00AM Genetic Adaptive A-Star Approach for Train Trip Profile Optimization Problems [#14843]

Jin Huang, Lei Sun, Fangyu Du, Hai Wan and Xibin Zhao, Tsinghua University, China; Tianjin University, China

Genetic adaptive A-Star searching algorithm for optimizing the running profile of a train in a trip under certain constraints is studied. The train trip profile optimization problem is formulated as a multi-constraints nonlinear optimization problem, and the corresponding use of A-Star searching algorithm is introduced. NSGA-II is employed for adaptive parameters selection for A-Star searching algorithm. The main structure of the cooperation of NSGA-II and A-Star algorithm is proposed. A practical train trip optimization problem is employed for illustrating how the proposed approach works.

11:20AM Probabilistic modeling of navigation bridge officer's behavior [#14409]

George Psarros, DNV GL AS, Norway

The performance of a navigating officer in critical situations is uncertain and has to be considered in a probabilistic framework, since this may provide an in depth insight in the human - machine interaction. Such a systematic approach will have the objective to understand, to predict and to minimize the role of the human as a causal factor for a casualty in terms of the time sequence needed to perform particular tasks during collision or grounding avoidance activities. By employing the exponential law, it is possible to quantify the cognitive processes of information acquisition, analysis, categorization, decision making and action implementation. Consequently, the minimum required time where an automated system may intervene is determined. In this way, it is expected that it is plausible to prevent the occurrence of a close encounter that could escalate in an accident. Albeit to the lack of an available and appropriate data set, the proposed concept is examined through the small sample results of a published simulation study.

11:40AM Behavior Characteristics of Mixed Traffic Flow on Campus [#14210]

Mianfang Liu, Shengwu Xiong, Xiaohan Yu, Pengfeng Duan and Jun Wang, School of Computer Science and Technology, Wuhan University of Technology, China, 430070, China

Campus security is an important part of social security in China. As reported in exist literature, very limited efforts are made to study mixed traffic flow behavior on campus. Present study attempts to highlight studies of single traffic flow or pedestrian-vehicle traffic flow. This paper deals with the research into the analysis of the characteristics of mixed traffic flow on campus, including cars , motorbikes, bicycles, and pedestrians. Total 440 minutes video data on two different locations on campus are extracted by employing videographic technique. The research is designed determine factors for traffic flow variety. Fluctuations in traffic flow depends on the student schedules, particularly during the peak time as there are large pedestrian flow and bicycle flow in short interval time. At the same time, a spatial-temporal analysis for establishing the relationship about mixed traffic flows is discussed. Flow models of speed-flow, speed-occupancy, flow-occupancy about mixed traffic are developed to illustrate behavior characteristics of mixed traffic stream on campus of different dimensions. The results obtained are significant for evacuation simulation and planning under various conditions on campus.

CIES'14 Session 5: Applications III

Friday, December 12, 11:00AM-12:00PM, Room: Bonaire 4, Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse

11:00AM Jump Detection Using Fuzzy Logic [#14184]

Claire Roberts-Thomson, Anatole Lokshin and Vitaly Kuzkin, AlpineReplay, Inc., United States; Saint Petersburg State Polytechnical University, Russia

Jump detection and measurement is of particular interest in a wide range of sports, including snowboarding, skiing, skateboarding, wakeboarding, motorcycling, biking, gymnastics, and the high jump, among others. However, determining jump duration and height is often difficult and requires expert knowledge or visual analysis either in real-time or using video. Recent advances in low-cost MEMS inertial sensors enable a data-driven approach to jump detection and measurement. Today, inertial and GPS sensors attached to an athlete or to his or her equipment, e.g. snowboard, skateboard, or skis, can collect data during sporting activities. In these real life applications, effects such as vibration, sensor noise and bias, and various athletic maneuvers make jump detection difficult even using multiple sensors. This paper presents a fuzzy logic-based algorithm for jump detection in sport using accelerometer data. Fuzzy logic facilitates conversion of human intuition and vague linguistic descriptions of jumps to algorithmic form. The fuzzy algorithm described here was applied to snowboarding and ski jumping data, and successfully detected 92% of snowboarding jumps identified visually (rejecting 8% of jumps identified visually), with only 8% of detected jumps being false positives. In ski jumping, it successfully detected 100% of jumps identified visually, with no false positives. The fuzzy algorithm

presented here has successfully been applied to automate jump detection in ski and snowboarding on a large scale, and as the basis of the AlpineReplay ski and snowboarding smartphone app, has identified 6370971 jumps from August 2011 through June 2014.

11:20AM Predicting the Perforation Capability of Kinetic Energy Projectiles using Artificial Neural Networks [#14357]

John Auten and Robert Hammell, Towson University, United States

The U.S. Army requires the evaluation of new weapon and vehicle systems through the use of experimental testing and Vulnerability/Lethality (V/L) modeling and simulation. The current modeling and simulation methods being utilized often require significant amounts of time and subject matter expertise. This typically means that quick results cannot be provided when needed to address new threats encountered in theater. Recently there has been an increased focus on rapid results for modeling and simulation efforts that can also provide accurate results. Accurately modeling the penetration and residual properties of a ballistic threat as it progresses through a target is an extremely important part of determining the effectiveness of the threat against that target. This paper presents preliminary results from the training of an artificial neural network for the prediction of perforation of a monolithic metallic target plate.

11:40AM Risk Profiler in Automated Human Authentication [#14330]

Shawn Eastwood and Svetlana Yanushkevich, Biometric Technologies Laboratory in the Department of Electrical and Computer Engineering at the University of Calgary, Canada

Risk profiler in this paper is understood as the tool for risk assessment in automated human authentication systems. Authentication of a biometric enable e-passport/ID and the holder of this document (traveler) are the most important functions of such systems. Risks in this procedure are related to both technical and human factors. We developed a profiler tool which can measure the system performance at an arbitrary state of the authentication process. The tool is based on modeling modules, and each is represented by a Belief network and interfacing between the modules. A collection of small modules with reasonably chosen parameters is given as an example, and some examples demonstrating how the modules can be used for inference is also given.

IA'14 Session 1: Multi-agent Systems

Friday, December 12, 11:00AM-12:00PM, Room: Bonaire 5, Chair: Hani Hagras and Vincenzo Loia

11:00AM Distributed Intelligent Management of Microgrids Using a Multi-Agent Simulation Platform [#14483]

Luis Gomes, Tiago Pinto, Pedro Faria and Zita Vale, Polytechnic of Porto, Portugal

Multi-agent approaches have been widely used to model complex systems of distributed nature with a large amount of interactions between the involved entities. Power systems are a reference case, mainly due to the increasing use of distributed energy sources, largely based on renewable sources, which have potentiated huge changes in the power systems' sector. Dealing with such a large scale integration of intermittent generation sources led to the emergence of several new players, as well as the development of new paradigms, such as the microgrid concept, and the evolution of demand response programs, which potentiate the active participation of consumers. This paper presents a multi-agent based simulation platform which models a microgrid environment, considering several different types of simulated players. These players interact with real physical installations, creating a realistic simulation environment with results that can be observed directly in the reality. A case study is presented considering players' responses to a demand response event, resulting in an intelligent increase of consumption in order to face the wind generation surplus.

11:20AM Data Mining Approach to support the Generation of Realistic Scenarios for Multi-Agent simulation of Electricity Markets [#14484]

Brigida Teixeira, Francisco Silva, Tiago Pinto, Isabel Praca, Gabriel Santos and Zita Vale, Polytechnic of Porto, Portugal

This paper presents the Realistic Scenarios Generator (RealScen), a tool that processes data from real electricity markets to generate realistic scenarios that enable the modeling of electricity market players' characteristics and strategic behavior. The proposed tool provides significant advantages to the decision making process in an electricity market environment, especially when coupled with a multi-agent electricity markets simulator. The generation of realistic scenarios is performed using mechanisms for intelligent data analysis, which are based on artificial intelligence and data mining algorithms. These techniques allow the study of realistic scenarios, adapted to the existing markets, and improve the representation of market entities as software agents, enabling a detailed modeling of their profiles and strategies. This work contributes significantly to the understanding of the interactions between the entities acting in electricity markets by increasing the capability and realism of market simulations.

11:40AM Output-Based High-Order Bipartite Consensus under Directed Antagonistic Networks [#14545]

Hongwen Ma, Derong Liu, Ding Wang and Hongliang Li, Chinese Academy of Sciences, China

In the presence of negative weights in communication graph, bipartite consensus is an extension of the traditional consensus problems where the communication weights are all positive. An output-based distributed control protocol is established to solve the bipartite consensus of the homogeneous multi-agent systems. Bipartite consensus problem is equivalent to a linear stabilizable and detectable problem by introducing a gauge transformation. If the multi-agent systems can reach the bipartite consensus, then the signed digraph should be structurally balanced and contains a spanning tree. Finally, the implementation provides three cases to validate the effectiveness of our developed criteria.

CIDUE'14 Session 2

Friday, December 12, 11:00AM-12:00PM, Room: Bonaire 6, Chair: Robi Polikar and Yaochu Jin

11:00AM Performance Evaluation of Sensor-Based Detection Schemes on Dynamic Optimization Problems [#14902]

Lokman Altin and Haluk Topcuoglu, Marmara University, Turkey

Most of the real world optimization problems in different domains demonstrate dynamic behavior, which can be in the form of changes in the objective function, problem parameters and/or constraints for different time periods. Detecting the points in time where a change occurs in the landscape is a critical issue for a large number of evolutionary dynamic optimization techniques in the literature. In this paper, we present an empirical study whose focus is the performance evaluation of various sensor-based detection schemes by using two well known dynamic optimization problems, which are moving peaks benchmark (MPB) and dynamic knapsack problem (DKP). Our experimental evaluation by using two dynamic optimization problem validates the sensor- based detection schemes considered, where the effectiveness of each scheme is measured with the average rate of correctly identified changes and the average number of sensors invoked to detect a change.

11:20AM A Framework of Scalable Dynamic Test Problems for Dynamic Multi-objective Optimization [#14224]

Shouyong Jiang and Shengxiang Yang, Centre for Computational Intelligence (CCI),School of Computer Science and Informatics,De Montfort University, United Kingdom

Dynamic multi-objective optimization has received increasing attention in recent years. One of striking issues in this field is the lack of standard test suites to determine whether an algorithm is capable of solving dynamic multi-objective optimization problems (DMOPs). So far, a large proportion of test functions commonly used in the literature have only two objectives. It is greatly needed to create scalable test problems for developing algorithms and comparing their performance for solving DMOPs. This paper presents a framework of constructing scalable dynamic test problems, where dynamism can be easily added and controlled, and the changing Pareto-optimal fronts are easy to understand and their landscapes are exactly known. Experiments are conducted to compare the performance of four state-of-the-art algorithms on several typical test functions derived from the proposed framework, which gives a better understanding of the strengths and weaknesses of these tested algorithms for scalable DMOPs.

11:40AM Short-term Wind Speed Forecasting using Support Vector Machines [#14485]

Tiago Pinto, Sergio Ramos, Tiago M. Sousa and Zita Vale, Polytechnic of Porto, Portugal

Wind speed forecasting has been becoming an important field of research to support the electricity industry mainly due to the increasing use of distributed energy sources, largely based on renewable sources. This type of electricity generation is highly dependent on the weather conditions variability, particularly the variability of the wind speed. Therefore, accurate wind power forecasting models are required to the operation and planning of wind plants and power systems. A Support Vector Machines (SVM) model for short-term wind speed is proposed and its performance is evaluated and compared with several artificial neural network (ANN) based approaches. A case study based on a real database regarding 3 years for predicting wind speed at 5 minutes intervals is presented.

Special Lecture: EALS'14 Talk: On-line Fault Detection and Diagnosis Using Autonomous Learning Classifiers

Friday, December 12, 11:00AM-12:00PM, Room: Bonaire 7, Speaker: Bruno Costa

CIBCI'14 Session 2

Friday, December 12, 11:00AM-12:00PM, Room: Bonaire 8, Chair: Robert Kozma and Kai Keng Ang

11:00AM Sensitivity Analysis of Hilbert Transform with Band-Pass FIR Filters for Robust Brain Computer Interface [#15081]

Jeffery Davis and Kozma Robert, CLION, U of Memphis, United States; U of Memphis, United States

Transient cortical oscillations in the form of rapid synchronization-desynchronization transitions are key candidates of neural correlates of higher cognitive activity monitored by scalp EEG and intracranial ECoG arrays. The transition period is in the order of 20-30 ms, and standard signal processing methodologies such as Fourier analysis are inadequate for proper characterization of the phenomenon. Hilbert transform- based (HT) analysis has shown great promise in detecting rapid changes in the synchronization properties of the cortex measured by high-density EEG arrays. Therefore, HT is a primary candidate of operational principles of brain computer interfaces (BCI). Hilbert transform over narrow frequency bands has been applied successfully to develop robust BCI methods, but optimal filtering is a primary concern. Here we systematically evaluate the performance of FIR filters over various narrow frequency bands before applying Hilbert transforms. The conclusions are illustrated using rabbit ECoG data. The results are applicable for the analysis of scalp EEG data for advanced BCI devices.

11:20AM Electroencephalographic Method Using Fast Fourier Transform Overlap Processing for Recognition of Right- or Left-handed Elbow Flexion Motor Imagery [#14761]

Tomoyuki Hiroyasu, Yuuki Ohkubo and Utako Yamamoto, Doshisha University, Japan

Recently, systems using motor imagery (MI) have been developed as practical examples of brain-computer interface (BCI). Electroencephalography (EEG) was used to generate an electroencephalogram of elbow flexion. In addition, a method was proposed to extract the feature values that would enable the recognition right- or left-handed elbow flexion MI. In the proposed method, fast Fourier transform overlap processing was used to determine the time period required to extract feature values. In this study, the following two experiments were performed. 1) the recognition of right- or left- handed elbow flexion by analyzing only the MI time period and 2) recognition of the right- or left-handed when

the MI time period was presumed. In the first experiment, right- or left-handed elbow flexion MI was processed for 20 subjects using support vector machine and the proposed method was used to extract the feature values. In the second experiment, the presumed MI time was determined using the channels in which the highest accuracy was obtained in the first experiment, and then, right- or left-handed recognition was processed for the time period presumed. In the first experiment, the recognition accuracy of the proposed method was superior to that of the previous method in 15 of 20 the subjects. In the second experiment, the mean accuracy was 7.2%. Therefore, the recognition accuracy can be improved by improving the MI detection method.

11:40AM Development of SSVEP-based BCI using Common Frequency Pattern to Enhance System Performance [#15032]

Li-Wei Ko, Shih-Chuan Lin, Wei-Gang Liang, Oleksii Komarov and Meng-Shue Song, Institute of Bioinformatics and Systems Biology, NCTU, Taiwan; Department of Physics, NTHU, Taiwan; Institute of Molecular Medicine and Bioengineering, NCTU, Taiwan; Brain Research Center, NCTU, Taiwan

Brain Computer Interface(BCI) systems provide an additional way for people to interact with external environment without using peripheral nerves or muscles[1]. In a variety of BCI systems, a BCI system based on the steady-state visual evoked potentials (SSVEP) is one most common system known for application, because of its ease of use and good performance with little user training. In this study, we employed the common frequency pattern method (CFP) to improve the accuracy of our EEG-based SSVEP BCI system. We used four basic classifiers (SVM, KNNC, PARZENDC, LDC) to estimate the accuracy of our SSVEP system. Without using CFP, the highest accuracy of the EEG-based SSVEP system was 80%. By using CFP, the accu-racy could be upgraded to 95%.

ADPRL'14 Optimal Control 2: Adaptive and Differential Dynamic Programming

Friday, December 12, 11:00AM-12:00PM, Room: Curacao 1, Chair: Shubhendu Bhasin and Hao Xu

11:00AM Continuous-Time Differential Dynamic Programming with Terminal Constraints [#14850]

Wei Sun, Evangelos Theodorou and Panagiotis Tsiotras, Georgia Institute of Technology, United States

In this work, we revisit the continuous-time Differential Dynamic Programming (DDP) approach for solving optimal control problems with terminal state constraints. We derive two algorithms, each for different order of expansion of the system dynamics and we investigate their performance in terms of their convergence speed. Compared to previous work, we provide a set of backward differential equations for the value function expansion by relaxing the assumption that the initial nominal control must be very close to the optimal control solution. We apply the derived algorithms to two classical optimal control problems, namely, the inverted pendulum and the Dreyfus rocket problem and show the benefit of second order expansion.

11:20AM Neural Network-based Adaptive Optimal Consensus Control of Leaderless networked Mobile Robots [#14543]

Haci Mehmet Guzey, Hao Xu and Jagannatan Sarangapani, Dept. of Electrical and Computer Engineering Missouri University of Science and Technology, United States; College of Science and Engineering, Texas A-M University-Corpus Christi, United States

A novel NN-based optimal adaptive consensus control scheme is introduced in this paper for networked mobile robots in the presence of unknown robot dynamics. Throughout the paper, two separated NN is used. The unknown formation dynamics of each robot is identified through the first NN. The second NN is utilized to approximate a novel value function derived in this paper as function of an augmented error vector, which comprise of the regulation errors and consensus based formation errors of each robot. A novel near optimal controller is developed by using approximated value function and identified formation dynamics. The Lyapunov stability theorem is employed to find the update laws of NN weights and demonstrate the consensus achievement of the overall formation. The simulation results are depicted to show performance of our theoretical claims in the final section.

11:40AM On-policy Q-learning for Adaptive Optimal Control [#14839]

Sumit Kumar Jha and Shubhendu Bhasin, Indian Institute of Technology Delhi, New Delhi, India

This paper presents a novel on-policy Q-learning approach for finding the optimal control policy online for continuous-time linear time invariant (LTI) systems with completely unknown dynamics. The proposed result estimates the unknown parameters of the optimal control policy based on the fixed point equation involving the Q-function. The gradient-based update laws, based on the minimization of the Bellman's error, are used to achieve online adaptation of parameters with the use of persistence of excitation condition. A novel asymptotically convergent state derivative estimator is presented to ensure that the proposed result is independent of knowledge of system dynamics. Simulation results are presented to validate the theoretical development.

CIDM'14 Session 8: Educational Data Mining

Friday, December 12, 11:00AM-12:00PM, Room: Curacao 2, Chair: Alexander Schulz

11:00AM FATHOM: A Neural Network-based Non-verbal Human Comprehension Detection System for Learning Environments. [#14411]

Fiona Buckingham, Keeley Crockett, Zuhair Bandar and James O'Shea, Manchester Metropolitan University, United Kingdom

This paper presents the application of FATHOM, a computerised non-verbal comprehension detection system, to distinguish participant comprehension levels in an interactive tutorial. FATHOM detects high and low levels of human comprehension by concurrently tracking multiple non-verbal behaviours using artificial neural networks. Presently, human comprehension is predominantly monitored from written and spoken language. Therefore, a large niche exists for exploring human comprehension detection from a non-verbal behavioral perspective using artificially intelligent computational models such as neural networks. In this paper, FATHOM was applied to a video-recorded exploratory study containing a learning task designed to elicit high and low comprehension states from the learner. The learning task comprised of watching a

video on termites, suitable for the general public and an interview led question and answer session. This paper describes how FATHOM's comprehension classifier artificial neural network was trained and validated in comprehension detection using the standard backpropagation algorithm. The results show that high and low comprehension states can be detected from learner's non-verbal behavioural cues with testing classification accuracies above 76%.

11:20AM Predicting Student Success Based on Prior Performance [#14539]

Ahmad Slim, Gregory Heileman, Jarred Kozlick and Chaouki Abdallah, University of New Mexico, United States

Colleges and universities are increasingly interested in tracking student progress as they monitor and work to improve their retention and graduation rates. Ideally, early indicators of student progress, or lack thereof, can be used to provide appropriate interventions that increase the likelihood of student success. In this paper we present a framework that uses machine learning, and in particular, a Bayesian Belief Network (BBN), to predict the performance of students early in their academic careers. The results obtained show that the proposed framework can predict student progress, specifically student grade point average (GPA) within the intended major, with minimal error after observing a single semester of performance. Furthermore, as additional performance is observed, the predicted GPA in subsequent semesters becomes increasingly accurate, providing the ability to advise students regarding likely success outcomes early in their academic careers.

11:40AM To What Extend Can We Predict Students' Performance? A Case Study in Colleges in South Africa [#14774]

Norman Poh and Ian Smythe, University of Surrey, United Kingdom; Do-IT Solutions Ltd, United Kingdom

Student performance depends upon factors other than intrinsic ability such as environment, socio-economic status, personality and familial-context. Capturing these patterns of influence may enable an educator to ameliorate some of these factors, or for governments to adjust social policy accordingly. In order to understand these factors, we have undertaken the exercise of predicting student performance, using a cohort of approximately 8,000 South African college students. They all took a number of tests in English and Maths. We show that it is possible to predict English comprehension test results from (1) other test results; (2) from covariates about self-efficacy, social economic status, and specific learning difficulties there are 100 survey questions altogether; (3) from other test results + covariates (combination of (1) and (2)); and from (4) a more advanced model similar to (3) except that the covariates are subject to dimensionality reduction (via PCA). Models 1-4 can predict student performance up to a standard error of 13-15%. In comparison, a random guess would have a standard error of 17%. In short, it is possible to conditionally predict student performance based on self-efficacy, socio- economic background, learning difficulties, and related academic test results.

SIS'14 Session 8: Swarm Algorithms & Applications - II

Friday, December 12, 11:00AM-12:00PM, Room: Curacao 3, Chair: Mohammed El-Abd and Oscar Castillo

11:00AM Repellent Pheromones for Effective Swarm Robot Search in Unknown Environments [#14597]

Filip Fossum, Jean-Marc Montanier and Pauline C. Haddow, NTNU, Trondheim, Norway

In time-critical situations such as rescue missions, effective exploration is essential. Exploration of such unknown environments may be achieved through the dispersion of a swarm of robots. Recent research has turned to biology where pheromone trails provide a form of collective memory of visited areas. Rather than the attractive pheromones that have been the focus of much research, this paper considers locally distributed repellent pheromones. Further, the conditions for maximising search efficiency are investigated.

11:20AM A MOPSO based on hyper-heuristic to optimize many-objective problems [#14271]

Olacir Castro Jr. and Aurora Pozo, Federal University of Parana, Brazil

Multi-Objective Problems (MOPs) presents two or more objective functions to be simultaneously optimized. MOPs presenting more than three objective functions are called Many-Objective Problems (MaOPs) and pose challenges to optimization algorithms. Multi-objective Particle Swarm Optimization (MOPSO) is a promising meta-heuristic to solve MaOPs. Previous works have proposed different leader selection methods and archiving strategies to tackle the challenges caused by MaOPs, however, selecting the most appropriated components for a given problem is not a trivial task. Moreover, the algorithm can take advantage by using a variety of methods in different phases of the search. The concept of hyper- heuristic emerges for automatically selecting heuristic components for effectively solve a problem. However few works on the literature apply hyper- heuristics on multi-objective optimizers. In this work, we use a simple hyper- heuristic to select leader and archiving methods during the search. Unlike other studies our hyper-heuristic is guided by the R2 indicator due to its good measuring characteristics and low computational cost. An experimental study was conducted to evaluate the ability of the proposed hyper-heuristic in guiding the search towards its preferred region. The study compared the performance of the H-MOPSO and its low-level heuristics used separately regarding the R_2 indicator. The results show that the hyper-heuristic proposed is able to guide the search through selecting the right components in most cases.

11:40AM Using Heterogeneous Knowledge Sharing Strategies with Dynamic Vector-evaluated Particle Swarm Optimisation [#14513]

Marde Helbig and Andries P. Engelbrecht, CSIR and University of Pretoria, South Africa; University of Pretoria, South Africa

Dynamic multi-objective optimisation problems have more than one objective with at least one objective that changes over time. Previous studies indicated that different knowledge sharing strategies increase the performance of the dynamic vector evaluated particle swarm optimisation (DVEPSO) algorithm in different dynamic environments. Therefore, this paper investigates the performance of the DVEPSO algorithm using heterogeneous particle swarm optimisation (HPSO) algorithms, where each particle uses a different knowledge sharing strategy. The goal of this study is to determine whether the use of HPSOs will improve the performance of DVEPSO by incorporating particles with different knowledge sharing strategies in a single DVEPSO algorithm. The results indicate that using HPSOs improves the performance of DVEPSO for dynamic multi-objective optimisation problems with a complex Pareto-optimal set and that the performance of heterogeneous DVEPSO compares favourably with that of DVEPSO.

Friday, December 12, 11:00AM-12:00PM

CICARE'14 Session 2: Applications of Computational Intelligence and eHealth in Disease Diagnosis and Therapy

Friday, December 12, 11:00AM-12:00PM, Room: Curacao 4, Chair: Newton Howard and Kamran Farooq

11:00AM Adaptive Splitting and Selection Ensemble for Breast Cancer Malignancy Grading [#14435]

Bartosz Krawczyk, Lukasz Jelen and Michal Wozniak, Wroclaw University of Technology, Poland

The article presents an application of Adaptive Splitting and Selection (AdaSS) ensemble classifier in real-life task of designing an efficient clinical decision support system for breast cancer malignancy grading. We approach the problem of cancer detection for ma different angle - we already know that given patient has malignant type of cancer, but we want to asses the level of malignancy to propose the most efficient treatment. We carry a cytological image segmentation process with fuzzy c-means procedure and extract a set of highly discriminative features. However, the difficulty lies in the fact, that we have a high disproportion in the number of patients between the groups, which leads to an imbalanced classification problem. To address this, we propose to use a dedicated ensemble model, which is able to exploit local areas of competence in the decision space. AdaSS is a hybrid combined classifier, based on an evolutionary splitting of object space into clusters and simultaneous selection of most competent classifiers for each of them. To increase the overall accuracy of the classification, in the hybrid training algorithm of AdaSS we embedded a feature selection and trained weighted fusion of individual classifiers based on their support functions. Experimental investigation proves that the introduced method is more accurate than previously used classification approaches.

11:20AM Patient Stratification based on Activity of Daily Living Score using Relational Self-Organizing Maps [#14442]

Mohammed Khalilia, Mihail Popescu and James Keller, University of Missouri, United States

Stratification is a valuable technique for providing an insight on the structure of the patient population based on some features such as Activity of Daily Living (ADL) scores. Grouping patients can play an important role in designing clinical trials or improving care delivery. In this paper, we present a method for stratifying patients based on their ADL scores. Every patient is represented by a time series consisting of ADL scores recorded over a period of up to two years. This approach relies on Dynamic Time Warping (DTW) technique to measure the similarity between two time series and then using Relational Self-Organizing Maps (RSOM) to discover patient clusters. The analysis was performed on a population of 6,000 patients. Six clusters were discovered: patients with high risk and steady ADL trajectory, low risk and steady trajectory, patients with sudden ADL score jumps, patients with declining ADL score and others with steady inclining trajectory.

11:40AM A Novel Cardiovascular Decision Support Framework for Effective Clinical Risk Assessment [#14925]

Kamran Farooq, Jan Karasek, Hicham Atassi, Amir Hussain, Peipei Yang, Calum MacRae, Chris Eckl, Warner Slack, Bin Luo and Mufti Mahmud, University of Stirling, United Kingdom; Brno University of Technology, Czech Republic; Chinese Academy of Sciences, China; Harvard Medical School, United States; Sitekit Solutions Ltd, United Kingdom; Anhui University, China; University of Antwerp, Belgium

The aim of this study is to help improve the diagnostic and performance capabilities of RACPC, by reducing delay and inaccuracies in the cardiovascular risk assessment of patients with chest pain by helping clinicians effectively distinguish acute angina patients from those with other causes of chest pain. Key to our new approach is (1) an intelligent prospective clinical decision support framework for primary and secondary care clinicians, (2) learning from missing/impartial clinical data using Bernoulli mixture models and Expectation Maximisation (EM) techniques, (3) utilisation of state-of-the- art feature section, pattern recognition and data mining techniques for the development of intelligent risk prediction models for cardiovascular patients. The study cohort comprises of 632 patients suspected of cardiac chest pain. A retrospective data analysis of the clinical studies evaluating clinical risk factors for chest pain patients was performed for the development of RACPC specific risk assessment models to distinguish between cardiac and non cardiac chest pain. A comparative analysis case study of machine learning methods was carried out for predicting RACPC clinical outcomes using real patient data acquired from Raigmore Hospital in Inverness, UK. The proposed framework was also validated using the University of Cleveland's Heart Disease dataset which contains 76 attributes, but all published experiments refer to using a subset of 14 of them. Experiments with the Cleveland database (based on 18 clinical features of 270 patients) were concentrated on attempting to distinguish presence of heart disease from absence (value 0).

Friday, December 12, 1:30PM-3:10PM

CICA'14 Session 6: Applications of CI to Control and Automation

Friday, December 12, 1:30PM-3:10PM, Room: Antigua 2, Chair: Alexander Kochegurov Li-Xin Wang

1:30PM What Happens When Trend-Followers and Contrarians Interplay in Stock Market [#14578]

Li-Xin Wang, Xian Jiaotong University, China

We analyze some basic properties of the stock price dynamical model when trend- followers and contrarians interplay with each other. We prove that the price dynamical model has an infinite number of equilibriums, but all these equilibriums are unstable. We demonstrate the short-term predictability of the price volatility and derive the detailed formulas of the Lyapunov exponent as functions of the model parameters. We show that although the price is chaotic, the volatility converges to some constant very quickly at the rate of the Lyapunov exponent. We extract the formula relating the converged volatility to the model parameters based on Monte-Carlo simulations.

1:50PM An efficient Method to Evaluate the Performance of Edge Detection Techniques by a two-dimensional Semi-Markov Model [#14046]

Dmitry Dubinin, Viktor Geringer, Alexander Kochegurov and Konrad Reif, Tomsk State University of Control Systems and Radioelectronics, Russia; Baden-Wuerttemberg Cooperative State University, DHBW-Ravensburg, Germany; National Research Tomsk Polytechnic University, Russia

The essay outlines one particular possibility of efficient evaluating the Performance of edge detector algorithms. Three generally known and published algorithms (Canny, Marr, Shen) were analysed by way of example. The analysis is based on two-dimensional signals created by means of two-dimensional Semi- Markov Model and subsequently provided with an additive Gaussian noise component. Five quality metrics allow an objective comparison of the algorithms.

2:10PM Design and Implementation of a Robust Fuzzy Controller for a Rotary Inverted Pendulum using the Takagi-Sugeno Descriptor Representation [#14227]

Quoc Viet Dang, Benyamine Allouche, Laurent Vermeiren, Antoine Dequidt and Michel Dambrine, LAMIH, University of Valenciennes, France

The rotary inverted pendulum (RIP) is an under-actuated mechanical system. Because of its nonlinear behavior, the RIP is widely used as a benchmark in control theory to illustrate and validate new ideas in nonlinear and linear control. This paper presents a robust Takagi-Sugeno (T-S) fuzzy descriptor approach for designing a stabilizing controller for the RIP with real-time implementation. It is shown in this paper how the modeling of the physical system on descriptor T-S form with a reduced number of rules possible can lead to a simplified controller that is practically implementable. Relaxed linear matrix inequality-based stability conditions for the non quadratic case are given. Experimental results illustrate the effectiveness of the proposed approach.

2:30PM Ensuring safe prevention and reaction in smarthome systems dedicated to people becoming disabled [#14286]

Sebastien Guillet, Bruno Bouchard and Abdenour Bouzouane, UQAC, Canada

Smart homes dedicated to people with disabilities, specially those with dementia, are critical systems which need to remain safe and adapted to the user. However the control part of such systems -- ensuring their safety -- is both difficult to design and verify without appropriate tools. Formal techniques have been used to cope with the verification problem, but this paper proposes a new way to specify smart home safety which also eases the design aspect. It enables the use of a correct by construction technique -- Discrete Controller Synthesis -- to automatically build from constraints a maximally permissive safety controller that can also reconfigure itself as the disabilities of the associated user evolve.

2:50PM How to Detect Big Buyers in Hong Kong Stock Market and Follow Them Up to Make Money [#14580]

Li-Xin Wang, Xian Jiaotong University, China

We apply the price dynamical model with big buyers and big sellers to the daily closing prices of the top 20 banking and real estate stocks listed in the Hong Kong Stock Exchange. The basic idea is to estimate the strength parameters of the big buyers and the big sellers in the model and make buy/sell decisions based on these parameter estimates. We propose two trading strategies: (i) Follow-the-Big-Buyer which buys when big buyer begins to appear and there is no sign of big sellers, holds the stock as long as the big buyer is still there, and sells the stock once the big buyer disappears; and (ii) Ride-the-Mood which buys as soon as the big buyer strength begins to surpass the big seller strength, and sells the stock once the opposite happens. Based on the testing over 245 two-year intervals uniformly distributed across the seven years from 03-July-2007 to 02-July-2014 which includes a variety of scenarios, the net profits would increase 67% or 120% on average if an investor switched from the benchmark Buy-and-Hold strategy to the Follow-the-Big-Buyer or Ride-the-Mood strategies during this period, respectively.

Special Session: ICES'14 Session 6: Evolutionary Robotics I

Friday, December 12, 1:30PM-3:10PM, Room: Antigua 3, Chair: Jim Torrensen

1:30PM A Robotic Ecosystem with Evolvable Minds and Bodies [#14800]

Berend Weel, Emanuele Crosato, Jacqueline Heinerman, Evert Haasdijk and A.E. Eiben, VU University Amsterdam, Netherlands

This paper presents a proof of concept demonstration of a novel evolutionary robotic system where robots can self-reproduce. We construct and investigate a strongly embodied evolutionary system, where not only the controllers, but also the morphologies undergo evolution in an on-line fashion. Forced by the lack of available hardware we build this system in simulation. However, we use a high quality simulator (Webots) and an existing hardware platform (Roombots) which makes the system, in principle, constructible. Our system can be perceived as an Artificial Life habitat, where robots with evolvable bodies and minds live in an arena and actively induce an evolutionary process `from within', without a central evolutionary agency or a user-defined synthetic fitness function.

1:50PM On Using Gene Expression Programming to Evolve Multiple Output Robot Controllers [#14834]

Jonathan Mwaura and Edward Keedwell, University of Pretoria, South Africa; University of Exeter, United Kingdom

Most evolutionary algorithms (EAs) represents a potential solution to a problem as a single- gene chromosome encoding, where the chromosome gives only one output to the problem. However, where more than one output is required such as in classification and robotic problems, these EAs have to be either modified in order to deal with a multiple output problem or are rendered incapable of dealing with such problems. This paper investigates the parallelisation of genes as independent chromosome entities as described in the Gene Expression Programming (GEP) algorithm. The aim is to investigate the capabilities of a multiple output GEP (moGEP) technique and compare its performance to that of a single-gene GEP chromosome (ugGEP). In the described work, the two approaches are utilised to evolve controllers for a robotic obstacle avoidance and exploration behaviour. The obtained results show that moGEP is a robust technique for the investigated problem class as well as for utilisation in evolutionary robotics.

2:10PM Filling the Reality Gap: Using Obstacles to Promote Robust Gaits in Evolutionary Robotics [#14881]

Kyrre Glette, Andreas Johnsen and Eivind Samuelsen, University of Oslo, Norway

In evolutionary robotics, which concerns automatic design of robotic systems using evolutionary algorithms, the well-known reality gap phenomenon occurs when transferring results from simulation to real world robots. Several approaches have been proposed to tackle this challenge, such as improving the simulator, avoiding poorly simulated solutions, or promoting robust controllers by introducing noise in the simulation. In this paper we investigate if the addition of a set of small obstacles in the simulated environment can help promote more robust gaits when transferred to a real world robot. In total 80 robot gaits are tested in the real world, evolved using flat and obstacle-seeded ground planes, and using two different scenario difficulties. The results show that in the easy scenario the proposed obstacle method has little impact on the reality gap of the evolved gaits, whereas there is a significant reduction for the difficult scenario: The average real world performance ratio is 2.3 times higher than the result obtained with the flat plane, and there are no null- performing gaits.

2:30PM Adaptive Self-assembly in Swarm robotics through Environmental Bias [#14767]

Jean-Marc Montanier and Pauline C. Haddow, CRAB Lab, Department of Computer and Information Science, NTNU, Trondheim, Norway, Norway

A swarm of robots may face challenges in unknown environments where self-assembly is a necessity e.g.\ crossing difficult areas. When exploring such environments, the self-assembly process has to be triggered only where needed and only for those robots required, leaving other robots to continue exploration. Further, self-assembled robots should dis-assemble when assembled structures are no longer required. Strategies have thus to be learned to trigger self-assembly and dis-assembly so as to meet the needs of the environment. Research has focused on the learning of strategies where all robots of the swarm had to adopt one common strategy: either self-assembly or dis-assembly. The work herein studies how strategies using both self-assembly and dis-assembly can be learned within the same swarm. Further, the effect of the different environments on this challenge is presented.

2:50PM Evolving a Lookup Table Based Controller for Robotic Navigation [#14709]

Mark Beckerleg and Justin Matulich, AUT University, New Zealand

This paper describes how lookup tables can be evolved to control the motion of a simulated two wheeled robot, whose functions are either to move towards a light source or avoid obstacles. The robot has two light sensors, six obstacle sensors and two DC motor drivers for the wheels. The lookup table controls the motion of the robot by changing the motor speeds dependent on the sensor values. For light following, the axes of the table are right and left light sensor levels, whilst for obstacle avoidance the axis is the bit combination of the six digital sensors. The parameters within both tables are left and right motor direction. The genetic algorithm using two point crossover with a mutation rate of three percent and tournament selection successfully evolved the lookup tables for both navigational tasks.

CIBIM'14 Session 6: Biometric Security Solution

Friday, December 12, 1:30PM-3:10PM, Room: Antigua 4, Chair: Sanjoy Das and Xiaojie Li

1:30PM Toward an Attack-sensitive Tamper-resistant Biometric Recognition with a Symmetric Matcher: A Fingerprint Case Study [#14302]

Norman Poh, Rita Wong and Gian-Luca Marcialis, University of Surrey, United Kingdom; University of Cagliari, Italy

In order to render a biometric system robust against malicious tampering, it is important to understand the different types of attack and their impact as observed by the liveness and matching scores. In this study, we consider zero-effort impostor attack (referred to as the Z-attack), nonzero-effort impostor attack such as presentation attack or spoofing (S-attack), and other categories of attack involving tampering at the template level (U - and T -attacks). In order to elucidate the impact of all possible attacks, we (1) introduce the concepts of source of origin and symmetric biometric matchers, and (2) subsequently group the attacks into four categories. These views not only improve the understanding of the nature of different attacks but also turn out to ease the design of the classification problem. Following this analysis, we design a novel classification scheme that can take full advantage of the attack-specific data characteristics. Two realisations of the scheme, namely, a mixture of linear classifiers, and a Gaussian Copula-based Bayesian classifier, turn out to outperform a strong baseline classifier based on SVM, as supported by fingerprint spoofing experiments.

1:50PM Authentication System using Behavioral Biometrics through Keystroke Dynamics [#14921]

Diego Alves, Gelson Cruz and Cassio Vinhal, School of Electrical, Mechanical and Computer Engineering - UFG, Brazil

This work presents a user's authentication system for computational environments based on keystroke dynamics. The methodology proposed is low-cost, non-intrusive and can be applied in areas of monitored access software to increase the level of data security. The algorithm works by monitoring the typing of the user in real time, capturing split times in which the key was pressed and released. Five characteristics are captured in this entry: The ASCII code (American Standard Code for Information Interchange), three splits associated and a duration associated with the key, which would be the time that it remained pressed. From this data it was possible to trace metrics that were able to identify the user in question. Results obtained show a high level of accuracy.

2:10PM Speeding up the Knowledge-based Deblocking Method for Efficient Forensic Analysis [#15055]

Yanzhu Liu, Xiaojie Li and Adams Wai Kin Kong, School of Computer Engineering, Nanyang Technological University, Singapore

Identifying individuals in evidence images (e.g. child sexual abuse and masked gunmen), where their faces are covered or obstructed, is a challenging task. Skin mark patterns and blood vessel patterns have been proposed as biometrics to overcome this challenge, but their clarity depends on the quality of evidence images. However, evidence images are very likely compressed by the JPEG method, which is widely installed in digital cameras. To remove blocking artifacts in skin images and restore the original clarity for forensic analysis, a knowledge- based deblocking method, which replaces compressed blocks in evidence images with uncompressed blocks from a large skin image database, was proposed. Experimental results demonstrated that this method is effective and performs better than other deblocking methods that were designed for generic images. The search for optimal uncompressed blocks in a large skin image database is computationally demanding. Ideally,

this computational burden should be reduced since even in one single case, the number of evidence images can be numerous. This paper first studies statistical characteristics of skin images. Making use of this information, hash functions, bitwise l1-minimization, and a parallel scheme were developed to speed up the knowledge-based deblocking method. Experimental results demonstrate that the proposed computational techniques speed up the knowledge-based deblocking method more than 150% on average.

2:30PM Ontology Development and Evaluation for Urinal Tract Infection [#15092]

Bureera Sabir, Dr Usman Qamar and Abdul Wahab Muzaffar, National University of Science and Technology CEME Rawalpindi, Pakistan; Department of Computer and Software Engineering National University of Science and Technology CEME Rawalpindi, Pakistan

This research is aimed to develop an ontology based on UMLS for the domain of urinal tract infection that contains information regarding definitions, synonyms, relations and semantic types from various biomedical vocabularies and to formally evaluate the resulting ontology. Domain expert review is applied to measure ontology correctness in terms of structure and content.

2:50PM Fingerprint Indexing through Sparse Decomposition of Ridge Flow Patches [#14999]

Antoine Deblonde, Telecom ParisTech - Safran Morpho, France

In this paper, we propose a novel method for fingerprint indexing based on local patterns of ridge flow centered on minutiae. These local descriptors are projected on a learned dictionary of ridge flow patches, with a sparsity-inducing algorithm. We show that this sparse decomposition allows to replace the ridge flow patches by a compressed signature with a reduced loss of accuracy. We experimented the combination of these descriptors with the formerly known Minutiae Cylinder Code (MCC) descriptor, that provides another kind of local information. Then, we show that the combination of these descriptors performs well for fast nearest neighbor search algorithms based on Locality-Sensitive Hashing (LSH), and allows to either to improve the accuracy of the state-of-the-art algorithm, or to improve its computational efficiency.

Special Session: MCDM'14 Session 6: Evolutionary Multi-Objective Optimization

Friday, December 12, 1:30PM-3:10PM, Room: Bonaire 1, Chair: Mardé Helbig, Sanaz Mostaghim and Rui Wang

1:30PM Difficulties in Specifying Reference Points to Calculate the Inverted Generational Distance for Many-Objective Optimization Problems [#14726]

Hisao Ishibuchi, Hiroyuki Masuda, Yuki Tanigaki and Yusuke Nojima, Osaka Prefecture University, Japan

Recently the inverted generational distance (IGD) measure has been frequently used for performance evaluation of evolutionary multi-objective optimization (EMO) algorithms on many-objective problems. When the IGD measure is used to evaluate an obtained solution set of a many-objective problem, we have to specify a set of reference points as an approximation of the Pareto front. The IGD measure is calculated as the average distance from each reference point to the nearest solution in the solution set, which can be viewed as an approximate distance from the Pareto front to the solution set in the objective space. Thus the IGD-based performance evaluation totally depends on the specification of reference points. In this paper, we illustrate difficulties in specifying reference points. First we discuss the number of reference points required to approximate the entire Pareto front of a many-objective problem. Next we show some simple examples where the uniform sampling of reference points on the known Pareto front leads to counter-intuitive results. Then we discuss how to specify reference points when the Pareto front is unknown. In this case, a set of reference points is usually constructed from obtained solutions by EMO algorithms to be evaluated. We show that the selection of EMO algorithms used to construct reference points has a large effect on the evaluated performance of each algorithm.

1:50PM Review of Coevolutionary Developments of Evolutionary Multi-Objective and Many-Objective Algorithms and Test Problems [#15082]

Hisao Ishibuchi, Hiroyuki Masuda, Yuki Tanigaki and Yusuke Nojima, Osaka Prefecture University, Japan

In the evolutionary multi-objective optimization (EMO) community, some well-known test problems have been frequently and repeatedly used to evaluate the performance of EMO algorithms. When a new EMO algorithm is proposed, its performance is evaluated on those test problems. Thus algorithm development can be viewed as being guided by test problems. A number of test problems have already been designed in the literature. Since the difficulty of designed test problems is usually evaluated by existing EMO algorithms through computational experiments, test problem design can be viewed as being guided by EMO algorithms. That is, EMO algorithms and test problems have been developed in a coevolutionary manner. The goal of this paper is to clearly illustrate such a coevolutionary development. We categorize EMO algorithms into four classes: non-elitist, elitist, many-objective, and combinatorial algorithms. In each category of EMO algorithms, we examine the relation between developed EMO algorithms and used test problems. Our examinations of test problems suggest the necessity of strong diversification mechanisms in many-objective EMO algorithms such as SMS-EMOA, MOEA/D and NSGA-III.

2:10PM Cascaded Evolutionary Multiobjective Identification Based on Correlation Function Statistical Tests for Improving Velocity Analyzes in Swimming [#14269]

Helon Vicente Hultmann Ayala, Luciano Cruz, Roberto Zanetti Freire and Leandro dos Santos Coelho, PUCPR, Brazil; PUCPR, UFPR, Brazil

By using biomechanical analyses applied to sports many researchers are providing important information to coaches and athletes in order to reach better performance in a shorter time. In swimming, these kinds of analyses are being used to evaluate, to detect and to improve the skills of high level athletes. Recently, evolutionary computing theories have been adopted to support swim velocity profile identification. Based on velocity profiles recognition, it is possible to identify distinct characteristics and classify swimmers according to their abilities. In this way, this work presents an application of Radial Basis Function Neural Network (RBF-NN) associated to a proposed cascaded evolutionary procedure composed by a genetic and Multiobjective Differential Evolution (MODE) algorithms as optimization method for searching the best fitness within a set of parameters to configure the RBF-NN. The main goal and novelty of the proposed approach is to enable, through the adoption of cascaded multiobjective optimization, the use of correlation based tests in order to select both the model lagged inputs and the associated parameters in a supervised fashion. Finally, the real data of a Brazilian elite female swimmer in crawl and breaststroke styles obtained into a 25 meters swimming pool have been identified by the proposed method. The soundness of the approach is illustrated with the adherence to the

model validity tests and the values of the multiple correlation coefficients between 0.95 and 0.93 for two tests for both breaststroke and crawl strokes, respectively.

2:30PM Optimization Algorithms for Multi-objective Problems with Fuzzy Data [#14793]

Oumayma Bahri, Nahla Ben Amor and Talbi El-Ghazali, LARODEC Laboratory, Tunisia; INRIA Laboratory, France

This paper addresses multi-objective problems with fuzzy data which are expressed by means of triangular fuzzy numbers. In our previous work, we have proposed a fuzzy Pareto approach for ranking the generated triangular-valued functions. Then, since the classical multi-objective optimization methods can only use crisp values, we have applied a defuzzification process. In this paper, we propose a fuzzy extension of two well-known multi-objective evolutionary algorithms: SPEA2 and NSGAII by integrating the fuzzy Pareto approach and by adapting their classical techniques of diversity preservation to the triangular fuzzy context. An application on multi-objective Vehicle Routing Problem (VRP) with uncertain demands is finally proposed and evaluated using some experimental tests.

2:50PM Multi-Objective Evolutionary Approach for the Satellite Payload Power Optimization Problem [#14877]

Emmanuel Kieffer, Apostolos Stathakis, Gregoire Danoy, Pascal Bouvry, El-Ghazali Talbi and Gianluigi Morelli, Interdisciplinary Centre for Security, Reliability, and Trust, University of Luxembourg, Luxembourg; CSC Research Unit, University of Luxembourg, Luxembourg; INRIA-Lille Nord Europe, Universite Lille 1, France; SES S.A, Luxembourg

Today's world is a vast network of global communications systems in which satellites provide high- performance and long distance communications. Satellites are able to forward signals after amplification to offer a high level of service to customers. These signals are composed of many different channel frequencies continuously carrying real-time data feeds. Nevertheless, the increasing demands of the market force satellite operators to develop efficient approaches to manage satellite configurations, in which power transmission is one crucial criterion. Not only the signal power sent to the satellite needs to be optimal to avoid large costs but also the power of the downlink signal has to be strong enough to ensure the quality of service. In this work, we tackle for the first time the bi-objective input/output power problem with multi-objective evolutionary algorithms to discover efficient solutions. A problem specific indirect encoding is proposed and the performance of three state-of-the-art multi-objective evolutionary algorithms, i.e. NSGA-II, SPEA2 and MOCell, is compared on real satellite payload instances.

Special Session: RiiSS'14 Session 6: Computational Intelligence for Cognitive Robotics III

Friday, December 12, 1:30PM-3:10PM, Room: Bonaire 2, Chair: Janos Botzheim

1:30PM Evolutionary Swarm Robotics Approach to a Pursuit Problem [#14728]

Toshiyuki Yasuda, Kazuhiro Ohkura, Tosei Nomura and Yoshiyuki Matsumura, Hiroshima University, Japan; Shinshu University, Japan

The pursuit problem is a conventional benchmark in distributed artificial intelligence research. The focal point of previous work in this domain has been the development of coordination mechanisms for predators that cooperatively hunt prey in a typically discrete grid world. This paper investigates a pursuit problem in a continuous torus field on the basis of swarm robotics. Twenty predator robots and three prey robots, each of which can be hunted by multiple predators, are assumed. Predators have a controller represented by evolving artificial neural networks (EANNs), and prey have a predetermined behavior rule for escaping predators. A series of computer simulations were conducted to compare three types of EANNs to determine the efficient artificial evolution of the predator robot controllers.

1:50PM Unknown Object Extraction based on Plane Detection in 3D Space [#14738]

Hiroyuki Masuta, Makino Shinichiro, Lim Hun-ok, Motoyoshi Tatsuo, Koyanagi Ken'ichi and Oshima Toru, Toyama Prefectural University, Japan; Kanagawa University, Japan

This paper describes an unknown object extraction based on plane detection for an intelligent robot using a 3D range sensor. Previously, various methods have been proposed to perceive unknown environments. However, conventional unknown object extraction methods need predefined knowledge, and have limitations with high computational costs and low-accuracy for small object. In order to solve these problems, we propose an online processable unknown object extraction method based on 3D plane detection. To detect planes in 3D space, we have proposed a simple plane detection that applies particle swarm optimization (PSO) with region growing (RG), and integrated object plane detection. The simple plane detection is focused on small plane detection and on reducing computational costs. Furthermore, integrated object plane detection focuses on the stability of the detecting plane. Our plane detection method can detect a lot of planes in sight. This paper proposes an object extraction method which is grouped some planes according to the relative position. Through experiment, we show that unknown objects are extracted with low computational cost. Moreover, the proposed method extracts some objects in complicated environment.

2:10PM Robot Team Learning Enhancement Using Human Advice [#14644]

Justin Girard and M. Reza Emami, University of Toronto, Canada

The paper discusses the augmentation of the Concurrent Individual and Social Learning (CISL) mechanism with a new Human Advice Layer (HAL). The new layer is characterized by a Gaussian Mixture Model (GMM), which is trained on human experience data. The CISL mechanism consists of the Individual Performance and Task Allocation Markov Decision Processes (MDP), and the HAL can provide preferred action selection policies to the individual agents. The data utilized for training the GMM is collected using a heterogeneous team foraging simulation. When leveraging human experience in the multi-agent learning process, the team performance is enhanced significantly.

2:30PM Slip Based Pick-and-Place by Universal Robot Hand with Force/Torque Sensors [#14119]

Futoshi Kobayashi, Hayato Kanno, Hiroyuki Nakamoto and Fumio Kojima, Kobe University, Japan

A multi-fingered robot hand receives much attention in various fields. We have developed the multi- fingered robot hand with the multi-axis force/torque sensors. For stable transportation, the robot hand must pick up an object without dropping it and places it without damaging it. This paper deals with a pick- and-place motion by the developed robot hand. In this motion, the robot hand detects a slip by using the multi-axis force/torque sensors and implements the pick-and-place motion according the detected slip. The effectiveness of the proposed grasp selection is verified through some experiments with the universal robot hand.

CIES'14 Session 6: Energy Systems

Friday, December 12, 1:30PM-3:10PM, Room: Bonaire 4, Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse

1:30PM Investigating the Use of Echo State Networks for Prediction of Wind Power Generation [#14175]

Aida Ferreira, Ronaldo Aquino, Teresa Ludermir, Otoni Nobrega Neto, Jonata Albuquerque, Milde Lira and Manoel Carvalho Jr., UFPE, Brazil; IFPE, Brazil

This paper presents the results of models created for prediction of wind power generation using Echo State Networks (ESN). An echo state network consist of a large, randomly connected neural network, the reservoir, which is driven by an input signal and projects to output units. ESN offer an intuitive methodology for using the temporal processing power of recurrent neural networks without the hassle of training them. The models perform forecasting of wind power generation with 6 hours ahead, discretized by 10 minutes and with 5 days ahead, discretized by 30 minutes. These models use ESNs with spectral radius greater than 1 and even then they can make predictions with good results. The forecast horizons presented here fall in medium-term forecasts, up to five days ahead, which is an appropriate horizon to subsidize the operation planning of power systems. Models that directly predict the wind power generation with ESNs showed promising results.

1:50PM A Multi-Population Genetic Algorithm to Solve Multi-Objective Remote Switches Allocation Problem in Distribution Networks [#14782]

Helton Alves and Railson Sousa, Instituto Federal do Maranhao - IFMA, Brazil

This paper presents a Multi-Population Genetic Algorithm to solve the switches allocation problem in electric distribution networks considering remote and manual switches. In the procedure, reliability index, remote or manual controlled switch and investments costs are considered. The problem is formulated as a multi-objective optimization problem to be solved trough of weighted sum method. This method obtains the optimal solution considering a priori articulation of preferences established by the decision maker in terms of an aggregating function which combines individual objective values into a single utility value. A 282-bus test system is presented. The results confirm the efficiency of the proposed method which makes it promising to solve complex problems of switches placement in electric distribution feeders.

2:10PM An Evolutionary Approach to Improve Efficiency for Solving the Electric Dispatch Problem [#14918]

Carolina G. Marcelino, Elizabeth F. Wanner and Paulo E. M. Almeida, Intelligent Systems Laboratory - LSI, Brazil

The consumption of electric energy for general supply of a country is increasing over the years. In Brazil, energy demand grows, on average, 5% per year and the power source is predominantly hydroelectric. Many of the power plants installed in Brazil do not operate efficiently, from the water consumption point of view. The normal mode of operation (NMO) equally divides power demand between existing generation units of a power plant, regardless if this individual demand represents or not a good operation point for each unit. The unit dispatch problem is defined as the attribution of operational values to each unit inside a power plant, given some criteria to be met. In this context, an optimal solution for the dispatch problem means production of electricity with minimal water consumption. This work proposes a multi-objective approach to solve the electric dispatch problem in which the objective functions considered are: maximization of hydroelectric productivity function and minimization of the distance between NMO and optimized control mode (OCM). The proposed approach is applied to a large hydroelectric plant operating in Brazil. Results indicate that it is possible to identify operating points near NMO that present productivity efficiency, saving in one month about 14.6 million m3 of water. Moreover, higher productivity can be achieved with smaller differences between NMO and OCM in lower power demands. Finally, it is worth to mention that the simplicity and the nature of the proposed approach indicate that it can be easily applied to studies of similar power plants, and thus can potentially be used to provide further economy on water consumption to larger extents of the hydroelectric production.

2:30PM Energy Price Forecasting in the North Brazilian Market using NN - ARIMA model and Explanatory Variables [#14356]

Jose Carlos Filho, Carolina Affonso and Roberto Celio Oliviera, Amazon Data Institute, Brazil; Federal University of Para, Brazil

This paper proposes a new hybrid approach for short-term energy price prediction. This approach combines ARIMA and NN models in a cascaded structure and uses explanatory variables. A two step procedure is applied. In the first step, the explanatory variables are predicted. In the second one, the energy prices are forecasted by using the explanatory variables prediction. The prediction time horizon is 12 weeks-ahead and is applied to the North Brazilian submarket, which adopts a cost-based model with unique characteristics of price behavior. The proposed strategy is compared with traditional techniques like ARIMA and NN and the results show satisfactory accuracy and good ability to predict spikes. Thus, the model can be an attractive tool to mitigate risks in purchasing power.

2:50PM Participatory Learning in the Neurofuzzy Short-Term Load Forecasting [#14953]

Michel Hell, Pyramo Costa Jr. and Fernando Gomide, DCE - FE - UFJF, Brazil; PPEE - PUC-MG, Brazil; DCA - FEEC - UNICAMP, Brazil

This paper presents a new approach for short-term load forecasting using the participatory learning paradigm. Participatory learning paradigm is a new training procedure that follows the human learning mechanism adopting an acceptance mechanism to determine which observation is used based upon its compatibility with the current beliefs. Here, participatory learning is used to train a class of hybrid neurofuzzy network to accurately forecast 24-h daily energy consumption series of an electrical operation unit located at the Southeast region of Brazil. Experimental results show that the neurofuzzy approach with participatory learning requires less computational effort, is more robust, and more efficient than alternative neural methods. The approach is particularly efficient when training data reflects anomalous load conditions or contains spurious measurements. Comparisons with alternative approaches suggested in the literature are also included to shown the effectiveness of participatory learning.

IA'14 Session 2: Applications of Intelligent Agents

Friday, December 12, 1:30PM-3:10PM, Room: Bonaire 5, Chair: Hani Hagras and Vincenzo Loia

1:30PM Human Activity Recognition in Smart Homes: Combining Passive RFID and Load Signatures of Electrical Devices [#14194]

Dany Fortin-Simard, Jean-Sebastien Bilodeau, Sebastien Gaboury, Bruno Bouchard and Abdenour Bouzouane, University of Quebec at Chicoutimi, Canada

Modern societies are facing an important aging of their population, leading to rising economic and social challenges such as the pressure on health support services for semi-autonomous persons. Smart home technology is considered by many researchers as a promising potential solution to help support the needs of elders. It aims to provide cognitive assistance by taking decisions, such as giving hints, suggestions and reminders, with different kinds of effectors (light, sound, screen, etc.) to a resident suffering from cognitive deficits in order to foster their autonomy. To implement such a technology, the first challenge we need to overcome is the recognition of the ongoing inhabitant activity of daily living (ADL). Moreover, to assist them correctly, we also need to be able to detect the perceptive errors they perform. Therefore, we present in this paper a new affordable activity recognition system, based on passive RFID technology and load signatures of appliances, able to detect errors related to cognitive impairment. The whole computational intelligent system is based on a multi- layer model that promotes scalability and adaptability. This system has been implemented and deployed in a real smart home prototype. We also present the promising results of our experiment conducted on real case scenarios about morning routines.

1:50PM Naive Creature Learns to Cross a Highway in a Simulated CA-Like Environment [#14633]

Anna Lawniczak, Bruno Di Stefano and Jason Ernst, University of Guelph, Canada; Nuptek Systems Ltd, Canada

We present a model of simple cognitive agents, called "creatures", and their learning process, a type of "social observational learning", that is each creature learns from the behaviour of other creatures. The creatures may experience fear and/or desire, and are capable of evaluating if a strategy has been applied successfully and of applying this strategy again with small changes to a similar but new situation. The creatures are born as "tabula rasa"; i.e. without built-in knowledge base of their environment and as they learn they build this knowledge base. We study learning outcomes of a population of such creatures when they are learning how to safely cross various types of highways. The highways are implemented as a modified Nagel-Schreckenberg model, a CA based highway model, and each creature is provided with mechanism to reason to cross safely the highway. We present selected simulation results and their analysis.

2:10PM An Agent-based Trading Infrastructure for Combinatorial Reverse Auctions [#14689]

Hakan Bayindir, Hurevren Kilic and Mohammed Rehan, Turkish Academic Network and Information Centre, Turkey; Gediz University Computer Engineering Department, Turkey; Atilim University Information Systems Engineering Department, Turkey

A Combinatorial Reverse Auction Trading Infrastructure - CRATI is designed and implemented as an agent-based system. Two basic building blocks Java Agent Development Framework (JADE) and an Open Source Java Constraint Programming Library (Choco Solver) are used to facilitate agent interactions and an optimization task. For our purpose, it is shown that auction Winner Determination Problem (WDP) can suitably be represented as a weighted set covering problem instance whose solution gives the decided winners of the auction process. In order to realize the system, a variation of Contract Net protocol is designed and implemented to handle auctions that occur in the platform from start to finish.

2:30PM Human Perceptions of Altruism in Artificial Agents [#14444]

Curry Guinn and Daniel Palmer, UNC Wilmington, United States

Modeling realistic altruism for non-player characters (NPCs) is an interesting problem with substantive potential benefits to game creators and players, in the form of more believable game characters and immersive games. An experiment was conducted to investigate how humans would interpret altruistic behavior in artificial agents in a predator/prey environment. This paper describes an experiment focused on whether human observers would attribute emotional characteristics and motivations to altruistic game agents.

2:50PM Developing Game-Playing Agents That Adapt to User Strategies: A Case Study [#14443]

Rececca Brown and Curry Guinn, UNC Wilmington, United States

This paper describes the development of a novel web-delivered computer game, Boundary, where human players vie against each other or computer agents that use adaptive learning to modify playing strategies. The novelty presents challenges in game development both in terms of game playability and enjoyment as well as designing intelligent computer game players. An adaptive artificial intelligent agent was developed by creating several basic AI agents, each of which employs a unique, simple strategy. The adaptive agent classifies its opponent's play during the game by simulating what moves each simple strategy would make and identifying the strategy that produces the closest approximation to the opponent's actions. During development, through computer-computer simulations, the relative strengths of each strategy versus the others were determined. Thus, once an opponent's moves are matched to the closest known strategy, the best counter-strategy can be selected by the computer agent. Our hypotheses are that 1) humans will quickly learn how to counter the static AI strategies, 2) humans will have more difficulty learning how to counter the adaptive AI, and 3) human players will judge the adaptive player as more challenging. This paper describes human subject experiments to test those hypotheses.

CIDUE'14 Session 3

Friday, December 12, 1:30PM-3:10PM, Room: Bonaire 6, Chair: Robi Polikar and Shengxiang Yang

1:30PM Ant Colony Optimization with Self-Adaptive Evaporation Rate in Dynamic Environments [#14247]

Michalis Mavrovouniotis and Shengxiang Yang, De Montfort University, United Kingdom

The performance of ant colony optimization (ACO) algorithms in tackling optimization problems strongly depends on different parameters. One of the most important parameters in ACO algorithms when addressing dynamic optimization problems (DOPs) is the pheromone evaporation rate. The role of pheromone evaporation in DOPs is to improve the adaptation capabilities of the algorithm. When a dynamic change occurs, the pheromone trails of the previous environment will not match the new environment especially if the changing environments are not similar. Therefore, pheromone evaporation helps to eliminate pheromone trails that may misguide ants without destroying any knowledge gained from previous environments. In this paper, a self-adaptive evaporation mechanism is proposed in which ants are responsible to select an appropriate evaporation rate while tracking the moving optimum in DOPs. Experimental results show the efficiency of the proposed self-adaptive evaporation mechanism on improving the performance of ACO algorithms for DOPs

1:50PM Learning Features and their Transformations from Natural Videos [#14276]

Jayanta Dutta and Bonny Banerjee, University of Memphis, United States

Learning features invariant to arbitrary transformations in the data is a requirement for any recognition system, biological or artificial. It is now widely accepted that simple cells in the primary visual cortex respond to features while the complex cells respond to features invariant to different transformations. We present a novel two-layered feedforward neural model that learns features in the first layer by spatial spherical clustering and invariance to transformations in the second layer by temporal spherical clustering. Learning occurs in an online and unsupervised manner following the Hebbian rule. When exposed to natural videos acquired by a camera mounted on a cat's head, the first and second layer neurons in our model develop simple and complex cell-like receptive field properties. The model can predict by learning lateral connections among the first layer neurons. A topographic map to their spatial features emerges by exponentially decaying the flow of activation with distance from one neuron to another in the first layer that fire in close temporal proximity, thereby minimizing the pooling length in an online manner simultaneously with feature learning.

2:10PM Neuron Clustering for Mitigating Catastrophic Forgetting in Feedforward Neural Networks [#14955]

Ben Goodrich and Itamar Arel, University of Tennessee, United States

Catastrophic forgetting is a fundamental problem with artificial neural networks (ANNs) in which learned representations are lost as new representations are acquired. This significantly limits the usefulness of ANNs in dynamic or non-stationary settings, as well as when applied to very large datasets. In this paper, we examine a novel neural network architecture which utilizes online clustering for the selection of a subset of hidden neurons to be activated in the feedforward and back propagation passes. It is shown that such networks are able to effectively mitigate catastrophic forgetting. Simulation results illustrate the advantages of the proposed network with respect to other schemes for addressing the memory loss phenomenon.

2:30PM Evolutionary Algorithms for Bid-Based Dynamic Economic Load Dispatch: A Large-Scale Test Case [#14957]

Sunny Orike and David Corne, Heriot-Watt University, United Kingdom

The bid-based dynamic economic load dispatch problem (BBDELD) is an optimization problem that arises in the modern context of a de-regulated national energy market, and involves matching bids from competing generating companies to the demands of consumers (regions) so as to maximize a measure of 'social profit'. We present a novel approach to solving the BBDELD, and introduce a large-scale test-case designed to reflect the deregulated Nigerian electricity industry. We build on previous work on smart evolutionary algorithm approaches to the static economic load dispatch (SELD) and dynamic economic load dispatch (DELD) problems, and also the BBELD (the non-dynamic form). We evaluate the performance of two evolutionary algorithm, previously reported on small-scale test cases of the BBELD, on dynamic extensions of those test cases (with demand profiles varied over 24 periods), and we introduce a new large-scale test case based on Nigerian sector data, involving 40 generators, 11 customers in 24 dispatch periods. The results demonstrate that the two approaches reported seem more effective than previous approaches on the previously reported cases (when tested on the non-dynamic versions for which prior results are available), and are capable of dealing successfully with the country's large-scale test case.

2:50PM Statistical Hypothesis Testing for Chemical Detection in Changing Environments [#14124]

Anna Ladi, Jon Timmis, Andy Tyrrell and Peter J Hickey, University of York, United Kingdom; Defense Science and Technology Laboratory (DSTL), United Kingdom

This paper addresses the problem of adaptive chemical detection, using the Receptor Density Algorithm (RDA), an immune inspired anomaly detection algorithm. Our approach is to first detect when and if something has changed in the environment and then adapt the RDA to this change. Statistical hypothesis testing is used to determine whether there has been concept drift in consecutive time windows of the data. Five different statistical methods are tested on mass- spectrometry data, enhanced with artificial events that signify a changing environment. The results show that, while no one method is universally best, statistical hypothesis testing performs reasonably well on the context of chemical sensing and it can differentiate between anomalies and concept drift.

CIBCI'14 Session 3

Friday, December 12, 1:30PM-3:10PM, Room: Bonaire 8, Chair: Kai Keng Ang and Damien Coyle

1:30PM EEG-based Golf Putt Outcome Prediction Using Support Vector Machine [#14502]

Qing Guo, Jingxian Wu and Baohua Li, University of Arkansas, United States

In this paper, a method is proposed to predict the putt outcomes of golfers based on their electroencephalogram (EEG) signals recorded before the impact between the putter and the ball. This method can be used into a brain-computer interface system that encourages golfers for putting when their EEG patterns show that they are ready. In the proposed method, multi-channel EEG trials of a golfer are collected from the electrodes placed at different scalp locations in one particular second when she/he concentrates on putting preparation. The EEG trials are used to predict two possible outcomes: successful or failed putts. This binary classification is performed by the support vector machine (SVM). Based on the collected time-domain EEG signals, the spectral coherences from 22- pair electrodes are calculated and then used as the feature and input for the SVM algorithm. Our experimental results show that the proposed method using EEG coherence significantly outperforms the SVM with other popular features such as power spectral density (PSD), average PSD, power, and average spectral coherence.

1:50PM Non-supervised Technique to Adapt Spatial Filters for ECoG Data Analysis [#14892]

Emmanuel Morales-Flores, Gerwin Schalk and J.Manuel Ramirez-Cortes, National Institute for Astrophysics Optics and Electronics INAOE, Mexico; Wadsworth Center, United States

Electrical Brain signals can be used for developing non-muscular communication and control systems, Brain-Computer Interfaces (BCIs) for people with motor disabilities. The performance of a BCI relies on the measured components of the brain activity, and on the feature extraction achieved by the spatial and temporal filtering methods applied prior to its translation into commands. In the present study we proposed a non-supervised technique based on steepest descent method with a minimization cost function given by the variance on differences of the linear combination of the electrodes in order to adapt filter's coefficients to the most appropriate spatial filter. Results of applying this technique to electrocorticographic (ECoG) signals of five subjects performing finger flexion task are shown. Adapted filters were compared with Common Average Reference Filter (CAR) when mean square error (MSE) between channels significantly correlated and power of filtered data was computed;results proved that adapted filters have better performance. Paired t-test was conducted to prove that results from CAR and the proposed technique are significantly different.

2:10PM Identification of Three Mental States Using a Motor Imagery Based Brain Machine Interface [#14552]

Trongmun Jiralerspong, Chao Liu and Jun Ishikawa, Tokyo Denki University, Japan

The realization of robotic systems that understands human intentions and produces accordingly complex behaviors is needed particularly for disabled persons, and would consequently benefit the aged. For this purpose, a control technique that recognizes human intentions from neural responses called brain machine interface (BMI) have been suggested. The unique ability to communicate with machines by brain signals opens a wide area of applications for BMI. Recently, combination of BMI capabilities with assistive technology has provided solutions that can benefit patients with disabilities and many others. This paper proposes a BMI system that uses a consumer grade electroencephalograph (EEG) acquisition device. The aim is to develop a low cost BMI system suitable for households and daily applications. As a preliminary study, an experimental system has been prototyped to classify user intentions of moving an object up or down, which are basic instructions needed for controlling most electronic devices by using only EEG signals. In this study, an EEG headset equipped with 14 electrodes is used to acquire EEG signals but only 8 electrodes are used to identify user intentions. The features of EEG signals are extracted based on power spectrum and artificial neural network are used as classifiers. To evaluate the system performance, online identification experiments for three subjects are conducted. Experiment results show that the proposed system has worked well and could achieve an overall correct identification rate of up to 72 % with 15 minutes of training time by a user with no prior experience in BMI.

2:30PM EEG Subspace Analysis and Classification Using Principal Angles for Brain-Computer Interfaces [#14117]

Rehab Ashari and Charles Anderson, Colorado State University, United States

Brain-Computer Interfaces (BCIs) help paralyzed people who have lost some or all of their ability to communicate and control the outside environment from loss of voluntary muscle control. Most BCIs are based on the classification of multichannel electroencephalography (EEG) signals recorded from users as they respond to external stimuli or perform various mental activities. The classification process is fraught with difficulties caused by electrical noise, signal artifacts, and nonstationarity. One approach to reducing the effects of similar difficulties in other domains is the use of principal angles between subspaces, which has been applied mostly to video sequences. In this paper, it is shown that principal angles are also a useful approach to the classification of EEG signals that are recorded during a BCI typing application. Single letters are flashed on a computer display every second as the subject counts the number of times the desired letter appears. The appearance of the subject's desired letter is detected by identifying a P300-wave within a one-second window of EEG following the flash of a letter. Classification of pairs of one-second windows of EEG resulted in an average accuracy of detecting the P300 of 88% for a motor-impaired subject recorded in their home and 76% for an unimpaired subject recorded in the lab.

CIDM'14 Session 9: Modelling and Mining Massive Data Sets

Friday, December 12, 1:30PM-3:10PM, Room: Curacao 2, Chair: Jean-Marc Andreoli

1:30PM Matching Social Network Biometrics Using Geo-Analytical Behavioral Modeling [#14340]

Mark Rahmes, Kevin Fox, John Delay and Gran Roe, Harris Corporation, United States

Social patterns and graphical representation of geospatial activity is important for describing a person's typical behavior. We discuss a framework using social media and GPS smart phone to track an individual and establish normal activity with a network biometric. An individual's daily routine may include visiting many locations - home, work, shopping, entertainment and other destinations. All of these activities pose a routine or status quo of expected behavior. What has always been difficult, however, is predicting a change to the status quo, or predicting unusual behavior. We propose taking the knowledge of location information over a relatively long period of time and marrying that with modern analytical capabilities. The result is a biometric that can be fused and correlated with another's behavioral biometric to determine relationships. Our solution is based on the analytical environment to support the ingestion of many data sources and the integration of analytical algorithms such as feature extraction, crowd source analysis, open source data mining, trends, pattern analysis and linear game theory optimization. Our framework consists of a hierarchy of data, space, time, and knowledge entities. We exploit such statistics to predict behavior or activity based on past observations. We use multivariate mutual information as a measure to compare behavioral biometrics.

1:50PM Massively Parallelized Support Vector Machines based on GPU-Accelerated Multiplicative Updates [#14757]

Connie (Khor Li) Kou and Chao-Hui Huang, Bioinformatics Institute, Agency for Science, Technology and Research, Singapore

In this paper, we present multiple parallelized support vector machines (MPSVMs), which aims to deal with the situation when multiple SVMs are required to be performed concurrently. The proposed MPSVM is based on an optimization procedure for nonnegative quadratic programming (NQP), called multiplicative updates. By using graphical processing units (GPUs) to parallelize the numerical procedure of SVMs, the proposed MPSVM showed good performance for a certain range of data size and dimension. In the experiments, we compared the proposed MPSVM with other cutting-edge implementations of GPU-based SVMs and it showed competitive performance. Furthermore, the proposed MPSVM is designed to perform multiple SVMs in parallel. As a result, when multiple operations of SVM are required, MPSVM can be one of the best options in terms of time consumption.

2:10PM Scaling a Neyman-Pearson Subset Selection Approach Via Heuristics for Mining Massive Data [#14996]

Gregory Ditzler, Matthew Austen, Gail Rosen and Robi Polikar, Drexel Univerity, United States; Rowan University, United States; Drexel University, United States

Feature subset selection is an important step towards producing a classifier that relies only on relevant features, while keeping the computational complexity of the classifier low. Feature selection is also used in making inferences on the importance of attributes, even when classification is not the ultimate goal. For example, in bioinformatics and genomics feature subset selection is used to make inferences between the variables that best describe multiple populations. Unfortunately, many feature selection algorithms require the subset size to be specified a priori, but knowing how many variables to select is typically a nontrivial task. Other approaches rely on a specific variable subset selection framework to be used. In this work, we examine an approach to feature subset selection works with a generic variable selection algorithm, and our approach provides statistical inference on the number of features that are relevant, which may be unknown to the generic variable selection algorithm. This work extends our previous implementation of a Neyman- Pearson feature selection (NPFS) hypothesis test, which acts as a meta-subset selection algorithm. Specifically, we examine the conservativeness of the NPFS approach by biasing the hypothesis test, and examine other heuristics for NPFS. We include results from carefully designed synthetic datasets. Furthermore, we demonstrate the NPFS's ability to perform on data of a massive scale.

2:30PM MapReduce Guided Approximate Inference Over Graphical Models [#15015]

Ahsanul Haque, Swarup Chandra, Latifur Khan and Michael Baron, The University of Texas at Dallas, United States

A graphical model represents the data distribution of a data generating process and inherently captures its feature relationships. This stochastic model can be used to perform inference, to calculate posterior probabilities, in various applications such as classification. Exact inference algorithms are known to be intractable on large networks due to exponential time and space complexity. Approximate inference algorithms are instead widely used in practice to overcome this constraint, with a trade off in accuracy. Stochastic sampling is one such method where an approximate probability distribution is empirically evaluated using various sampling techniques. However, these algorithms may still suffer from scalability issues on large and complex networks. To address this challenge, we have designed and implemented several MapReduce based distributed versions of a specific type of approximate inference algorithm called Adaptive Importance Sampling (AIS). We compare and evaluate the proposed approaches using benchmark networks. Experimental result shows that our approach achieves significant scaleup and speedup compared to the sequential algorithm, while achieving similar accuracy asymptotically.

2:50PM Optimization of Relational Database Usage Involving Big Data (A Model Architecture for Big Data applications) [#15031]

Erin-Elizabeth Durham, Andrew Rosen and Robert Harrison, Georgia State University, United States

Effective Big Data applications dynamically handle the retrieval of decisioned results based on stored large datasets efficiently. One effective method of requesting decisioned results, or querying, large datasets is the use of SQL and database management systems such as MySQL. But a problem with using relational databases to store huge datasets is the decisioned result retrieval time, which is often slow largely due to poorly written queries / decision requests. This work presents a model to re-architect Big Data applications in order to efficiently present decisioned results: lowering the volume of data being handled by the application itself, and significantly decreasing response wait times while allowing the flexibility and permanence of a standard relational SQL database, supplying optimal user satisfaction in today's Data Analytics world. We experimentally demonstrate the effectiveness of our approach.

SIS'14 Session 10: Combintorial Problems

Friday, December 12, 1:30PM-3:10PM, Room: Curacao 3, Chair: Donald Wunsch and Eunjin Kim

1:30PM A Distributed and Decentralized Approach for Ant Colony Optimization with Fuzzy Parameter Adaptation in Traveling Salesman Problem [#14178]

Jacob Collings and Eunjin Kim, University of North Dakota, United States

In this paper, we present a new decentralized peer-to-peer approach for implementing Ant Colony Optimization on distributed memory clusters. In addition, the approach is augmented with a fuzzy logic controller to reactively adapt several parameters of the ACO as a method of offsetting the increased exploitation resulting from the way in which information is shared between computing processes. We build an implementation of the approach for the Travelling Salesman Problem (TSP). The implementation is tested with several TSP problem instances with different numbers of processes in a cluster. The adaptive version is compared with the non-adaptive version and shown to agree with our expectations and performance is evaluated for different numbers of processes with an improvement shown.

1:50PM An Extended EigenAnt Colony System Applied to the Sequential Ordering Problem [#14185]

Ahmed Ezzat, Ashraf Abdelbar and Donald Wunsch, American University in Cairo, Egypt; Brandon University, Canada; Missouri University of Science and Technology, United States

The EigenAnt Ant Colony System (EAAS) model is an Ant Colony Optimization (ACO) model based on the EigenAnt algorithm. In previous work, EAAS was found to perform competitively with the Enhanced Ant Colony System (EACS) algorithm, a state-of-the-art method for the Sequential Ordering Problem (SOP). In this paper, we extend EAAS by increasing the amount of stochasticity in its solution construction procedure. In experimental results on the SOPLIB instance library, we find that our proposed method, called Probabilistic EAAS (PEAAS), performs better than both EAAS and EACS. The non-parametric Friedman test is applied to determine statistical significance.

2:10PM A Planner for Autonomuos Risk-Sensitive Coverage (PARCov) by a Team of Unmanned Aerial Vehicles [#14981]

Alex Wallar, Erion Plaku and Donald Sofge, St Andrews University, United Kingdom; Catholic University of America, United States; Naval Research Laboratory, United States

This paper proposes a path-planning approach to enable a team of unmanned aerial vehicles (UAVs) to efficiently conduct surveillance of sensitive areas. The proposed approach, termed PARCov (Planner for Autonomous Risk-sensitive Coverage), seeks to maximize the area covered by the sensors mounted on each UAV while maintaining high sensor data quality and minimizing detection risk. PARCov leverages from swarm intelligence the idea of using simple interactions among UAVs to promote an emergent behavior that achieves the desired objectives. PARCov uses a dynamic grid to keep track of the parts of the space that have been surveyed and the times that they were last surveyed. This information is then used to move the UAVs toward areas that have not been covered in a long time. Moreover, a nonlinear optimization formulation is used to determine the altitude at which each UAV flies. The efficiency and scalability of PARCov is demonstrated in simulation using complex environments and an increasing number of UAVs to conduct risk-sensitive surveillance.

2:30PM Path Planning for Swarms in Dynamic Environments by Combining Probabilistic Roadmaps and Potential Fields [#14659]

Alex Wallar and Erion Plaku, University of St Andrews, United Kingdom; Catholic University of America, United States

This paper presents a path-planning approach to enable a swarm of robots move to a goal region while avoiding collisions with static and dynamic obstacles. To provide scalability and account for the complexity of the interactions in the swarm, the proposed approach combines probabilistic roadmaps with potential fields. The underlying idea is to provide the swarm with a series of intermediate goals which are obtained by constructing and searching a roadmap of likely collision-free guides. As the swarm moves from one intermediate goal to the next, it relies on potential fields to quickly react and avoid collisions with static and dynamic obstacles. Potential fields are also used to ensure that the swarm moves in cohesion. When the swarm deviates or is unable to reach the planned intermediate goals due to interferences from the dynamic obstacles, the roadmap is searched again to provide alternative guides. Experiments conducted in simulation demonstrate the efficiency and scalability of the approach.

2:50PM Feature Selection for Problem Decomposition on High Dimensional Optimization [#14946]

Pedro Reta and Ricardo Landa, Cinvestav Tamaulipas, Mexico

In general, the Cooperative Coevolutionary Algorithms based on separability have shown good performance when solving high dimensional optimization problems. However, the number of function evaluations required for the decomposition stage of these algorithms can growth very fast, and depends on the dimensionality of the problem. In cases where a single function evaluation is computationally expensive or time consuming, it is of special interest keeping the function evaluations as low as possible. In this document we propose the use of a feature selection technique for choosing the most important decision variables of an optimization problem in order to apply separability analysis on a reduced decision variable set intending to save the most optimization resources.

Special Session: CICARE'14 Session 3: Prospects and Applications of Computational Intelligence in Health Assessment, Monitoring and eHealth

Friday, December 12, 1:30PM-3:10PM, Room: Curacao 4, Chair: Haider Ali Al-Lawati and Mufti Mahmud

1:30PM Exploring sustained phonation recorded with acoustic and contact microphones to screen for laryngeal disorders [#14126]

Adas Gelzinis, Antanas Verikas, Evaldas Vaiciukynas, Marija Bacauskiene, Jonas Minelga, Magnus Hallander, Virgilijus Uloza and Evaldas Padervinskis, Department of Electric Power Systems, Kaunas University of Technology, Lithuania; IS-Lab, Halmstad University, Sweden; Kaunas University of Technology, Lithuania; Department of Otolaryngology, Lithuanian University of Health Sciences, Lithuania

Exploration of various features and different structures of data dependent random forests in screening for laryngeal disorders through analysis of sustained phonation recorded by acoustic and contact microphones is the main objective of this study. To obtain a versatile characterization of voice samples, 14 different sets of features were extracted and used to build an accurate classifier to distinguish between normal and pathological cases. We proposed a new, data dependent random forest-based, way to combine information available from the different feature sets. An approach to exploring data and decisions made by a random forest was also presented. Experimental investigations using a mixed gender database of 273 subjects have shown that the Perceptual linear predictive cepstral coefficients (PLPCC) was the best feature set for both microphones. However, the LP-coefficients and LPCT-coefficients feature sets exhibited good performance in the acoustic microphone case only. Models designed using the acoustic microphone data significantly outperformed the ones built using data recorded by the contact microphone. The contact microphone did not bring any additional information useful for classification. The proposed data dependent random forest significantly outperformed traditional designs.

1:50PM Rule Based Realtime Motion Assessment for Rehabilitation Exercises [#14514]

Wenbing Zhao, Roanna Lun, Deborah Espy and Ann Reinthal, Cleveland State University, United States

In this paper, we describe a rule based approach to realtime motion assessment of rehabilitation exercises. We use three types of rules to define each exercise: (1) dynamic rules, with each rule specifying a sequence of monotonic segments of the moving joint or body segment, (2) static rules for stationary joints or body segments, and (3) invariance rules that dictate the requirements of moving joints or body segments. A finite state machine based approach is used in dynamic rule specification and realtime assessment. In addition to the typical advantages of the rule based approach, such as realtime motion assessment with specific feedback, our approach has the following advantages: (1) increased reusability of the defined rules as well as the rule assessment engine facilitated by a set of generic rule elements; (2) increased customizability of the rules for each exercise enabled by the use of a set of generic rule elements and the use of extensible rule encoding method; and (3) increased robustness without relying on expensive statistical algorithms to tolerate motion sensing errors and subtle patient errors.

2:10PM Exploring Emotion in an E-learning System using Eye Tracking [#14585]

Saromporn Charoenpit and Michiko Ohkura, Shibaura Institute of Technology, Japan

Since appropriate emotions are a sign of mental health, learners who have good mental health learn more successfully. Inappropriate emotions indicate mental health problems. If learners are mentally healthy, they will react to a learning situation with an appropriate emotion, regardless of the event. If learners have problems, they may react in the exact opposite way or in a conflicted manner. E- learning is an innovative technology that provides a strategy to improve the quality of teaching and learning. In e-learning systems, emotions are critical for learners to create positive contexts for optimal learning. To data, however, few e-learning systems have derived emotions from eye tracking data. With eye tracking equipment, we recorded the eye movements of learners and calculated their eye metric indexes. We applied an eye metric index that is related to the learner emotions. The following describes the eye metric indexes as a the number of fixation, the fixation duration, the fixation point, the fixation length, and the pupil diameter. In this paper, we focused on to explore their relationship to two learner emotions: interest and boredom. We designed and implemented a prototype and experimentally evaluated it. Our experimental results, identified, such useful eye metric indexes as the number of fixation ratio and the fixation duration ratio.

2:30PM Privacy Preservation, Sharing and Collection of Patient Records using Cryptographic Techniques for Cross-Clinical Secondary Analytics [#14789]

Hajara Abdulrahman, Norman Poh and Jack Burnett, University of Surrey, United Kingdom

The growing interest in research on Clinical Medical Records (CMRs) presents opportunities in finding meaningful patterns of symptoms, treatments and patient outcomes. The typically distributed collection of CMRs across various clinical centres suggests the need to integrate the records in a centralized data repository. This is necessary to explore many data analytic algorithms which are not supported on distributed databases. As highly private patient records are being dealt with, it is important to consider how privacy will be preserved. This is especially important since the patient records are to be shared and used for reasons other than the primary reasons they were collected, i.e., for secondary use of healthcare data. In addition, the need for securing data transmission becomes necessary to ensure privacy and confidentiality. We advance the literature on privacy- enhancing data minining in the healthcare setting by (1) presenting strategies of using de-identification as well as cryptographic techniques to facilitate patient identity protection and securely transmit the records to a centralized data repository for secondary data analytics; (2) addressing key management issues related to the use of cryptography constructs; and (3) establishing the security requirements as well as carrying out vulnerability assessment with respect to the tranmission process, data repository, and direct attacks to the encrypted patient ID.

2:50PM How to find your appropriate doctor: An integrated recommendation framework in big data context [#14966]

Hongxun Jiang and Wei Xu, School of Information, Renmin University of China, China

To find a specialty-counterpart, diagnosis-accurate, skill-superb, reputation-high, and meanwhile cost-effective and distance-close doctor is always essential for patients but not an easy job. According to various categories of medical professions, the diversity of user symptoms, and the information asymmetry and incompetence of doctors' profiles as well as patients' medical history, today most recommender applications are difficult to fit this field. The emerging web medical databases and online communities, providing doctors information and user reviews for them respectively, make it possible to personalized medical recommender services. In this paper, we describe an integrated recommender framework for seeking doctors in accordance with patients' demand characteristics, including their illness symptoms and their preference. In the proposed

method, a users' matching model is firstly suggested for finding the similarities between users' consultation and doctors' profiles. Second, to measure doctors' quality, doctors' experiences and dynamic user's opinions are considered. Finally, to combine the results of the relevance model and the quality model, an AHP based integrated method is suggested for doctor recommendation. A mobile recommender APP is proposed to demonstrate the framework as above. And a survey is carried out for method evaluation. The results illustrate the new recommender outperforms others on accuracy and efficiency, as well as user experience. Our paper provides an efficient method for doctor recommendation, which has good practical value in China regarding to its huge land area with medical resource's uneven distribution.

CICA'14 Session 7: Computational Intelligence in Robotics

Friday, December 12, 3:30PM-5:10PM, Room: Antigua 2, Chairs: Yongping Pan, Andrei Petrovski

3:30PM Calibration between a Laser Range Scanner and an Industrial Robot Manipulator [#14123]

Thomas Timm Andersen, Nils Axel Andersen and Ole Ravn, Technical University of Denmark, Denmark

In this paper we present a method for finding the transformation between a laser scanner and a robot manipulator. We present the design of a flat calibration target that can easily fit between a laser scanner and a conveyor belt, making the method easily implementable in a manufacturing line. We prove that the method works by simulating a range of different orientations of the target, and performs an extensive numerical evaluation of the targets design parameters to establish the optimal values as well as the worst-case accuracy of the method.

3:50PM Context-based Adaptive Robot Behavior Learning Model (CARB-LM) [#14763]

Joohee Suh and Dean Hougen, University of Oklahoma, United States

An important, long-term objective of intelligent robotics is to develop robots that can learn about and adapt to new environments. We focus on developing a learning model that can build up new knowledge through direct experience with and feedback from an environment. We designed and constructed Context- based Adaptive Robot Behavior-Learning Model (CARBLM) which is conceptually inspired by Hebbian and anti-Hebbian learning and by neuromodulation in neural networks. CARB-LM has two types of learning processes: (1) context-based learning and (2) reward-based learning. The former uses past accumulated positive experiences as analogies to current conditions, allowing the robot to infer likely rewarding behaviors, and the latter exploits current reward information so the robot can refine its behaviors based on current experience. The reward is acquired by checking the effect of the robot's behavior in the environment. As a first test of this model, we tasked a simulated TurtleBot robot with moving smoothly around a previously unexplored environment. We simulated this environment using ROS and Gazebo and performed experiments to evaluate the model. The robot showed substantial learning and greatly outperformed both a hand-coded controller and a randomly wandering robot.

4:10PM Biomimetic Hybrid Feedback Feedforword Adaptive Neural Control of Robotic Arms [#14787]

Yongping Pan and Haoyong Yu, Department of Biomedical Engineering, National University of Singapore, Singapore

This paper presents a biomimetic hybrid feedback feedforword (HFF) adaptive neural control for a class of robotic arms. The control structure includes a proportional-derivative feedback term and an adaptive neural network (NN) feedforword term, which mimics the human motor learning and control mechanism. Semiglobal asymptotic stability of the closed-loop system is established by the Lyapunov synthesis. The major difference of the proposed design from the traditional feedback adaptive approximation-based control (AAC) design is that only desired outputs, rather than both tracking errors and desired outputs, are applied as NN inputs. Such a slight difference leads to several attractive properties, including the convenient NN design, the decrease of the number of NN inputs, and semiglobal asymptotic stability dominated by control gains. Compared with previous HFF-AAC approaches, the proposed approach has two unique features: 1) all above attractive properties are achieved by a much simpler control scheme; 2) the bounds of plant uncertainties are not required to be known. Simulation results have verified the effectiveness and superiority of this approach.

4:30PM Improved Multiobjective Particle Swarm Optimization for Designing PID Controllers Applied to Robotic Manipulator [#14967]

Juliano Pierezan, Helon V. H. Ayala, Luciano F. Cruz, Leandro dos Santos. Coelho and Roberto Z. Freire, Federal University of Parana - UFPR, Brazil; Pontifical Catholic University of Parana - PUCPR, Brazil; Pontifical Catholic University of Parana - PUCPR and Federal University of Parana - UFPR, Brazil

In order to improve equipment efficiency in terms of performance, energy consumption and degradation for example, the industry has increased the use of control systems like PD (proportional-derivative) and PID (proportional-integral-derivative) to a new baseline, mainly because it's ease of implementation and low number of parameters to be adjusted. However, some requirements as response time, energy consumption and the variance of the control action are often included on multivariable systems that classical methods are not able to solve. Thus, the multiobjective tuning of PID controllers is a feasible resource to solve these requirements concurrently. Consequently, this procedure is a topic the has been hugely explored in literature. This paper approaches the application of multiobjective optimization techniques Multiobjective Differential Evolution (MODE), Multiobjective Harmony Search (MOHS) and Multiobjective Particle Swarm Optimization (MOPSO) in multivariable PID controllers tuning. Moreover, an improved version of MOPSO (I-MOPSO) is proposed and its performance is compared with the other algorithms. Further, in order to validate it under control systems, the optimization technique is applied on a two degree of freedom robotic manipulator. It is shown that the I-MOPSO performance is better than the other algorithms in most features. Finally, a detailed analysis is made on the I-MOPSO achievements.

4:50PM Automated Inferential Measurement System for Traffic Surveillance: Enhancing Situation Awareness of UAVs by Computational Intelligence [#14349]

Prapa Rattadilok and Andrei Petrovski, Robert Gordon University, United Kingdom

An adaptive inferential measurement framework for control and automation systems has been proposed in the paper and tested on simulated traffic surveillance data. The use of the framework enables making inferences related to the presence of anomalies in the surveillance data with the help of statistical, computational and clustering analysis. Moreover, the performance of the ensemble of these tools can be dynamically tuned by a computational intelligence technique. The experimental results have demonstrated that the framework is generally applicable to various problem domains and reasonable performance is achieved in terms of inferential accuracy. Computational intelligence can also be effectively utilised for identifying the main contributing features in detecting anomalous data points within the surveillance data.

Special Session: ICES'14 Session 7: Evolutionary Robotics II

Friday, December 12, 3:30PM-5:10PM, Room: Antigua 3, Chair: Martin A. Trefzer

3:30PM Improvements to Evolutionary Model Consistency Checking for a Flapping-Wing Micro Air Vehicle [#14273]

John Gallagher, Eric Matson, Garrison Greenwood and Sanjay Boddhu, Wright State University, United States; Purdue University, United States; Portland State University, United States

Evolutionary Computation has been suggested as a means of providing ongoing adaptation of robot controllers. Most often, using Evolutionary Computation to that end focuses on recovery of acceptable robot performance with less attention given to diagnosing the nature of the failure that necessitated the adaptation. In previous work, we introduced the concept of Evolutionary Model Consistency Checking in which candidate robot controller evaluations were dual-purposed for both evolving control solutions and extracting robot fault diagnoses. In that less developed work, we could only detect single wing damage faults in a simulated Flapping Wing Micro Air Vehicle. We now extend the method to enable detection and diagnosis of both single wing and dual wing faults. This paper explains those extensions, demonstrates their efficacy via simulation studies, and provides discussion on the possibility of augmenting EC adaptation by exploiting extracted fault diagnoses to speed EC search.

3:50PM Evolutionary Strategy Approach for Improved In-Flight Control Learning in a Simulated Insect-Scale Flapping-Wing Micro Air Vehicle [#14285]

Monica Sam, Sanjay Boddhu, Kayleigh Duncan and John Gallagher, Wright State University, United States

Insect-Scale Flapping-Wing Micro-Air Vehicles (FW-MAVs), can be particularly sensitive to control deficits caused by ongoing wing damage and degradation. Since any such degradation could occur during flight and likely in ways difficult to predict apriori, any automated methods to apply correction would also need to be applied in-flight. Previous work has demonstrated effective recovery of correct flight behavior via online (in service) evolutionary algorithm based learning of new wing-level oscillation patterns. In those works, Evolutionary Algorithms (EAs) were used to continuously adapt wing motion patterns to restore the force generation expected by the flight controller. Due to the requirements for online learning and fast recovery of correct flight behavior, the choice of EA is critical. The work described in this paper replaces previously used oscillator learning algorithms with an Evolution Strategy (ES), an EA variant never previously tested for this application. This paper will demonstrate that this approach is both more effective and faster than previously employed methods. The paper will conclude with a discussion of future applications of the technique within this problem domain.

4:10PM Islands of Fitness Compact Genetic Algorithm for Rapid In-Flight Control Learning in a Flapping-Wing Micro Air Vehicle: A Search Space Reduction Approach [#14278]

Kayleigh Duncan, Sanjay Boddhu, Monica Sam and John Gallagher, Wright State University, United States

On-going effective control of insect-scale Flapping- Wing Micro Air Vehicles could be significantly advantaged by active in-flight control adaptation. Previous work demonstrated that in simulated vehicles with wing membrane damage, in-flight recovery of effective vehicle attitude and vehicle position control precision via use of an in-flight adaptive learning oscillator was possible. A significant portion of the most recent approaches to this problem employed an island-of-fitness compact genetic algorithm (ICGA) for oscillator learning. The work presented in this paper provides the details of a domain specific search space reduction approach implemented with existing ICGA and its effect on the in-flight learning time. Further, it will be demon- strated that the proposed search space reduction methodology is effective in producing an error correcting oscillator configuration rapidly, online, while the vehicle is in normal service. The paper will present specific simulation results demonstrating the value of the search space reduction and discussion of future applications of the technique to this problem domain.

4:30PM Balancing Performance and Efficiency in a Robotic Fish with Evolutionary Multiobjective Optimization [#14599]

Anthony Clark, Jianxun Wang, Xiaobo Tan and Philip McKinley, Michigan State University, United States

In this paper, we apply evolutionary multiobjective optimization to the design of a robotic fish with a flexible caudal fin. Specifically, we use the NSGA-II algorithm to discover solutions (physical dimensions, flexibility, and control parameters) that optimize both swimming performance and power efficiency. The optimization is conducted in a custom simulation environment based on an accurate yet computationally- efficient model of hydrodynamics. The results of these simulations reveal general principles that can be applied in the design of robotic fish morphology and control. To verify that the simulation results are physically relevant, we selected several of the evolved solutions, fabricated flexible caudal fins using a multi-material 3D printer, and attached them to a robotic fish prototype. Experimental results, conducted in a large water tank, correspond reasonably well to simulation results in both swimming performance and power efficiency, demonstrating the usefulness of evolutionary computation methods to this application domain.

CIES'14 Session 7: Applications IV

Friday, December 12, 3:30PM-5:10PM, Room: Bonaire 4, Chair: Vladik Kreinovich, Michael Beer and Rudolf Kruse

3:30PM Video Summarization based on Subclass Support Vector Data Description [#14150]

Vasileios Mygdalis, Alexandros Iosifidis, Anastasios Tefas and Ioannis Pitas, Aristotle University of Thessaloniki, Greece

In this paper, we describe a method for video summarization that operates on a video segment level. We formulate this problem as the one of automatic video segment selection based on a learning process that employs salient video segment paradigms. We design a hierarchical learning scheme that consists of two steps. At the first step, an unsupervised process is performed in order to determine salient video segment types. The second step is a supervised learning process that is performed for each of the salient video segment type independently. For the latter case, since only salient training examples are available, the problem is stated as an one-class classification problem. In order to take into account subclass information that may appear in the video segment types, we introduce a novel formulation of the Support Vector Data Description method that exploits subclass information in its optimization process. We evaluate the proposed approach in three Hollywood movies, where the performance of the proposed subclass SVDD (SSVDD) algorithm of SVDD and relating methods. Experimental results denote that the adoption of both hierarchical learning and the proposed SSVDD method contribute to the final classification performance.

3:50PM Determination of sugar content in whole Port Wine grape berries combining hyperspectral imaging with neural networks methodologies [#14154]

Veronique Gomes, Armando Fernandes, Arlete Faia and Pedro Melo-Pinto, CITAB-Centre for the Research and Technology of Agro-Environmental and Biological Sciences, Universidade de Tras-os-Montes e Alto Douro, Portugal; CITAB-Centre for the Research and Technology of Agro-Environmental and Biological Sciences, Universidade de Tras-os-Montes e Alto Douro; Center of Intelligent Systems, IDMEC/LAETA, Instituto Superior Tecnico, Universidade de Lisboa, Portugal; IBB-Institute for Biotechnology and Bioengineering, Centre of Genomics and Biotechnology, Universidade de Tras-os-Montes e Alto Douro, Portugal; CITAB-Centre for the Research and Technology of Agro-Environmental and Biological Sciences, Universidade de Tras-os-Montes e Alto Douro; Departamento de Engenharias, Escola de Ciencias e Tecnologia, Universidade de Tras-os-Montes e Alto Douro, Portugal

The potential of hyperspectral imaging combined with machine learning algorithms to measure sugar content of whole grape berries is presented, as a starting point for developing generalized and flexible frameworks to estimate enological parameters in wine grape berries. In this context, to evaluate the generalization ability of the used machine learning procedure, two neural networks were trained with different training data to compare the performance of each one when tested with the same data set. Six whole grape berries were used for each sample to draw the hyperspectral spectrum in reflectance mode between 308 and 1028 nm. The sugar content was estimated from the spectra using feedforward multiplayer perceptrons in two different neural networks trained each one with a data set from a different year (2012 and 2013); the validation for both neural networks was done by n-fold cross- validation, and the test set used was from 2013. The test set revealed R2 values of 0.906 and RMSE of 1.165 Brix for the neural network trained with 2012 data and R2 of 0.959 and RMSE of 1.026 Brix for the 2013 training data neural network. The results obtained indicate that both neural networks present good results and that the 2012 training data neural network exhibits a good performance when compared with the other NN, suggesting that the approach is robust since a generalization (without further training) over years may be obtainable.

Special Session: IA'14 Session 3: Ambient Computational Intelligence

Friday, December 12, 3:30PM-5:10PM, Room: Bonaire 5, Chair: Ahmad Lotfi and Giovanni Acampora

3:30PM Distributed Team Formation in Urban Disaster Environments [#14852]

Abel Correa, Universidade Federal do Rio Grande do Sul, Brazil

In the disaster management, the agents have to coordinate them to form groups of agents to solve disaster tasks. They must satisfy resource, temporal and communication constraints. In multiagent systems, disaster management can be formalized as a task assignment problem (TAP). In TAP, agents with different capabilities must satisfy constraints to assign values associated with the disaster tasks. In other hand, the tasks must join sets of agents with specific features. From the point of view of the task, the disaster management can be formalized as a partitioning or clustering problem. The agents must to cooperate to solve tasks and to minimize damage. The allocation of tasks to groups of agents is necessary when one single agent cannot perform them efficiently. In this paper, we discuss an algorithm to provide partitions of agents to assign tasks in urban disaster environment. Our algorithm creates partitions of agents in a tree-structure factor graph. The vertices are the agents (variable nodes) or the tasks (factor nodes). We explore the efficiency of a recursive cardinality model, and belief propagation to reduce the communication among the agents. Our empirical evaluations show that, by using our approach, it is possible to create partitions of agents to solve the tasks in less time than a swarm intelligence approach. The agents self organize themselves to represent the priorities over the observed states.

3:50PM Prediction of Mobility Entropy in an Ambient Intelligent Environment [#14631]

Saisakul Chernbumroong, Ahmad Lotfi and Caroline Langensiepen, Nottingham Trent University, United Kingdom

Ambient Intelligent (AmI) technology can be used to help older adults to live longer and independent lives in their own homes. Information collected from AmI environment can be used to detect and understanding human behaviour, allowing personalized care. The behaviour pattern can also be used to detect changes in behaviour and predict future trends, so that preventive action can be taken. However, due to the large number of sensors in the environment, sensor data are often complex and difficult to interpret, especially to capture behaviour trends and to detect changes over the long-term. In this paper, a model to predict the indoor mobility using binary sensors is proposed. The model utilizes weekly routine to predict the future trend. The proposed method is validated using data collected from a real home environment, and the results show that using weekly pattern helps improve indoor mobility prediction. Also, a new measurement, Mobility Entropy (ME), to measure indoor

mobility based on entropy concept is proposed. The results indicate ME can be used to distinguish elders with different mobility and to see decline in mobility. The proposed work would allow detection of changes in mobility, and to foresee the future mobility trend if the current behaviour continues.

4:10PM A Hybrid Computational Intelligence Approach for Efficiently Evaluating Customer Sentiments in E-Commerce Reviews [#14860]

Giovanni Acampora and Georgina Cosma, Nottingham Trent University, United Kingdom

The Internet has opened new interesting scenarios in the fields of e-commerce, marketing and on-line transactions. In particular, thanks to mobile technologies, customers can make purchases in a faster and cheaper way than visiting stores, and business companies can increase their sales volume due to a world-wide visibility. Moreover, online trading systems allow customers to gather all the required information about product quality and characteristics, via customer reviews, and make an informed purchase. Due to the fact that these reviews are used to determine the extent of customers acceptance and satisfaction of a product or service, they can affect the future selling performance and market share of a company because they can also be used by companies to determine the success of a product, and predict its demand. As a consequence, tools for efficiently classifying textual customer reviews are becoming a key component of each e-commerce development framework to enable business companies to define the most suitable selling strategies and improve their market capabilities. This paper introduces an innovative framework for efficiently analysing customer sentiments in textual reviews in order to compute their corresponding numerical rating by allowing companies to better plan their future business activities. The proposed approach addresses different issues involved in this significant task: the dimension and imprecision of ratings data. As shown in experimental results, the proposed hybrid approach yields better learning performance than other state of the art rating predictors.

4:30PM Interoperable Services based on Activity Monitoring in Ambient Assisted Living Environments [#14873]

Giovanni Acampora, Kofi Appiah, Autilia Vitiello and Andrew Hunter, Nottingham Trent University, United Kingdom; University of Salerno, Italy; University of Lincoln, United Kingdom

Ambient Assisted Living (AAL) is considered as the main technological solution that will enable the aged and people in recovery to maintain their independence and a consequent high quality of life for a longer period of time than would otherwise be the case. This goal is achieved by monitoring human's activities and deploying the appropriate collection of services to set environmental features and satisfy user preferences in a given context. However, both human monitoring and services deployment are particularly hard to accomplish due to the uncertainty and ambiguity characterising human actions, and heterogeneity of hardware devices composed in an AAL system. This research addresses both the aforementioned challenges by introducing 1) an innovative system, based on Self Organising Feature Map (SOFM), for automatically classifying the resting location of a moving object in an indoor environment and 2) a strategy able to generate context-aware based Fuzzy Markup Language (FML) services in order to maximize the users' comfort and hardware interoperability level. The overall system runs on a distributed embedded platform with a specialised ceiling-mounted video sensor for intelligent activity monitoring. The system has the ability to learn resting locations, to measure overall activity levels, to detect specific events such as potential falls and to deploy the right sequence of fuzzy services modelled through FML for supporting people in that particular context. Experimental results show less than 20% classification error in monitoring human activities and providing the right set of services, showing the robustness of our approach over others in literature with minimal power consumption.

4:50PM Semantic-Based Decision Support for Remote Care of Dementia Patients [#14942]

Taha Osman, Ahmad Lotfi, Ccaroline Langensiepen, Mahmoud Saeed and Saisakul Chernbumroong, Nottingham Trent University, United Kingdom; John Black Day Hospital, United Kingdom

This paper investigates the challenges in developing a semantic-based Dementia Care Decision Support System based on the non-intrusive monitoring of the patient's behaviour. Semantic-based approaches are well suited for modelling context-aware scenarios similar to Dementia care systems, where the patient's dynamic behaviour observations (occupants movement, equipment use) need to be analysed against the semantic knowledge about the patient's condition (illness history, medical advice, known symptoms) in an integrated knowledgebase. However, our research findings establish that the ability of semantic technologies to reason upon the complex interrelated events emanating from the behaviour monitoring sensors to infer knowledge assisting medical advice represents a major challenge. We attempt to address this problem by introducing a new approach that relies on propositional calculus modelling to segregate complex events that are amenable for semantic reasoning from events that require pre-processing outside the semantic engine before they can be reasoned upon. The event pre-processing activity also controls the timing of triggering the reasoning process in order to further improve the efficiency of the inference process. Using regression analysis, we evaluate the response-time as the number of monitored patients increases and conclude that the incurred overhead on the response time of the prototype decision support systems remains tolerable.

CIDM'14 Session 10: Advanced signal processing and data analysis

Friday, December 12, 3:30PM-5:10PM, Room: Curacao 2, Chair: Barbara Hammer

3:30PM Learning Energy Consumption Profiles from Data [#14102]

Jean-Marc Andreoli, Xerox Research Centre Europe, France

A first step in the optimisation of the power consumption of a device infrastructure is to detect the power consumption signature of the involved devices. In this paper, we are especially interested in devices which spend most of their time waiting for a job to execute, as is often the case of shared devices in a networked infrastructure, like multi-function printing devices in an office or transaction processing terminals in a public service. We formulate the problem as an instance of power disaggregation in non intrusive load monitoring (NILM), with strong prior assumptions on the sources but with specific constraints: in particular, the aggregation is occlusive rather than additive. We use a specific variant of Hidden Semi Markov Models (HSMM) to build a generative model of the data, and adapt the EM algorithm to that model, in order to learn, from daily operation data, the physical characteristics of the device, separated from those linked to the job load or the device configurations. Finally, we show some experimental results on a multifunction printing device.

3:50PM kNN estimation of the unilateral dependency measure between random variables [#14195]

Angel Cataron, Razvan Andonie and Yvonne Chueh, Transylvania University of Brasov, Romania; Central Washington University, United States

The informational energy (IE) can be interpreted as a measure of average certainty. In previous work, we have introduced a non-parametric asymptotically unbiased and consistent estimator of the IE. Our method was based on the k-th nearest neighbor (kNN) method, and it can be applied to both continuous and discrete spaces, meaning that we can use it both in classification and regression algorithms. Based on the IE, we have introduced a unilateral dependency measure between random variables. In the present paper, we show how to estimate this unilateral dependency measure from an available sample set of discrete or continuous variables, using the kNN and the naive histogram estimators. We experimentally compare the two estimators. Then, in a real-world application, we apply the kNN and the histogram estimators to approximate the unilateral dependency between random variables which describe the temperatures of sensors placed in a refrigerating room.

4:10PM Using Data Mining to Investigate Interaction between Channel Characteristics and Hydraulic Geometry Channel Types [#14350]

Leong Lee and Gregory S. Ridenour, Austin Peay State University, United States

Data was mined for the purpose of extracting data from an online source to compute and classify hydraulic geometry as well as providing additional data (channel stability, material, and evenness) for pattern discovery. Hydraulic geometry, the relationships between a stream's geometry (width and depth) and flow (velocity and discharge), is applicable to flood prediction, water resources management, and modeling point sources of pollution. Although data to compute hydraulic geometry and additional channel data are freely available online, a systematic data mining approach is seldom if ever used for classification of hydraulic geometry and discernment of regional trends encompassing multi-state areas. In this paper, a method for computing and classifying hydraulic geometry from mined channel flow and geometry data from several states was introduced. Additional channel characteristics (stability, evenness, and material) were also mined. Channels were mapped by stability and a scatterplot matrix revealed no anomalies in the hydraulic geometry of individual channel sections. To assess the quality of data output, statistical analyses were conducted to show that our mined data were comparable to data from the literature as indicated by Euclidean distances between multivariate means, histograms of frequency distributions of hydraulic exponents, and Spearman's rank order correlation applied to channel types. Channels exhibited significant interaction between stability and material, between stability and evenness, but not between material and evenness. Boundary lines through the classification diagram were effective in discriminating stability and material but not evenness.

4:30PM Experimental Studies on Indoor Sign Recognition and Classification [#14540]

Zhen Ni, Siyao Fu, Bo Tang, Haibo He and Xinming Huang, University of Rhode Island, United States; Worcester Polytechnic Institute, United States

Previous works on outdoor traffic sign recognition and classification have been demonstrated useful to the driver assistant system and the possibility to the autonomous vehicles. This motivates our research on the assistance for visual impairment or visual disabled pedestrians in the indoor environment. In this paper, we build an indoor sign database and investigate the recognition and classification for the indoor sign problem. We adopt the classical techniques on extracting the features, including the principle component analysis (PCA), dense scale invariant feature transform (DSIFT), histogram of oriented gradients (HOG), and conduct the state-of-art classification techniques, such as the neural network (NN), support vector machine (SVM) and k nearest neighbors (KNN). We provide the experimental results on this newly built database and also discuss the insight for the possibility of indoor navigation for the blind or visual-disabled people.

4:50PM High-SNR Model Order Selection Using Exponentially Embedded Family and Its Applications to Curve Fitting and Clustering [#15019]

Quan Ding, Steven Kay and Xiaorong Zhang, University of California, San Francisco, United States; University of Rhode Island, United States; San Francisco State University, United States

The exponentially embedded family (EEF) of probability density functions was originally proposed in [1] for model order selection. The performance of the original EEF deteriorates somewhat when nuisance parameters are present, especially in the case of high signal-to-noise ratio (SNR). Therefore, we propose a new EEF for model order selection in the case of high SNR. It is shown that without nuisance parameters, the new EEF is the same as the original EEF. However, with nuisance parameters, the new EEF takes a different form. The new EEF is applied to problems of polynomial curve fitting and clustering. Simulation results show that, with nuisance parameters, the new EEF outperforms the original EEF and Bayesian information criterion (BIC) at high SNR.

Special Session: SIS'14 Session 9: Cultural Algorithms and Their Applications

Friday, December 12, 3:30PM-5:10PM, Room: Curacao 3, Chair: Robert G. Reynolds

3:30PM Improving Artifact Selection via Agent Migration in Multi-Population Cultural Algorithms [#14468]

Felicitas Mokom and Ziad Kobti, University of Windsor, Canada

Multi-population cultural algorithms are cultural evolutionary frameworks involving multiple independently evolving subpopulations. Artifact selection involves the ability of agents to autonomously reason about selecting artifacts towards achieving their goals. In this study, agent migration between populations in a multi-population cultural algorithm is explored as an approach for augmenting artifact selection knowledge in social agents. Embedded in a social simulation model the multi-population cultural algorithm consists of two subpopulations where agents in one subpopulation consistently outperform agents in the other due to the presence of knowledge about certain artifacts. Social networks connect agents within a subpopulation and agent knowledge can be altered by members of their network or the best performers of their subpopulation. The model investigates agent migration with novel artifact knowledge from the advanced subpopulation to the underperforming one. Child safety restraint selection is provided as an implemented case study. Results demonstrate the benefits of migration with a higher likelihood of an increase in agent performance when the social network is enabled. The study shows that culturally evolving agents can improve artifact selection knowledge in the absence of standard interventions as a result of migration.

3:50PM An Artificial Bee Colony Algorithm for Minimum Weight Dominating Set [#14256]

C.G. Nitash and Alok Singh, University of Hyderabad, India

The minimum weight dominating set (MWDS) problem is a classic NP-Hard optimisation problem with a wide range of practical applications. As a result, many algorithms have been proposed for this problem. Several greedy and approximation algorithms exist which provide good results for unit disk graphs with smooth weights. However, these algorithms do not perform well when applied to general graphs. There are a few metaheuristics in the literature such as genetic algorithms and ant colony optimisation algorithm, which also work for general graphs. In this paper, a swarm intelligence algorithm called artificial bee colony (ABC) algorithm is presented for the MWDS problem. The proposed ABC algorithm is compared with other metaheuristics in the literature and shown to perform better than any of these metaheuristics, both in terms of solution quality and time taken.

4:10PM A New Strategy to Detect Variable Interactions in Large Scale Global Optimization [#14997]

Mohammad R. Raeesi N. and Ziad Kobti, University of Windsor, Canada

Dynamic Heterogeneous Multi-Population Cultural Algorithm (D-HMP-CA) is a novel optimization algorithm which presents an effective as well as efficient performance to solve large scale global optimization problems. It incorporates dynamic decomposition techniques in order to divide problem dimensions among its local CAs. The variable interactions is not considered in the incorporated dynamic decomposition techniques. In this article, a new strategy is incorporated to detect the variable interactions to improve the process of dimension decomposition. This strategy is integrated into bottom-up dynamic decomposition technique and the integration is called supervised bottom-up approach. The proposed approach is evaluated over the large scale global optimization problems. The evaluation results reveal that the proposed approach outperforms the classical bottom-up technique in solving separable and single-group non-separable optimization functions, while the classical bottom-up approach offers a better performance for multi-group non-separable functions. However, the proposed supervised bottom-up approach presents a more efficient performance compared to the classical bottom-up method which shows that the variable interaction detection strategy does not impose extra computational costs.

4:30PM A Computational Basis for the Presence of Sub-Cultures in Cultural Algorithms [#14250]

Yousof Gawasmeh and Robert Reynolds, Wayne State University, United States

Cultural Algorithms are computational models of social evolution based upon principle of Cultural Evolution. A Cultural Algorithm consists of a Belief Space consisting of a network of active and passive knowledge sources and a Population Space of agents. The agents are connected via a social fabric over which information used in agent problem solving as passed. The knowledge sources in the Belief Space compete with each other in order to influence the decision making of agents in the Population Space. Likewise, the problem solving experiences of agents in the Population Space are sent back to the Belief Space and used to update the knowledge sources there. It is a dual inheritance system in which both the Population and Belief spaces evolve in parallel. In this paper we investigate why sub-cultures can emerge in the Population Space in response to the complexity of the problems presented to a Cultural System. This system is compared with other evolutionary approaches relative to a variety of benchmark problem of varying complexity. We show that the presence of sub-cultures can provide computational advantages in problem landscape that are generated by multiple independent processes. These advantages can to increases in problem solving efficiency along with the ability to dampen the impact of increase in problem complexity.

4:50PM Balancing Search Direction in Cultural Algorithm for Enhanced Global Numerical Optimization [#14784]

Mostafa Ali, Noor Awad and Robert Reynolds, Jordan University of Science and technology, Jordan; Wayne State University, United States

Many meta-heuristics methods are applied to guide the exploration and exploitation of the search space for large scale optimization problems. These problems have attracted much attention from researchers who proposed developed a variety of techniques for locating the optimal solutions. Cultural Algorithm has been recently adopted to solve global numerical optimization problems. In this paper, a modified version of Cultural Algorithm (CA) that uses four knowledge sources in order to incorporate the information obtained from the objective function as well as constraint violation into knowledge structure in the belief space is proposed. The archived knowledge in the proposed approach will be used to enhance the way the belief space influences future generations of problem solvers. The first step is to use the four knowledge sources to guide the direction of the search to more promising solutions. The search is balanced between exploration and exploitation by dynamically adjusting the number of evaluations available for each type of knowledge source based on whether is primarily exploratory or exploitative. The second step selects one local search method to find the nearest solutions to those proposed by the knowledge sources. The proposed work is employed to solve seven global optimization problems in 50 and 100 dimensions, and an engineering application problem. Simulation results show how the approach speeds up the convergence process with very competitive results on such complex benchmarks when compared to other state-of-the-art algorithms.

5:10PM Hybrid Cooperative Co-evolution for Large Scale Optimization [#14219]

Mohammed El-Abd, American University of Kuwait, Kuwait

In this paper, we propose the idea of hybrid cooperative co-evolution (hCC). In CC, multiple instances of the same evolutionary algorithm work in parallel, each optimizes a different subset of the problem in hand. In recent years, different approaches have been introduced to divide the problem variables into separate groups based on the property of separability. The idea is that when dependent variables are grouped together, a better optimization performance is reached. However, the same evolutionary algorithm is still applied to all groups regardless of the type of variables each group contains. In this work, we propose the use of multiple evolutionary algorithms to optimize the different subsets within the CC framework. We use one algorithm for the non-separable group(s) and another algorithm for the separable group. Experiments carried on the CEC10 benchmarks indicate the promising performance of this proposed approach.

5:30PM Prediction of University Enrollment Using Computational Intelligence [#15004]

Biswanath Samanta and Ryan Stallings, Georgia Southern University, United States

This work presents a study on prediction of university enrollment using three computational intelligence (CI) techniques. The enrollment forecasting has been considered as a form of time series prediction using CI techniques that include an artificial neural network (ANN), a neuro-fuzzy inference system (ANFIS) and an aggregated fuzzy time series model. A novel form of ANN, namely, single multiplicative neuron (SMN), as an alternative to traditional multi-layer perceptron (MLP), has been used for time series prediction. A variation of population based heuristic optimization approach, namely, co-operative particle swarm optimization (COPSO), has been used to estimate the parameters for the SMN, the combination is termed here as COPSO-SMN. The second CI technique used for time series prediction is adaptive neuro fuzzy

inference system (ANFIS) which combines the advantages of ANN and fuzzy logic (FL). The third technique is based on an aggregated fuzzy time series model that utilizes both global trend of the past data and the local fuzzy fluctuations. The first two CI models have been developed for one-step-ahead prediction of time series using the data of the current time and three previous time steps. The models based on these three techniques have been trained using a previously published dataset. The models have been further trained and tested using enrollment data of Georgia Southern University for the period of 1924-2012. The training and test performances of all three CI techniques have been compared for the datasets.

Special Session: CICARE'14 Session 4: Big Data Analytic Technology for Bioinformatics and Health Informatics

Friday, December 12, 3:30PM-5:10PM, Room: Curacao 4, Chair: Giovanni Paragliola and Mufti Mahmud

3:30PM A Novel Mixed Values k-Prototypes Algorithm with Application to Health Care Databases Mining [#14116]

Ahmed Najjar, Christian Gagne and Daniel Reinharz, Universite Laval, Canada

The current availability of large datasets composed of heterogeneous objects stresses the importance of large-scale clustering of mixed complex items. Several algorithms have been developed for mixed datasets composed of numerical and categorical variables, a well-known algorithm being the k-prototypes. This algorithm is efficient for clustering large datasets given its linear complexity. However, many fields are handling more complex data, for example variable-size sets of categorical values mixed with numerical and categorical values, which cannot be processed as is by the k-prototypes algorithm. We are proposing a variation of the k-prototypes clustering algorithm that can handle these complex entities, by using a bag- of-words representation for the multivalued categorical variables. We evaluate our approach on a real- world application to the clustering of administrative health care databases in Quebec, with results illustrating the good performances of our method.

3:50PM Label the many with a few: Semi-automatic medical image modality discovery in a large image collection [#14127]

Szilard Vajda, Daekeun You, Antani Sameer and George Thoma, National Library of Medicine, National Institutes of Healths, United States

In this paper we present a fast and effective method for labeling images in a large image collection. Image modality detection has been of research interest for querying multimodal medical documents. To accurately predict the different image modalities using complex visual and textual features, we need advanced classification schemes with supervised learning mechanisms and accurate training labels. Our proposed method, on the other hand, uses a multiview-approach and requires minimal expert knowledge to semi-automatically label the images. The images are first projected in different feature spaces, and are then clustered in an unsupervised manner. Only the cluster representative images are labeled by an expert. Other images from the cluster ``inherit'' the labels from these cluster representatives. The final label assigned to each image is based on a voting mechanism, where each vote is derived from different feature space clustering. Through experiments we show that using only 0.3% of the labels was sufficient to annotate 300,000 medical images with 49.95% accuracy. Although, automatic labeling is not as precise as manual, it saves approximately 700 hours of manual expert labeling, and may be sufficient for next-stage classifier training. We find that for this collection accuracy improvements are feasible with better disparate feature selection or different filtering mechanisms.

4:10PM Identifying Risk Factors Associate with Hypoglycemic Events [#14664]

Ran Duan, Haoda Fu and Chenchen Yu, Eli Lilly and Company, United States

Episodes of hypoglycemia occurred over the study period and is one of the most noticeable adverse events in diabetes care. It is important to identify the factors causing hypoglycemic events and rank these factors by their importance. Most research works only use the time of first hypoglycemia onset and treat it as time to event endpoint due to the limitation of methodology. Traditional model selection methods are not able to provide variable importance in this context. Methods that are able to provide the variable importance, such as gradient boosting and random forest algorithms, cannot directly be applied to recurrent events data. In this paper, we propose a two-step method to
identify risk factors that are associate with hypoglycemia. In general, this method allows us to evaluate the variable importance for recurrent events data. The performance of our proposed method are evaluated through intensive simulation studies.

4:30PM Towards a Prototype Medical System for Devices Vigilance and Patient Safety [#14836]

Antonios Deligiannakis, Nikos Giatrakos and Nicolas Pallikarakis, Technical University of Crete, Greece; University of Patras, Greece

For all healthcare institutions and organizations, patient safety is of the utmost importance. A factor that influences patient safety is the existence (or not) of observed adverse events associated with medical devices. Upon the detection of adverse events, all healthcare providers that own the affected medical devices should be promptly notified. In this paper we present the core of a prototype system for medical devices vigilance and patient safety. We present the architecture of this system, the way that it detects the healthcare providers that need to be notified through an entity matching algorithm, as well as briefly present its user interface.

4:50PM FDT 2.0: Improving scalability of the fuzzy decision tree induction tool - integrating database storage [#14970]

Erin-Elizabeth Durham, Xiaxia Yu and Robert Harrison, Georgia State University, United States

Effective machine-learning handles large datasets efficiently. One key feature of handling large data is the use of databases such as MySQL. The freeware fuzzy decision tree induction tool, FDT, is a scalable supervised-classification software tool implementing fuzzy decision trees. It is based on an optimized fuzzy ID3 (FID3) algorithm. FDT 2.0 improves upon FDT 1.0 by bridging the gap between data science and data engineering: it combines a robust decisioning tool with data retention for future decisions, so that the tool does not need to be recalibrated from scratch every time a new decision is required. In this paper we briefly review the analytical capabilties of the freeware FDT tool and its major features and functionalities; examples of large biological datasets from HIV, microRNAs and sRNAs are included. This work shows how to integrate fuzzy decision algorithms with modern database technology. In addition, we show that integrating the fuzzy decision tree induction tool with database storage allows for optimal user satisfaction in today's Data Analytics world.

AUTHOR INDEX

BOLD NUMBERS = Page numbers of papers where a person is the first author.
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