ICAROB 2017

PROCEEDINGS OF THE 2017 INTERNATIONAL CONFERENCE ON ARTIFICIAL LIFE AND ROBOTICS

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ARTIFICIAL LIFE AND ROBOTICS

(ICAROB2017)

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HISTORY

The International Conference on Artificial Life and Robotics (ICAROB) resulted from the AROB-symposium (International Symposium on Artificial Life and Robotics) whose first edition was held in 1996 and the eighteenth and last edition in 2013. The AROB symposium was annually organized by Oita University, Nippon Bunri University (NBU), and ALife Robotics Corporation Ltd., under the sponsorship of the Science and Technology Policy Bureau, the Ministry of Education, Science, Sports, and Culture (Monbusho), presently, the Ministry of Education, Culture, Sports, Science, and Technology (Monkasho), Japanese Government, Japan Society for the Promotion of Science (JSPS), the Commemorative Organization for the Japan World Exposition ('70), Air Force Office of Scientific Research, Asian Office of Aerospace Research and Development (AFOSR/AOARD), USA. I would like to express my sincere thanks to not only Monkasho (annually fund support from 1996 to 2013) but also JSPS, the Commemorative Organization for the Japan World Exposition ('70), and various other Japanese companies for their repeated support. The old symposium (this symposium has been held every year at B-Con Plaza, Beppu, Oita, Japan except in Oita, Japan (AROB 5th '00) and in Tokyo, Japan (AROB 6th '01).) was organized by the International Organizing Committee of AROB and was co-operated by the Santa Fe Institute (USA), RSJ, IEEJ, ICASE (Now ICROS) (Korea), CAAI (P. R. China), ISCIE, IEICE, IEEE (Japan Council), JARA, and SICE. The old AROB-symposium expanded much by absorbing much new knowledge and technologies into it. This history and character of the former AROB symposiums are passed on the current ICAROB conference and to this journal, International Journal of Robotics, Networking and Artificial Life (JRNAL). From now on, ALife Robotics Corporation Ltd. is in charge of management of both the conference and the journal. The future of the ICAROB is brilliant from a point of view of yielding new technologies to human society in the 21st century. This conference invites you all.

AIMS AND SCOPE

The objective of this conference is the development of new technologies for artificial life and robotics which have been recently born in Japan and are expected to be applied in various fields. This conference presents original technical papers and authoritative state-of-the-art reviews on the development of new technologies concerning robotics, networking and artificial life and, especially computer-based simulation and hardware for the twenty-first century. This conference covers a broad multidisciplinary field, including areas such as:
Artificial intelligence & complexity
Artificial living
Artificial mind research
Artificial nervous systems for robots
Artificial sciences
Bipedal robot
Brain science and computing
Chaos
Cognitive science

Computational Molecular biology

Computer graphics

Data mining

Disasters robotics

DNA computing

Empirical research on network and MOT

Environment navigation and localization

Evolutionary computations

Facial expression analysis, music recommendation and augmented reality

Foundation of computation and its application

Fuzzy control

Genetic algorithms

Human-welfare robotics

Image processing

Insect-like aero vehicles

Intelligence in biological systems

Intelligent control

Management of technology

Medical surgical robot

Micro-machines

Multi-agent systems

Nano-biology

Nano-robotics

Networking

Neural circuits

Neuro-computer

Neuromorphic Systems

Neuroscience

Pattern recognition

Quantum computing

Reinforcement learning system & genetic programing

Robotics

Software development support method

System cybernetics

Unmanned underwater vehicles

Unmanned Aerial Systems Technologies

Unmanned Aerial Systems designing, controls and navigation

Unmanned Aero vehicles

Virtual reality

Visualization

Hardware-oriented submissions are particularly welcome. This conference will discuss new results in the field of artificial life and robotics

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MESSAGES

Masanori Sugisaka

General Chair of ICAROB

Masanori Sugisaka
General Char

(Professors, Open University (UK), University of Malaysia-Peris (Malaysia) and President of Alife Robotics Co., Ltd. (Japan))

It is my great honor to invite you all to The 2017 International Conference on Artificial Life and Robotics (ICAROB 2017).

This Conference is changed as the old symposium from the first (1996) to the Eighteenth (2013) annually which were organized by Oita University, Nippon Bunri University(NBU), and ALife Robotics Corporation Ltd. under the sponsorship of the Science and Technology Policy Bureau, the Ministry of Education, Science, Sports, and Culture (Monbusho), presently, the Ministry of Education, Culture, Sports, Science, and Technology (Monkasho), Japanese Government, Japan Society for the Promotion of Science (JSPS), The Commemorative Organization for the Japan World Exposition ('70), Air Force Office of Scientific Research, Asian Office of Aerospace Research and Development (AFOSR/AOARD), USA. I would like to express my sincere thanks to not only Monkasho (annually fund support from 1996 to 2013) but also JSPS, the Commemorative Organization for the Japan World Exposition ('70) , Japanese companies for their repeated support.

The old symposium was organized by International Organizing Committee of AROB and was co-operated by the Santa Fe Institute (USA), RSJ, IEEJ, ICASE (Now ICROS) (Korea), CAAI (P. R. China), ISCIE, IEICE, IEEE (Japan Council), JARA, and SICE. The old AROB symposium was growing up by absorbing many new knowledge and technologies into it.

This history and character was inherited also from ICAROB 2014(The 2014 International Conference on Artificial Life and Robotics, included a series of ICAROB proceedings in **SCOPUS** and **CPCI** now. From now on, ALife Robotics Corporation Ltd. is in charge of management. This year we have The 2017 International Conference on Artificial Life and Robotics (ICAROB2017) (22nd AROB Anniversary). The future of The ICAROB is brilliant from a point of view of yielding new technologies to human society in 21st century.

I hope that fruitful discussions and exchange of ideas between researchers during Conference (ICAROB2017) will yield new merged technologies for happiness of human beings and, hence, will facilitate the establishment of an international joint research institute on Artificial Life and Robotics in future.

Yingmin Jia

Co-General Chair of ICAROB

It is my great pleasure to invite you to The 2017 International Conference on Artificial Life and Robotics (ICAROB 2017), in Miyazaki, Japan from Jan. 19th to 22nd, 2017.

ICAROB develops from the AROB that was created in 1996 by Prof. Masanori Sugisaka and will celebrate her birthday of 22nd years old in 2017. Doubtless, new mission and big challenges in the field of artificial life and robotics will promote ICAROB to start a new stage and attract wide interests among scientist, researchers, and engineers around the world.

For a successful meeting, many people have contributed their great efforts to ICAROB. Here, I would like to express my special thanks to all authors and speakers, and the meeting organizing team for their excellent works. Looking forward to meeting you at ICAROB in Miyazaki and wishing you enjoy your stay in Japan.

Yingmin Jia
Co-General Chair
(Professor, Beihang University, R .P. China)

Takao Ito

Co General Chair of ICAROB

It is my great honor to invite you all to The 2017 International Conference on Artificial Life and Robotics (ICAROB 2017). This Conference is changed as the old symposium from the first (1996) to the Eighteenth. I am pleased to welcome you to The 2017 International Conference on Artificial Life and Robotics in the wonderful city of Miyazaki City, Miyazaki Prefecture, Japan. The ICAROB has its long history. The former organization of the ICAROB was developed under the strong leadership of the President, famous Professor Masanori Sugisaka, the father of AROB. We gathered many researchers, faculty members, graduate students from all over the world, and published many high-quality proceedings and journals every year.

Over the years, dramatic improvements have been made in the field of artificial life and its applications. The ICAROB has becoming the unifying the exchange of scientific information on the study of man-made systems that exhibit the behavioral characteristic of natural living systems including software, hardware and/or wetware. Our conference shapes the development of artificial life, extending our empirical research beyond the territory circumscribed by life-as-we-know-it and into the domain of life-as-it-could–be. It will provide us a good place to present our new research results, excellent ideas, and valuable information about artificial intelligence, complex systems theories, robotics, management of technology, etc.

The conference site is Seagaia Convention Center, one of the most famous resort hotels in Japan. You can find many fantastic scenic spots and splendid historical places in Miyazaki city. Enjoy your stay and take your time to visit the city of Miyazaki.

I am looking forward to meeting you in Miyazaki during the ICAROB 2017 and to sharing a most pleasant, interesting and fruitful conference.

Takao Ito
Co-General Chair
(Professor Hiroshima
University, Japan)

Ju-Jang Lee
Co-General Chair
(Professor, KAIST)

Ju-Jang Lee

Co-General Chair of ICAROB

The First International Conference on Artificial Life and Robotics (ICAROB) was held in Oita City, Oita, Japan from Jan. 11th to 13th, 2014. This year's Conference will be held amidst the high expectation of the increasingly important role of the new interdisciplinary paradigm of science and engineering represented by the field of artificial life and robotics that continuously attracts wide interests among scientist, researchers, and engineers around the globe.

Distinguished researchers and technologists from around the world are looking forward to attending and meeting at ICAROB. ICAROB is becoming the annual excellent forum that represents a unique opportunity for the academic and industrial communities to meet and assess the latest developments in this fast growing artificial life and robotics field. ICAROB enables them to address new challenges, share solutions, discuss research directions for the future, exchange views and ideas, view the results of applied research, present and discuss the latest development of new technologies and relevant applications.

In addition, ICAROB offers the opportunity of hearing the opinions of well-known leading experts in the field through the keynote sessions, provides the bases for regional and international collaborative research, and enables to foresee the future evolution of new scientific paradigms and theories contributed by the field of artificial life and robotics and associated research area. The twenty-first century will become the century of artificial life and intelligent machines in support of humankind and ICAROB is contributing through wide technical topics of interest that support this direction.

It is a great honor for me as a Co-General Chair of the 4th ICAROB 2017 to welcome everyone to this important event. Also, I would like to extend my special thanks to all authors and speakers for contributing their research works, the participants, and the organizing team of the 4th ICAROB.

I'm looking forward to meeting you at the 4th ICAROB in Miyazaki City, Miyazaki Prefecture and wishing you all the best.

GENERAL SESSION TOPICS

GS1 Artificial Neural Network & Bio-Signal Controlled Robotics (3)	GS2 Automated Guided Vehicles I (6)
GS3 Automated Guided Vehicles II (3)	GS4 Biological Systems (4)
GS5 Filtering & Control Systems (2)	GS6 Human-Welfare Robotic System & Medical Application (5)
GS7 Micro-Machines & Robotics I (6)	GS8 Micro-Machines & Robotics II (3)
GS9 Neuromorphic Robotic Systems (5)	GS10 Reinforcement & Evolutionary Computations (3)
GS11 Others (12)	

ORGANIZED SESSION TOPICS

OS1 Informational Narratology and Automated Content Generation (5)	OS2 Intelligence Control Systems and Applications I (6)
OS3 Intelligence Control Systems and Applications II (6)	OS4 Human-In-The-Loop (HITL) Systems (4)
OS5 Human Interface and Content Security (5)	OS6 Software Development Support Method (6)
OS7 Advances in Marine Robotics and Applications (6)	OS8 Multiagent systems and Reality Mining (4)
OS9 Theory and Implementation of Neuromorphic Systems (5)	OS10 Biological Signal Sensing Technology, Device and Its Applications (5)
OS11 Robot Control and Localization (4)	OS12 Machine Learning and Its Applications (4)
OS13 Intelligent Control (6)	OS14 Advanced Control (5)
OS15 Recognition and Control (8)	OS16 Image Recognition and Chaotic Systems (8)
OS17 Natural Computing and Biology (4)	OS18 Advanced Management and Technology (4)
OS19 Kansei Engineering and Applications (4)	OS20 Image Processing and Computer Graphics (6)
OS21 Computer Science and Information Processing (5)	OS22 Robotic Technology for Competition (4)

1/19(Thu.) 17:30-19:30	Welcome Party (Conference Site: Gibraltar)
1/19(Thu.) - 1/22(Sun.)	ICAROB Secretariat
1/22(Sun.) 16:45-17:15	Farewell Party (Conference Site: Gibraltar)

TIME TABLE (1/20)

1/20(Fri.)	Fountain Room (A1) 2nd F	Orchard Room (A2) 2nd F, N	Orchard Room (A3) 2nd F, S
8:40-	Registration		
9:00-10:15	OS14 Advanced Control (5)	GS6 Human-Welfare Robotic System & Medical Application (5)	OS15 Recognition and Control (8) & OS16 Image Recognition and Chaotic Systems (8)
10:15-10:30	Coffee break		
10:30-11:00	Opening Ceremony (Fountain Room (A1) 2nd F)		
11:10-12:10	Chair: Takao Ito Invited session IS-2, IS-4 (Fountain Room (A1) 2nd F) Henrik Hautop Lund		
12:10-13:10	Lunch		
13:10-13:50	Chair: Jangmyung Lee Invited session IS-1 (Fountain Room (A1) 2nd F) Luigi Pagliarini		
13:50-14:10	Invited session IS-3 (Fountain Room (A1) 2nd F) Ismael Baira Ojeda		
14:10-14:30	Coffee break		
14:30-16:00	OS3 Intelligence Control Systems and Applications (II) (6)	OS5 Human Interface and Content Security (5)	GS7 Micro-Machines & Robotics I (6)
16:00-16:20	Coffee break		
16:20-17:50	OS2 Intelligence Control Systems and Applications (I) (6)	OS9 Theory and Implementation of Neuromorphic Systems (5)	OS7 Advances in Marine Robotics and Applications (6)

TIME TEBLE (1/21)

1/21(Sat.)	Fountain Room (A1) 2nd F	Orchard Room (A2) 2nd F, N	Orchard Room (A3) 2nd F, S
8:40-	Registration		
9:00-11:00	OS6 Software Development Support Method (6)	GS2 Automated Guided Vehicles I (6)	OS4 Human-In-The-Loop (HITL) Systems (4) & OS11 Robot Control and Localization (4)
11:00-11:15	Coffee break		
11:15-12:00	GS5 Filtering & Control Systems (2)	GS8 Micro-Machines & Robotics II (3)	GS1 Artificial Neural Network and Bio-Signal Controlled Robotics (3)
12:00-13:00	Lunch		
13:00-14:00	Chair: Yingmin Jia Plenary Speech PS1(Fountain Room (A1) 2nd F) Kazuo Ishii		
14:00-14:20	Coffee break		
14:20-15:50	OS20 Image Processing and Computer Graphics (6)	OS13 Intelligent Control (6)	OS8 Multiagent systems and Reality Mining (4)
15:50-16:10	Coffee break		
16:10-17:25	GS9 Neuromorphic Robotic Systems (5)	OS22 Robotic Technology for Competition (4)	GS4 Biological Systems (4)
18:00-20:00	Banquet: Tenzui (4th F)		

TIME TABLE (1/22)

1/22(Sun.)	Fountain Room (A1) 2nd F	Orchard Room (A2) 2nd F, N	Orchard Room (A3) 2nd F, S
8:50-	Registration		
9:10-10:25	OS10 Biological Signal Sensing Technology, Device and Its Applications (5)	OS19 Kansei Engineering and Applications (4)	OS1 Informational Narratology and Automated Content Generation (5)
10:25-10:40	Coffee break		
10:40-11:40	Chair: Makoto Sakamoto Plenary Speech PS2 (Fountain Room (A1) 2nd F) Tomoyuki Nishita		
11:40-13:00	Lunch		
13:00-13:50	Chair: Takao Ito Invited session IS-5 (Fountain Room (A1) 2nd F) Peter Sapaty		
13:50-14:10	Coffee break		
14:10-15:10	OS18 Advanced Management and Technology (4)	OS17 Natural Computing and Biology (4)	OS12 Machine Learning and Its Applications (4)
15:10-15:30	Coffee break		
15:30-16:45	GS10 Reinforcement & Evolutionary Computations (3)	GS3 Automated Guided Vehicles II (3)	OS21 Computer Science and Information Processing (5)
Farewell Party (16:45-17:15)			

The 2017 International Conference on
ARTIFICIAL LIFE AND ROBOTICS
(ICAROB2017)

January 19 (Thursday)

17:30-19:30   **Welcome Party (Conference Site: Gibraltar 2nd F)**

January 20 (Friday)

10:30-11:00

Opening Ceremony (Fountain Room (A1) 2nd F)

Chair: Marion Oswald (The Vienna University of Technology, Austria)

Welcome Addresses

1. General Chairman of ICAROB	Masanori Sugisaka (ALife Robotics Corporation Ltd. Japan)
2. Co-General Chairman of ICAROB	Yingmin Jia (Beihang University, China)
3. Co-General Chairman of ICAROB	TaKao Ito (Hiroshima University, Japan)
4. Vice General Chair of ICAROB	Henrik Hautop Lund (Technical University of Denmark, Denmark)
5. Vice General Chair of ICAROB	Jangmyung Lee (Pusan National University, South Korea)

January 21 (Saturday)

Banquet: Tenzui (4th F)

18:00-20:00

Chair: T. Ito (Hiroshima University, Japan)

Welcome Addresses

Prof. Yingmin Jia (Beihang University, P.R. China.)

Prof. Jang-Myung Lee (Pusan National University, South Korea)

Prof. Marion Oswald (The Vienna University of Technology, Austria)

Prof. Saori Iwanaga (Japan Coast Guard Academy, Japan)

TECHNICAL PAPER INDEX

January 20 (Friday)

08:40-Registration

Fountain Room (A1) 2nd F
9:00-10:15 OS14 Advanced Control (5)
Chair: Yingmin Jia (Beihang University, P.R. China)
Co-Chair: Weicun Zhang (University of Sciences and Technology Beijing, P.R. China)

OS14-1   *Targeting Chaos System via Minimum Principle Control*
Yunzhong Song, Ziyi Fu, Fuzhong Wang (Henan Polytechnic University, P.R.China,)

OS 14-2   *Three-dimensional Leader-Follower Formation Flocking of Multi-Agent System*
Yongnan Jia, Weicun Zhang (University of Sciences and Technology Beijing, China)

OS14-3   *Leader-follower Formation Control of Mobile Robots with Sliding Mode*
Wenhao Zheng and Yingmin Jia (Beihang University, P.R.China)

OS14-4 H_∞ *Containment Control for Nonlinear Multi-agent Systems with Parameter Uncertainties and Communication Delays*
Ping Wang[1], Yingmin Jia[2] ([1]North China Electric Power University, [2]Beihang University, P.R.China)

OS14-5   *Stochastic Resonance in an Array of Dynamical Saturating Nonlinearity with Second-Order*
Yumei Ma, Lin Zhao, Zhenkuan Pan and Jinpeng Yu*(Qingdao University , P.R.China)

10:30-11:00 Opening Ceremony
Chair: Marion Oswald (The Vienna University of Technology, Austria)

11:10-12:10
Invited session IS-2, IS-4
Chair: Takao Ito (Hiroshima University, Japan)

IS-2 *Playware ABC: Engineering Play for Everybody*
Henrik Hautop Lund (Technical University of Denmark, Denmark)

IS-4 *Playware ABC2: a Disruptive Technology for Global Development*
Henrik Hautop Lund (Technical University of Denmark, Denmark)

13:10-13:50

Invited session IS-1

Chair: Jang-Myung Lee (Pusan National University, South Korea)

IS-1 *The future of Robotics Technology.*
Luigi Pagliarini [1,2], Henrik Hautop Lund [1] ([1] Technical University of Denmark, Denmark, [2] Academy of Fine Arts of Macerata, Italy)

13:50-14:10

Invited session IS-3

Chair: Jang-Myung Lee (Pusan National University, South Korea)

IS-3 *A combination of Machine Learning and Cerebellar models for the Motor Control and Learning of a Modular Robot*
Ismael Baira Ojeda, Silvia Tolu, Moisés Pachecho, David Johan Christensen and Henrik Hautop Lund (Technical University of Denmark, Denmark)

14:30-16:00 OS3 Intelligence Control Systems and Applications II (6)

Chair: Chian C. Ho (National Yunlin University of Science & Technology, Taiwan)

Co-Chair: Chia-Nan Ko (Nan Kai University of Technology, Taiwan)

OS3-1   *Image Compression Using Hybrid Evolution Based Takagi-Sugeno Fuzzy Neural Network*
[1]Chia-Nan Ko and [2]Ching-I Lee ([1,2] Nan Kai University of Technology, Taiwan)

OS3-2   *MQPSO Algorithm Based Fuzzy PID Control for a Pendubot System*
[1]Li-Chun Lai, [2]Yu-Yi Fu, and [3]Chia-Nan Ko ([1]National Pingtung University, [2,3]Nan Kai University of Technology, Taiwan)

OS3-3   *A Sensorless Ultra-High Speed Motor Drive*r
Chung-Wen Hung, Yan-Ting Yu, Bo-Kai Huang, Wei-Lung Mao (National Yunlin University of Science and Technology, Taiwan)

OS3-4   *Android-Based Patrol Robot Featuring Automatic Vehicle Patrolling and Automatic Plate Recognition*
Chian C. Ho, Shih-Jui Yang, Jian-Yuan Chen, Chang-Yun Chiang, and Hsin-Fu Chen
(National Yunlin University of Science and Technology, Taiwan)

OS3-5   *Adaptive CMAC Filter for Chaotic Time Series Prediction*
Wei-Lung Mao, Suprapto, Chung-Wen Hung (National Yunlin University of Science and Technology, Taiwan)

OS3-6   *Surface Defect Detection for Anodized Aluminum Tube Based on Automatic Optical Inspection*
Hsien-Huang P. Wu and Hsuan-Min Sun
(National Yunlin University of Science and Technology, Taiwan)

16:20-17:50

OS2 Intelligence Control Systems and Applications I (6)

Chair: Kuo-Hsien Hsia (Far East University, Taiwan)

Co-Chair: Kuo-Lan Su (National Yunlin University of Science & Technology, Taiwan)

OS2-1   *Develop Low Cost IoT Module with Multi-Agent Method*
Jr-Hung Guo, Kuo-Hsien Hsia, Kuo-Lan Su
(National Yunlin University of Science and Technology, Taiwan)

OS2-2   *Based on Short Motion Paths and Artificial Intelligence Method for Chinese Chess Game*
Chien-Ming Hung, Jr-Hung Guo, Kuo-Lan Su
(National Yunlin University of Science and Technology, Taiwan)

OS2-3   *Design and Implementation of the SCARA Robot Arm*
Jian-Fu Weng, Bo-Yi Li, Kuo-Lan Su
(National Yunlin University of Science and Technology, Taiwan)

OS2-4   *Transmission Power Control for Wireless Sensor Network*
Kuo-Hsien Hsia[1], Chung-Wen Hung[2], Hsuan T. Chang, Yuan-Hao Lai[2]
([1]Far East University, Taiwan, [2]National Yunlin University of Science and Technology, Taiwan)

OS2-5   *Mechanism of Autonomous Mowing Robot for Long Grass*
Kuo-Hsien Hsia[1], Yao-Shing Huang[2], Kuo-Lan Su[2] and Jr-Hung Guo[2]
([1]Far East University, Taiwan, [2]National Yunlin University of Science and Technology, Taiwan)

OS2-6   *Design of Optimal Position Controller for Three-Phase Brushless DC Motor Applying Adaptive Sliding Mode Control*
Tai-Huan Tsai, Mei-Yung Chen (National Taiwan Normal University, Taiwan)

Orchard Room (A2) 2nd F, N

9:00-10:15 GS6 Human-Welfare Robotic System & Medical Application (5)

Chair:

GS6-1   *Virtual surgery system with realistic visual effects and haptic interaction.*
Vlada Kugurakova, Murad Khafizov, Ruslan Akhmetsharipov, Alexei Lushnikov, Diana Galimova, Vitaly Abramov (Kazan Federal University, Russia), Omar Correa Madrigal (University of Informatic Sciences, Cuba)

GS6-2   *A Human Reaching Movement Model for Myoelectric Prosthesis Control*
Go Nakamura[*1, 5], Taro Shibanoki[*2], Yuichiro Honda[*1], Futoshi Mizobe[*3], Akito Masuda[*4], Takaaki Chin[*1], Toshio Tsuji[*5], [*1](Robot Rehabilitation Center in The Hyogo institute of Assistive Technology, Japan), [*2](Ibaraki University, Japan), [*3](Hyogo Rehabilitation Center, Japan) [*4](Kinki Gishi Corporation, Japan), [*5](Hiroshima University, Japan)

GS6-3   *Re-creation of a membrane puncture's sense of an object constituted of liquid and an outer membrane by a haptic device and a deformation simulation of the virtual objects*
Takahiro Okada, Eiji Hayashi (Kyusyu Institute of Technology, Japan)

GS6-4   *Exercise classification using CNN with image frames produced from time-series motion data*
Hajime Itoh, Naohiko Hanajima, (Muroran Institute of Technology, Japan), Yohei Muraoka, Makoto Ohata, (Steel Memorial Muroran Hospital, Japan), Masato Mizukami, Yoshinori Fujihira, (Muroran Institute of Technology,, Japan)

GS6-5   *Proposal and Evaluation of the Gait Classification Method using Arm Acceleration Data and Decision Tree*
Kodai Kitagawa, Yu Taguchi, Nobuyuki Toya
(National Institute of Technology, Kushiro Collage, Japan)

14:30-16:00 OS5 Human Interface and Content Security (5)
Chair: Yasunari Yoshitomi (Kyoto Prefectural University, Japan)
Co-Chair: Masayoshi Tabuse (Kyoto Prefectural University, Japan)

OS5-1   *A Method for Secure Communication Using a Discrete Wavelet Transform for Audio Data and Improvement of Speaker Authentication*
Kouhei Nishimura, Yasunari Yoshitomi, Taro Asada, and Masayoshi Tabuse
(Kyoto Prefectural University, Japan)

OS5-2   *A Recipe Decision Support System Using Knowledge Information and Agent*
Keita Saito, Taro Asada, Yasunari Yoshitomi, Ryota Kato, and Masayoshi Tabuse
(Kyoto Prefectural University, Japan)

OS5-3   *A System for Analyzing Facial Expression and Verbal Response of a Person While Answering Interview Questions on Video*
Taro Asada, Yasunari Yoshitomi, and Masayoshi Tabuse (Kyoto Prefectural University, Japan)

OS5-4   *Real-Time System for Horizontal Asymmetry Analysis on Facial Expression and Its Visualization*
Ryoichi Shimada, Taro Asada, Yasunari Yoshitomi, and Masayoshi Tabuse
(Kyoto Prefectural University, Japan)

OS5-5   *Development of Mouse System for Physically Disabled Person by Face Movement Using Kinect*
Junpei Miyachi, Masayoshi Tabuse (Kyoto Prefectural University, Japan)

16:20-17:35 OS9 Theory and Implementation of Neuromorphic Systems (5)
Chair: Takashi Kohno (The University of Tokyo, Japan)
Co-Chair: Takuya Nanami (The University of Tokyo, Japan)

OS9-1   *Implementation of Multi-FPGA Communication using Pulse-Coupled Phase Oscillators*
Dinda Pramanta, Takashi Morie, Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

OS9-2   *Multi-Valued Quantization Convolutional Neural Networks toward Hardware Implementation*
Yoshiya Aratani, Yoeng Jye Yeoh, Daisuke Shuto, Takashi Morie, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

OS9-3   *An Improved Parameter Value Optimization Technique for the Reflectionless Transmission-Line Model of the Cochlea*
Takemori Orima and Yoshihiko Horio (Tohoku University, Japan)

OS9-4   *A parameter optimization method for Digital Spiking Silicon Neuron model*
Takuya Nanami and Takashi Kohno (The University of Tokyo, Japan)

OS9-5   *A Multistage Heuristic Tuning Algorithm for an Analog Silicon Neuron Circuit*
Ethan Green and Takashi Kohno (The University of Tokyo, Japan)

Orchard Room (A3) 2nd F, S
9:00-10:15 OS15 Recognition and Control (8)
Chair: Fengzhi Dai (Tianjin University of Science and Technology, China)
Co-Chair: Hongtao Zhang (Tianjin University of Science and Technology, China)

OS15-1   *Integral Design of Intelligent Home Equipment*
Yuxing Ouyang [1], Fengzhi Dai [1*], Yiqiao Qin [1], Ce Bian [1], Bo Liu [2], Hongwei Jiao [3] ([1] Tianjin University of Science & Technology, [2] Inner Mongolia University, [3] Tianjin Technology School of Printing and Decoration, China)

OS15-2   *Research on Underwater Robot Recognition*
Binhu Song[1], Fengzhi Dai[1*], Qijia Kang[1], Haifang Man[1], Hongtao Zhang[1], Long Li[2], Hongwei Jiao[3] ([1] Tianjin University of Science and Technology, [2] Tianjin Electric Locomotive Co., Ltd, [3] Tianjin Technology School of Printing & Decoration, China)

OS15-3   *Design of Intellectual Vehicles with Path Memorizing Function*
Yiqiao Qin [1], Fengzhi Dai [1*], Yuxing Ouyang [1], Baochang Wei [1], Simini Chen [2], Hongwei Jiao [3] ([1] Tianjin University of Science & Technology, [2] Palace Museum, [3] Tianjin Technology School of Printing & Decoration, China)

OS15-4   *Action Recognition based on Binocular Vision*
Yiwei Ru [1,2,*], Hongyue Du [1], Shuxiao Li [2], Hongxing Chang [2] ([1] Harbin University of Science and Technology, China, [2] Institute of Automation Chinese Academy of Sciences, China)

OS15-5   *Analysis and Control of a Novel 4D Chaotic System*
Hong Niu (Tianjin University of Science and Technology, China)

OS15-6   *Analysis of a three-dimensional chaotic system and its FPGA implementation*
Hefei Li [*], Xianghui Hu (Tianjin University of Science and Technology, China)

OS15-7   *Image Encryption Based on Fractional-order Chaotic Model of PMSM*
Wei Xue [*], Mei Zhang, Shilong Liu, Xue Li (Tianjin University of Science and Technology, China)

OS15-8   *The Application of a Novel Fractional Hyper-chaotic in Image Encryption*
Wei Xue [*], Shilong Liu, Mei Zhang, Xue Li (Tianjin University of Science and Technology, China)

OS16 Image Recognition and Chaotic Systems (8)
Chair: Huailin Zhao (Shanghai Institute of Technology, China)
Co-Chair: Shunzhou Wang (Shanghai Institute of Technology, China)

OS16-1   *A Method of Detecting Abnormal Crowd Behavior Events Applied in Patrol Robot*
Huailin Zhao, Shunzhou Wang, Shifang Xu, Yani Zhang (Shanghai Institute of Technology, China), Masanori Sugisaka (ALife Robotics Corp. Ltd, Japan)

OS16-2   *Design of the Multi-Car Collaboration System*
Huailin Zhao, Yangguang Guo (Shanghai Institute of Technology, China)
Masanori Sugisaka (ALife Robotics Corp. Ltd, Japan)

OS16-3   *Research on an Algorithm of the Character Recognition with Self-learning the Recognition Errors*
Huailin Zhao, Yawei Hou, Shifang Xu, Congdao Han (Shanghai Institute of Technology, China), Masanori Sugisaka (ALife Robotics Corp. Ltd, Japan)

OS16-4   *An Improved Method of the Power System Short Term Load Forecasting Based on the Neural Network*
Shunzhou Wang, Huailin Zhao, Yani Zhang, Peng Bai (Shanghai Institute of Technology, China)

OS16-5   *Improvement on LEACH Agreement of Mine Wireless Communication Network*
Liu Yun-xiang and Zhang Wei (Shanghai Institute of Technology, China)

OS16-6   *A New Four-Wing Chaotic System Generated by Sign Function*
Hongyan Jia, Shanfeng Wang, Yongjun Wu (Tianjin University of Science and Technology, China)

OS16-7   *A Three-Dimensional Chaotic System Generating Single-wing or Two-Wing Chaotic Attractors*
Hongyan Jia, Yongjun Wu, Shanfeng Wang (Tianjin University of Science and Technology, China)

OS16-8   *Circuit implementation of a new fractional-order hyperchaotic system*
Xuyang Wu, Hongyan Jia, Ning Bai, Weibo Jia
(Tianjin University of Science and Technology, China)

14:30-16:00 GS7 Micro-Machine & Robotics I (6)
Chair:

GS7-1   *Estimation and Categorization of Errors in Error Recovery Using Task Stratification and Error Classification*
Akira Nakamura[*1], Kazuyuki Nagata[*1], Kensuke Harada[*2] and Natsuki Yamanobe[*1]
([*1] National Institute of Advanced Industrial Science and Technology (AIST), Japan, [*2] Osaka University, Japan)

GS7-2   *The Suitable Timing of Visual Sensing in Error Recovery Using Task Stratification and Error Classification*
Akira Nakamura[*1], Kazuyuki Nagata[*1], Kensuke Harada[*2] and Natsuki Yamanobe[*1]
([*1] National Institute of Advanced Industrial Science and Technology (AIST), Japan, [*2] Osaka University, Japan)

GS7-3   *Hexapod Type MEMS Microrobot Equipped with an Artificial Neural Networks IC*
Kazuki Sugita, Taisuke Tanaka, Yuya Nakata, Minami Takato, Ken Saito, Fumio Uchikoba
(Nihon University, Japan)

GS7-4   *Heat Distribution of Current Output Type Artificial Neural Networks IC for the MEMS Microrobot*
Taisuke Tanaka, Yuya Nakata, Kazuki Sugita, Minami Takato, Ken Saito, Fumio Uchikoba
(Nihon University, Japan)

GS7-5   *AGV with Mind and its production simulations for autonomous decentralized FMSs*
Masato Chikamatsu, Hidehiko Yamamoto, Takayoshi Yamada (Gifu University, Japan)

GS7-6   *UNARM System to Decide Units Locations of Cell-type Assembly Machines with Robots Arms*
Hirotaka Moribe, Hidehiko Yamamoto and Takayoshi Yamada (Gifu University, Japan)

16:20-17:50 OS7 Advances in Marine Robotics and Applications (6)
Chair: Kazuo Ishii (Kyushu Institute of Technology, Japan)
Co-Chair: Keisuke Watanabe (Tokai University, Japan)

OS7-1   *Development of a Hydraulic Underwater Manipulator for Deep-Sea Survey AUV*
Kazuo Ishii, Amir Ali Forough Nassiraei, Ivan Godler, Takashi Sonoda, Tharindu Weerakoon
(Kyushu Institute of Technology, Japan)

OS7-2   *Experiments of floatable UAV drone for wave dissipating block inspection(I)*
Keisuke Watanabe, Kazuho Mitsumura, Koshi Utsunomiya, Shiyun Takasaki
(Tokai University, Japan)

OS7-3   *Experiments of floatable UAV drone for wave dissipating block inspection(II)*
Keisuke Watanabe, Kazuho Mitsumura, Koshi Utsunomiya, Shiyun Takasaki
(Tokai University, Japan)

OS7-4   *Development of self-diagnostic system of an autonomous underwater vehicle Tuna-Sand 2*
Naoya Fujii, Yuya Nishida, Kazuo Ishii (Kyushu Institute of Technology, Japan)

OS7-5   *Development of Underwater Wireless Power Supply System Using resonant energy transfer*
Kazuo Ishii, Hidaka Shota, Keisuke Watanabe
(Kyushu Institute of Technology, Tokai University, Japan)

OS7-6   *Development of End-effector for Sampling-AUV "TUNA-SAND2"*
Kazuo Ishii, Takashi Sonoda Atsushi Nishjima, Keisuke Watanabe
(Kyushu Institute of Technology, Tokai University, Japan)

January 21 (Saturday)

08:40-Registration
Fountain Room (A1) 2nd F
9:00-10:30 OS6 Software Development Support Method (6)
Chair: Tetsuro Katayama (University of Miyazaki, Japan)
Co-Chair: Tomohiko Takagi (Kagawa University, Japan

OS6-1   *Development of a Tool for Extended Place/transition Net-Based Mutation Testing*
Tomohiko Takagi[1], Shogo Morimoto[1], Tetsuro Katayama[2]
([1]Kagawa University, [2]University of Miyazaki, Japan)

OS6-2   *Improvement of Decision Table Automatic Generation Tool VDTable for let in Statement*
Yinuo Huang*, Tetsuro Katayama* Yoshihiro Kita†, Hisaaki Yamaba*, and Naonobu Okazaki*
(*University of Miyazaki, Japan, †Tokyo University of Technology, Japan)

OS6-3   *Prototype of Test Cases Automatic Generation Tool BWDM Based on Boundary Value Analysis with VDM++*
Hiroki Tachiyama[*], Tetsuro Katayama[*] Yoshihiro Kita†, Hisaaki Yamaba*, and Naonobu Okazaki*
(*University of Miyazaki, Japan,†Tokyo University of Technology, Japan)

OS6-4   *Prototype of Refactoring Support Tool MCC Focusing on the Naming of Variables*
Satoshi Tanoue[*], Tetsuro Katayama[*] Yoshihiro Kita†, Hisaaki Yamaba*, and Naonobu Okazaki*
(*University of Miyazaki, Japan,†Tokyo University of Technology, Japan)

OS6-5   *Improvement of Transitions and Flow Visualization TFVIS for Exception Handling.*
Takuya Sato*, Tetsuro Katayama*, Yoshihiro Kita†, Hisaaki Yamaba*, and Naonobu Okazaki*
(*University of Miyazaki, Japan,†Tokyo University of Technology, Japan)

OS6-6   *Automatically Business Decision Making System for Software Development by using CMMI*
Hnin Thandar Tun†, Tetsuro Katayama*, Kunihito Yamamori*, and Khine Khine Oo†
(*University of Miyazaki, Japan, †University of Computer Studies, Myanmar)

11:15-11:45 GS5 Filtering & Control Systems (2)
Chair:

GS5-1   *An Application of Collaborative Filtering in Student Grade Prediction*
Chaloemphon Sirikayon and Panita Thusaranon (Dhurakij Pundit University, Thailand)

GS5-2   *An improved detection method for railway fasteners*
Jiwu Wang[1], Yan Long[1], Sugisaka Masanori [2] (Beijing Jiaotong University, China[1], Alife Robotics Corporation Ltd, Japan and Open University, United Kingdom[2])

13:00-14:00
Plenary Speech PS1
Chair: Yingmin Jia (Beihang University, P.R. China)
PS1 *A New Tool to Access Deep-Sea Floor "Sampling-AUV"*
Kazuo Ishii, Takashi Sonoda, Yuya Nishida, Shinsuke Yasukawa and Tamaki Ura (Kyushu Institute of Technology, Japan)

14:20-15:50 OS20: Image Processing and Computer Graphics (6)

Chair: Thi Thi Zin (University of Miyazaki, Japan)

Co-Chair: Masayuki Mukunoki (University of Miyazaki, Japan)

OS20-1 *An effective method for detecting snatch thieves in video surveillance*
Hiroaki Tsushita[1], Thi Thi Zin[2] ([1, 2] University of Miyazaki, Japan)

OS20-2 *Color and Shape based Method for Detecting and Classifying Card Images*
Cho Nilar Phyo[1], Thi Thi Zin[2], Hiroshi Kamada[3], Takashi Toriu[4] ([1, 2] University of Miyazaki, Japan, [3] Kanazawa Institute of Technology, Japan [4] Osaka City University, Japan)

OS20-3 *Automatic Assessing Body Condition Score from Digital Images by Active Shape Model and Multiple Regression Technique*
Nay Chi Lynn, Thi Thi Zin, Ikuo Kobayashi (University of Miyazaki, Japan)

OS20-4 *General Image Categorization Using Collaborative Mean Attraction*
Hiroki Ogihara, Masayuki Mukunoki (University of Miyazaki, Japan)

OS20-5 *Consideration on the Photo-Realistic Rendering of Fruits by 3DCG*
Haruka Tsuboi[1], Makoto Sakamoto[1], Sho Yamada[1], Kensuke Ando[1], Chongyang Sun[1], Makoto Nagatomo[1], Koshiro Mitsuhashi[2], Yukari Kodama[2] ([1]University of Miyazaki, Japan, [2]Miyazaki Multimedia Academy, Japan)

OS20-6 *Consideration for the Possibility to the Tourism by the AR Technology*
Masamichi Hori[1], Makoto Sakamoto[1], Koshiro Mitsuhashi[2], Yukari Kodama[2], Takeshi Tanaka[1], Mihoko Fukushima[1], Chikashi Deguchi[1], Masahiro Yokomichi[1], Masayuki Mukunoki[1], Kunihito Yamamori[1], Atsushi Iiboshi[3] ([1]University of Miyazaki, Japan, [2]Miyazaki Multimedia Academy, Japan, [3]Takachiho Muratabi Co., Ltd., Japan)

16:10-17:25 GS9 Neuromorphic Robotic Systems (5)

Chair:

GS9-1 *Development of Cloud Actions for Seamless Robot Using Backpropagation Neural Network*
Wisanu Jitviriya[1], Jiraphan Inthiam[2] and Eiji Hayashi[3] ([1]King Mongkut's University of Technology North Bangkok, Thailand, [2,3]Kyushu Institute of Technology, Japan)

GS9-2 *Mathematical modelling of human fear and disgust emotional reactions based on skin surface electric potential changes*
Kristina Gaisina and Ruslan Gaisin (Kazan Federal University, Russia)

GS9-3   *Neuromorphic Robot Dream: A Spike Based Reasoning System*
Alexander Toschev, Max Talanov (Kazan Federal University, Russia),
Alexander Tchitchigin (Innopolis University and Kazan Federal University, Russia),
Salvatore Distefano (Kazan Federal University, Russia)

GS9-4   *Development of Behavioral Robot using Imitated Multiplex Neurotransmitters System*
Saji Keita[1], Wisanu Jitviriya[2] and Eiji Hayashi[3] ([1,3] Kyushu Institute of Technology, Japan)
([2] King Mongkut's University of Technology North Bangkok, Thailand)

GS9-5   *Nonlinear Estimation Strategies Applied on an RRR Robotic Manipulator*
Jacob Goodman[1], Jinho Kim[1], Andrew S. Lee[1], S. Andrew Gadsden[1,2]
([1]University of Maryland, USA) ([2]University of Guelph, Canada)

Orchard Room (A2) 2nd F, N
9:00-10:30 GS2 Automated Guided Vehicles I (6)
Chair:

GS2-1   *Adaptive Negotiation-rules Acquisition Methods in Decentralized AGV Transportation Systems by Reinforcement Learning with a State Space Filter*
Masato Nagayoshi, Simon Elderton (Niigata College of Nursing)
Kazutoshi Sakakibara (Toyama Prefectural Univ.), Hisashi Tamaki (Kobe Univ.)

GS2-2   *Modeling and Control of a Quadrotor Vehicle Subject to Disturbance Load*
Jun Wang, Song Xin*, Yuxi Zhang (Beihang University, P. R. China)

GS2-3   *A multithreaded algorithm of UAV visual localization based on a 3D model of environment: implementation with CUDA technology and CNN filtering of minor importance objects*
Alexander Buyval, Mikhail Gavrilenkov (Bryansk State Technical University, Russia)
Evgeni Magid (Kazan Federal University, Russia)

GS2-4   *Modelling a crawler-type UGV for urban search and rescue in Gazebo environment*
Maxim Sokolov, Aidar Gabdullin, Roman Lavrenov, Ilya Afanasyev (Innopolis University, Russia), Leysan Sabirova, Evgeni Magid (Kazan Federal University, Russia)

GS2-5   *Development of Autonomous Robot for Laborsaving of the Forestry - Positioning of the Robot using IMU, GPS, and Encoder -*
Sho Yamana, and Eiji Hayashi (Kyushu Institute of Technology, JAPAN)

GS2-6   *Development of Autonomous Robot for Laborsaving of the Forestry - Detection of young plants by RGB and Depth Sensor -*
Nobuo Miyakawa and Eiji Hayashi (Kyushu Institute of Technology, Japan)

11:15-12:00 GS8 Micro-Machine & Robotics II (3)
Chair:

GS8-1
Development of arm trajectory planning of Seamless Robot
Teedanai Pramanpol, Eiji Hayashi (Kyushu Institute of Technology, Japan)

GS8-2
Localization Method of Autonomous Moving Robot for Forest Industry
Ayumu Tominaga, E. Hayashi(Kyushu Institute of Technology, Japan), T. Sasao (Meiji Univ., Japan)

GS8-3
Dynamic Modeling and Motion Control of an RRR Robotic Manipulator
Jinho Kim[1], Kevin Chang[1], Brian Schwarz[1], Andrew S. Lee[1], S. Andrew Gadsden[1,2]
([1]University of Maryland, USA), ([2]University of Guelph, Canada)

14:20-15:50 OS13: Intelligent Control (6)
Chair: Yingmin Jia (Beihang University (BUAA), P.R.China)
Co-Chair: Fuzhong Wang (Henan Polytechnic University, P.R.China)

OS13-1
Modeling and Simulation for a Quadrotor Vehicle with Adaptive Wing
Qunpo Liu ,Fuzhong Wang, Hongqi Wang, Jikai Si (Henan Polytechnic University, P.R.China)
Hanajima Naohiko (Muroran Institute of Technology, Japan)

OS13-2
Fuzzy self-tuning PID control algorithm for belt conveyor driven by multi-motor
Caixia Gao, Fuzhong Wang, Ziyi Fu (Henan Polytechnic University, P.R. China)

OS13-3
Continuous Non-singular Fast Terminal Sliding Mode Control for an Active Gravity Field Simulator
Jiao Jia, Yingmin Jia and Shihao Sun(Beihang University (BUAA), P.R.China)

OS13-4
Weighted Multiple Model Adaptive Control for a Category of Systems with Colored Noise
Yuzhen Zhang, Qing Li and Weicun Zhang
(University of Science and Technology Beijing, P. R. China)

OS13-5
Neutral Networks-Based Adaptive Fixed-Time Consensus Tracking Control for Uncertain Multiple AUVs
Lin Zhao[1,*], Yingmin Jia[2] and Jinpeng Yu[1]
([1]Qingdao University, P.R.China; [2] Beihang University (BUAA), P.R. China)

OS13-6
Conducted electromagnetic interference prediction of the Buck Converter via Neural Networks
Sumin Han, Fuzhong Wang (Henan Polytechnic University, P.R. China)

16:10-17:10 OS22 Robotic Technology for Competition (4)
Chair: Kazuo Ishii (Kyushu Institute of Technology, Japan)
Co-Chair: Keisuke Watanabe (Tokai University, Japan)

OS22-1　　*Development of a Tomato Harvesting Robot*
Bingh Li, Shinsuke Yasukawa, Takashi Sonoda, Kazuo Ishii
(Kyushu Institute of Technology, Japan)

OS22-2　　*Analysis of Relationship between Team Role and Individual's Role in Vollyball Team using SOM*
Yasunori Takemura (Nishi Nippon Institute of Technology, Japan)

OS22-3　　*Ball Dribbling Control for RoboCup Soccer Robot*
Shota Chikushi, Kenji Kimura, Kazuo Ishii
(Nippon-Bunri University, Kyushu Institute of Technology, Japan)

OS22-4　　*Strategy Analysis of RoboCup Soccer Teams Using Self-Organizing Map*
Moeko Tominaga, Yasunori Takemura, Kazuo Ishii
(Kyushu Institute of Technology, NishiNippon Institute of Technology, Japan)

Orchard Room (A3) 2nd F, S
9:00-11:00 OS4 Human-In-The-Loop (HITL) Systems (4)
Chair: Toru Yamamoto (Hiroshima University, Japan)

OS4-1　　*Feature Extraction for Digging Operation of Excavator*
Kazushige Koiwai*, Toru Yamamoto (Hiroshima University, Japan)
Takao Nanjo, Yoichiro Yamazaki, Yoshiaki Fujimoto (KOBELCO Construction Machinery CO., LTD. , Japan)

OS4-2　　*Design of a Data-Oriented Kansei Feedback System*
Takuya Kinoshita and Toru Yamamoto (Hiroshima University, Japan)

OS4-3　　Parameter Estimation of Skill Evaluation Model
Kazuo Kawada, Toru Yamamoto (Hiroshima University, Japan)

OS4-4　　*Human Skill Quantification for Excavator Operation using Random Forest*
Hiromu Imaji, Kazushige Koiwai*, Toru Yamamoto (Hiroshima University, Japan)
Koji Ueda, Yoichiro Yamazaki, Yoshiaki Fujimoto (KOBELCO Construction Machinery CO., LTD. , Japan)

OS11 Robot Control and Localization (4)
Chair: Jang-Myung Lee (Pusan National University, South Korea)
Co-Chair: Min-Cheol Lee (Pusan National University, South Korea)

OS11-1   *Marker Recognition System for Localization of the Rover on the Lunar Space*
Na-Hyun Lee, Jang-Myung Lee (Pusan National University, South Korea)

OS11-2   *Dynamic Model and Finite-Time SMC and Backstepping Control of a Mabile Manipulator System*
Seongik Han, Hyunuk Ha, and Jangmyung Lee (Pusan National University, Korea)

OS11-3   *Bilateral Control of Hydraulic Servo System for 1DOF Master Slave Manipulator*
Jie Wang, Karam Dad and Min Cheol Lee (Pusan National University ,Korea)

OS11-4   *Advanced impedance control of haptic joystick for effective mobile robot handling*
Gyung-I Choi, Jang-Myung Lee (Pusan National University, South Korea)

11:15-12:00 GS1 Artificial Neural Network and Bio-Signal Controlled Robotics (3)
Chair:

GS1-1   *Obstacle Avoidance Method for Electric Wheelchairs Based on a Multi-Layered Non-Contact Impedance Model*
Haruna Kokubo, Taro Shibanoki (Ibaraki University, Japan), Takaaki Chin (Hyogo Rehabilitation Center, Japan), and Toshio Tsuji (Hiroshima University, Japan)

GS1-2   *A Voice Signal-Based Manipulation Method for the Bio-Remote Environment Control System Based on Candidate Word Discriminations*
Taro Shibanoki (Ibaraki University, Japan), Go Nakamura, Takaki Chin (Hyogo Rehabilitation Center, Japan), and Toshio Tsuji (Hiroshima University)

GS1-3   *Experiments on classification of electroencephalography (EEG) signals in imagination of direction using Stacked Autoencoder*
Kenta Tomonaga, Takuya Hayakawa, Jun Kobayashi (Kyushu Institute of Technology, Japan)

14:20-15:20 OS8 Multiagent systems and Reality Mining (4)
Chair: Masao Kubo (National Defense Academy, Japan)
Co-Chair: Saori Iwanaga (Japan Coast Guard Academy, Japan)

OS8-1   *Influence of Partner Selection on Functional Differentiation:*
Emergence of Diversity by Isolated Interaction and Preference Change
Saori Iwanaga (Japan Coast Guard Academy, Japan),
Akira Namatame **(**National Defense Academy, Japan*)*

OS8-2   *Beacon-based tourist information system to identify visiting trends of tourists*
Akihiro Yamaguchi[1], Masashi Hashimoto[1], Kiyohiro Urata[1], Yu Tanigawa[1], Tetsuya Nagaie[1], Toshitaka Maki[1], Toshihiko Wakahara[1], Akihisa Kodate[2], Toru Kobayashi[3] and Noboru Sonehara[4] ([1] Fukuoka Institute of Technology, Japan) ([2] Tsuda College, Japan) ([3] Nagasaki University, Japan) ([4] National Institute of Informatics, Japan)

OS8-3   *Analysis of Survey on Employment Trends*
Masao Kubo (National Defense Academy, Japan), Hiroshi Sato (National Defense Academy, Japan), Akihiro Yamaguchi (Fukuoka Institute of Technology, Japan), Yuji Aruka (Chuo University, Japan)

OS8-4   *Direction switch behavior to enclose a target*
Masao Kubo, Nhuhai Phung, Hiroshi Sato (National Defense Academy, Japan),

16:10-17:10 GS4 Biological Systems (4)
Chair:

GS4-1   *Force and Motion Analysis of larval zebrafish (Danio rerio) using a body dynamics model*
Naohisa Mukaidani[1], Zu Soh[1], Shinichi Higashijima[2], Toshio Tsuji[1]   ([1]Hiroshima University, Japan, [2]National Institutes of Natural Sciences, Okazaki Institute for Integrative Bioscience, National Institute for Physiological Sciences, Japan)

GS4-2   *Behavior Analysis on Boolean and ODE models for Extension of Genetic Toggle Switch from Bi-Stable to Tri-stable.*
Masashi Kubota, Manabu Sugii, Hiroshi Matsuno (Yamaguchi University, Japan)

GS4-3   *Boolean modeling of mammalian cell cycle and cancer pathways*
Hideaki Tanaka, Hiroshi Matsuno, Adrien Fauré(Yamaguchi University, Japan)

GS4-4   *An Estimation Method for Environmental Friction Based on Body Dynamic Model of Caenorhabditis elegans*
Zu Soh (Hiroshima University, Japan), Michiyo Suzuki (National Institutes for Quantum and Radiological Science and Technology, Japan), Toshio Tsuji (Hiroshima University, Japan)

January 22 (Sunday)

08:50-Registration
Fountain Room (A1) 2nd F
9:10-10:25 OS10 Biological Signal Sensing Technology, Device and Its Applications (5)
Chair: Hiroki Tamura (University of Miyazaki, Japan)
Co-Chair: Koichi Tanno (University of Miyazaki, Japan)

OS10-1   *Mouse Cursor-like Control System in Consideration of the DC-EOG Signals using EOG-sEMG Human Interface*
Mingmin Yan, Yu Cheng, Keiko Sakurai, Hiroki Tamura, Koichi Tanno
(University of Miyazaki, Japan)

OS10-2   *A Study on Eyes Tracking Method using Analysis of Electrooculogram Signals*
Keiko Sakurai, Mingmin Yan, Hiroki Tamura, Koichi Tanno (University of Miyazaki, Japan)

OS10-3   *Development of Diagnosis Evaluation System of Facial Nerve Paralysis Using sEMG*
Shogo Okazaki, Misaki Syoichizono, Hiroki Tamura, Takahiro Nakashima, Eiji Kato,
Tetsuya Tono (University of Miyazaki)

OS10-4   *High CMRR and Wideband Current Feedback Instrumentation Amplifier Using Current Conveyors*
Shota Mago, Hiroki Tamura, Koichi Tanno (University of Miyazaki, Japan)

OS10-5   *Voltage Rectifier Circuit with Voltage Doubler Using New Active Diode*
Masayuki Uchihara, Hiroki Tamura, Kochi Tanno (University of Miyazaki, Japan)

10:40-11:40 Plenary Speech PS2
Chair: Makoto Sakamoto (University of Miyazaki, Japan)
PS2 *Realistic Visualization of Complex Systems such as Natural Phenomena based on Particle Behaver*
Tomoyuki Nishita (Hiroshima Shudo University/UEI research)

13:00-13:50 Invited Session IS-5
Chair: Takao Ito (Hiroshima University, Japan)
IS-5 *Towards Unified Human-Robotic Societies*
Peter Sapaty (Academy of Sciences, Ukraine), Masanori Sugisaka (ALife Robotics, Japan)
Takao Ito (Hiroshima University, Japan)

14:10-15:10 OS18 Advanced Management and Technology (4)
Chair: Kensuke Ogata (University of Nagasaki, Japan)
Co-Chair: Takao Ito (Hiroshima University, Japan)

OS18-1 *Development of English Text for the engineers to preserve the environment of North-East Asia*
Yuji Minami, Kenji Fukuchi, Shinya Tagawa (National Institute of Technology, Ube, Japan)

OS18-2 *Measuring Fragility and its Implications in Networked Systems*
Tsutomu Ito*, Katsuhiko Takahashi, Katsumi Morikawa, Takao Ito (Hiroshima University, Japan), Rajiv Mehta (New Jersey Institute of Technology, USA), Seigo Matsuno (Ube National College of Technology, Japan), Makoto Sakamoto (University of Miyazaki, Japan)

OS18-3 *A Formation of Standard Setter to Transplant Global Standards into Domestic Institution*
Kensuke Ogata (University of Nagasaki, Japan)

OS18-4 *A Comparison Study on the Vertical Integration and Horizontal Specialization of Chinese ICT Companies*
Yunju Chen (Shiga University, Japan), Yousin Park (Prefectural University of Hiroshima, Japan) Iori Nakaoka (National Institute of Technology, Ube College, Japan)

15:30-16:15 GS10 Reinforcement & Evolutionary Computations (3)
Chair:

GS10-1 *The Optimized Function Selection Using Wolf Algorithm for Classification*
Duangjai Jitkongchuen, Worapat Paireekreng (Dhurakij Pundit University, Thailand)

GS10-2 *Tell Agent Where to Go: Human Coaching for Accelerating Reinforcement Learning*
Nakarin Suppakun[1], Suriya Natsupakpong[2], and Thavida Maneewarn[3]
(Mongkut's University of Technology Thonburi, Thailand)

GS10-3 *Fall Risk Reduction for Elderly Using Mobile Robots Based on the Deep Reinforcement Learning*
Takaaki Namba (Nagoya University, Japan)

Orchard Room (A2) 2nd F, N
9:10-10:10 OS19 Kansei Engineering and Applications (4)
Chair: Tetsuo Hattori (Kagawa University)
Co-Chair: Hiromich Kawano (NTT AT)

OS19-1   *Histogram Matching Based on Gaussian Distribution Using Regression Analysis Variance Estimation*
Yusuke Kawakami (DynaxT Co., Ltd., Japan), Tetsuo Hattori, Yoshiro Imai, Kazuaki Ando,
Yo Horikawa (Kagawa University, Japan)
R. P. C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

OS19-2   *Histogram Matching Based on Gaussian Distribution Using Variance Estimation -- Comparison between Curvature Computation and Regression Analysis –*
Yusuke Kawakami (DynaxT Co., Ltd., Japan), Tetsuo Hattori, Yoshiro Imai, Kazuaki Ando,
Yo Horikawa (Kagawa University, Japan)
R. P. C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

OS19-3   *An Extended Optimal Stopping Method for Structural Change Point Detection Problem*
Yoshihide Koyama, Tetsuo Hattori, Yoshiro Imai, Yo Horikawa, Hiromichi Kawano*,
Yusuke Kawakami** (Kagawa University, Kagawa, Japan, *NTT advanced technology
Company Ltd, Japan, ** DynaxT Co., Ltd., Japan)

OS19-4   *A Study of Sentimental Value Analysis for Tweeting Message*
Shunsuke Doi*, Shinya Hara*, Yoshiro Imai*, Yusuke Kawakami** and Tetsuo Hattori*
(* Kagawa University, Japan, **DynaxT Co., Ltd., Japan)

14:10-15:10 OS17 Natural Computing and Biology (4)
Chair: Marion Oswald (The Vienna University of Technology, Austria)
Co-Chair: Yasuhiro Suzuki (Graduate School of Information Science, Nagoya University, Japan)

OS17-1   *Molecular Artificial Intelligence by using DNA reactions*
Yasuhiro Suzuki, Rie Taniguchi (Nagoya University, Japan)

OS17-2   *Neural Networks by using Self-Reinforcement Reactions*
Yasuhiro Suzuki (Nagoya University, Japan)

OS17-3   *Artificial Chemistry by Sound Waves*
Yasuhiro Suzuki (Nagoya University, Japan)

OS17-4   *Variants of spiking neural P systems with energy control*
Rudolf Freund, Marion Oswald (TU Wien, Vienna, Austria)

15:30-16:15 GS3 Automated Guided Vehicles II (3)
Chair:

GS3-1   *Motion Improvement of Four-Wheeled Omnidirectional Mobile Robots for Indoor Terrain*
Amornphun Phunopas[1] and, Shinichi Inoue[2] ([1]King Mongkut's University of Technology North Bangkok, Thailand, [2]Kyushu Institute of Technology, Japan)

GS3-2   *An Improved Algorithm for Obstacle Avoidance by Follow the gap method combined Potential Field*
Chakhrit La-orworrakhun, Suriya Natsupakpong (King Mongkut's University Technology Thonburi, Thailand)

GS3-3   *Study on the target positioning for an Omni-directional 3 DOF mobile manipulator based on machine vision*
Jiwu Wang, Yao Du, Wensheng Xu (Beijing Jiaotong University, China)
Masanori Sugisaka (ALife Robotics Corporation Ltd., Japan and Open University, United Kingdom)

Orchard Room (A3) 2nd F, S
9:10-10:25 OS1 Informational Narratology and Automated Content Generation (5)
Chair: Takashi Ogata (Iwate Prefectural University, Japan)
Co-Chair: Yoji Kawamura (Kindai University, Japan)

OS1-1   *Informational Narratology and Automated Content Generation*
Takashi Ogata (Iwate Prefectural University, Japan), Yoji Kawamura (Kindai University, Japan)
Akihito Kanai (Hosei University, Japan)

OS1-2   *Analyzing Multiple Narrative Structures of Kabuki based on the Frameworks of Narrative Generation Systems*
Takashi Ogata (Iwate Prefectural University, Japan)

OS1-3   *Rhetoric of Commercial Film and the Response of Viewers*
Yoji Kawamura (Kindai University, Japan)

OS1-4   *Comparison Between Variational Autoencoder and Encodder-Decoder Models for Short Conversation*
Shin Asakawa (Tokyo Women's Christian University, Japan)
Takashi Ogata (Iwate Prefectural University, Japan)

OS1-5   *Changing and Transforming a Story for a Framework of an Automatic Narrative Generation Game*
Jumpei Ono and Takashi Ogata (Iwate Prefectural University, Japan)

14:10-15:10 OS12 Machine Learning and Its Applications (4)
Chair: Kunikazu Kobayashi (Aichi Prefectural University, Japan)
Co-Chair: Shingo Mabu (Yamaguchi University, Japan)

OS12-1   *A Rule-Based Classification System Enhanced by Multi-Objective Genetic Algorithm*
Kenzoh Azakami, Shingo Mabu, Masanao Obayashi, Takashi Kuremoto
(Yamaguchi University, Japan)

OS12-2   *A Method of Feature Extraction for EEG Signals Recognition using by ROC curve*
Takashi Kuremoto, Yuki Baba, Masanao Obayashi, Shingo Mabu
(Yamaguchi University, Japan)
  Kunikazu Kobayashi (Aichi Prefectural University, Japan)

OS12-3   *Forecasting Real Time Series Data using Deep Belief Net and Reinforcement Learning*
Takaomi Hirata, Takashi Kuremoto, Masanao Obayashi, Shingo Mabu
(Yamaguchi University, Japan), Kunikazu Kobayashi (Aichi Prefectural University, Japan)

OS12-4   *Improvement of Robot's Self-localization by Using Observer View Positional Information*
Yo Aizawa, Takuo Suzuki, and Kunikazu Kobayashi (Aichi Prefectural University, Japan)

15:30-16:45 OS21 Computer Science and Information Processing (5)
Chair: Makoto Sakamoto (University of Miyazaki, Japan)
Co-Chair: Yu-an Zhang (Qinghai University, China)

OS21-1   *Consideration on the Recognizability of Three-Dimensional Patterns*
Chongyang Sun[1], Makoto Sakamoto[2], Makoto Nagatomo[3], Yu-an Zhang[2], Shinnosuke Yano[1], Satoshi Ikeda[2], Takao Ito[4], Tsutomu Ito[4], Yasuo Uchida[5], Tsunehiro Yoshinaga[6], ([1, 2, 3] University of Miyazaki, Japan), ([4] Hiroshima University, Japan), ([5] Ube National College of Technology, Japan), ([6] Tokuyama college of Technology, Japan)

OS21-2   *Some Properties of Four-Dimensional Homogeneous Systolic Pyramid Automata*
Makoto Nagatomo[1], Makoto Sakamoto[2], Yu-an Zhang[2], Chongyang Sun[3], Shinnosuke Yano[3], Satoshi Ikeda[2], Takao Ito[4], Tsutomu Ito[4], Yasuo Uchida[5], Tsunehiro Yoshinaga[6] ([1, 2, 3] University of Miyazaki, Japan) ([4] Hiroshima University, Japan) ([5]Ube National College of Technology, Japan) ([6] Tokuyama college of Technology, Japan)

OS21-3   *Reduction of the search space to find perfect play of 6×6 board Othello*
Yuki Takeshita[1], Makoto Sakamoto[1], Takao Ito[2], Tsutomu Ito[2], Satoshi Ikeda[3]
([1]University of Miyazaki, [2]Hiroshima University, Japan)

OS21-4   *A comparative study on the delisting ratings of firms from the UN Global Compact in the international management environment*
Kanako Negishi (National Institute of Technology, Ube college, Japan)

OS21-5   *Application of ViSC to the Natural Grazing in Qinghai Tibet Plateau*
Cheng-shui Niu[1], Bing-fen Li[1], Yu-an Zhang[1], Makoto Sakamoto[2] ([1]Qinghai University, P.R. China, [2]University of Miyazaki, Japan)

Farewell Party

GS11 Others (12)

GS11-1   *Clinical Evaluation of UR-System-PARKO for Recovery of Motor Function of Severe Plegic Hand after Stroke*
Hirofumi Tanabe (Shonan University of Medical Sciences, Japan)
Yoshifumi Morita (Nagoya Institute of Technology, Japan)

GS11-2   *A Piston Finger Device for Restoring the Motor Function of Chronic Plegic Fingers: Analysis of the Piston Finger Technique*
Mengsu Wang (Nagoya Institute of Technology: Nitech, Japan)
Hirofumi Tanabe (Shonan University of Medical Sciences, Japan)
Kenji Ooka (Nitech, Japan), Yoshifumi Morita (Nitech, Japan)

GS11-3   *Verifying the Sleep-Inducing Effect of a Mother's Rocking Motion in Adults*
Hiroaki Shibagaki, Keishi Ashida, Yoshifumi Morita (Nagoya Institute of Technology, Japan),
Ryojun Ikeura (Mie University, Japan) and Kiyoko Yokoyama (Nagoya City University, Japan)

GS11-4   *Design of Automated Real-Time BCI Application Using EEG Signals*
Chong Yeh Sai, Norrima Mokhtar, Hamzah Arof, Masahiro Iwahashi
(University of Malaya, Malaysia / Nagaoka University of Technology, Japan)

GS11-5   *A Hybrid Simulated Kalman Filter - Gravitational Search Algorithm (SKF-GSA)*
Badaruddin Muhammad, Zuwairie Ibrahim, Mohd Falfazli Mat Jusof (Universiti Malaysia Pahang, Malaysia), Nor Hidayati Abdul Aziz, Nor Azlina Ab. Aziz (Multimedia University, Malaysia), Norrima Mokhtar (University of Malaya, Malaysia)

GS11-6   *Simulated Kalman Filter with Randomized Q and R Parameters*
Nor Hidayati Abdul Aziz, Nor Azlina Ab. Aziz (Multimedia University, Malaysia)
Zuwairie Ibrahim, Saifudin Razali, Mohd Falfazli Mat Jusof (Universiti Malaysia Pahang, Malaysia), Khairul Hamimah Abas, Mohd Saberi Mohamad (Universiti Teknologi Malaysia, Malaysia), Norrima Mokhtar (University of Malaya, Malaysia)

GS11-7   *Real Detection of 3D Human Hand Orientation Based Morphology*
Abadal-Salam T. Hussain, Hazry D., Waleed A. Oraibi, M.S Jawad, Zuradzman M. Razlan,
A. Wesam Al-Mufti, S. Faiz Ahmed, Taha A. Taha, Khairunizam WAN, Shahriman A.B
(Universiti Malaysia Perlis, Malaysia)

GS11-8   *Multilevel Non-Inverting Inverter Based Smart Green Charger System*
Abadal-Salam T. Hussain, Waleed A. Oraibi, Hazry D, Zuradzman M. Razlan, S. Faiz Ahmed,
Taha A. Taha, Khairunizam WAN & Shahriman AB (Universiti Malaysia Perlis, Malaysia)

GS11-9   *Design A New Model of Unmanned Aerial Vehicle Quadrotor Using The Variation in The Length of The Arm*
Yasameen Kamil, D. Hazry, Khairunizam Wan, Zuradzman M. Razlan, Shahriman AB
(Universiti Malaysia Perlis, Malaysia)

GS11-10   *Development of Automatic Take Off and Smooth Landing Control System for Quadrotor UAV*
Syed. F. Ahmed (Universiti Kuala Lumpur, British Malaysian Institute, Malaysia, Universiti Malaysia Perlis, Malaysia), D. Hazry (Universiti Malaysia Perlis, Malaysia), Kushsairy Kadir (University Kuala Lumpur, British Malaysian Institute, Malaysia), Abadal Salam T. Hussain, Zuradzman M. Razlan, Shahriman AB (Universiti Malaysia Perlis, Malaysia)

GS11-11   *Auto Pilot Ship Heading Angle Control Using Adaptive Control Algorithm*
Abadal-Salam T. Hussain, Hazry D., S. Faiz Ahmed, Wail A. A. Alward, Zuradzman M. Razlan & Taha A. Taha (Universiti Malaysia Perlis, Malaysia)

GS11-12   *Classification of Hippocampal Region using Extreme Learning Machine*
Muhammad Hafiz Md Zaini, Mohd Ibrahim Shapiai (Universiti Teknologi Malaysia)
Ahmad Rithauddin Mohamed (Hospital Kuala Lumpur)
Norrima Mokhtar (University of Malaya), Zuwairie Ibrahim (Universiti Malaysia Pahang)

PS abstracts
PS1 A New Tool to Access Deep-Sea Floor "Sampling-AUV"

Kazuo Ishii, Takashi Sonoda, Yuya Nishida, Shinsuke Yasukawa and Tamaki Ura (Kyushu Institute of Technology, Japan)

Underwater robot is one of the important research tools to explore deep-sea. Especially, Autonomous Underwater Vehicles (AUVs) attract attentions as new tools because they are un-tethered and suitable for wide area observation. As the next generation AUV, we have been developing a Sampling-AUV that can dive into deep-sea and bring back marine creatures using a mounted manipulator. In the mission, the AUV transmits the deep-sea floor images to the support ship using acoustic communication, and the operator selects the marine creatures to sample and bring back them. In this talk, we introduce the new AUV, the underwater manipulator and image processing techniques for sampling.

PS2 Realistic Visualization of Complex Systems such as Natural Phenomena based on Particle Behaver

Tomoyuki Nishita (Hiroshima Shudo University/UEI research)

Computer graphics (CG) is very useful tool for visualization of scientific simulation, computer aided design, arts, education, and games. Researches on complex systems and AI (acritical intelligence) including artificial life also become popular recently.   Complex systems is a field of science studying how parts of a system give rise to the collective behaviors of the system, and how the system interacts with its environment. Examples are Earth's global climate, organisms, social organization, a living cell, and ultimately the entire universe. In complex systems, neural network, cellar automation, fractal, chaos dynamics, and GA are useful techniques.   These are also used in CG. The purpose of CG is reality with interactive speed. In recent years, point primitives have received growing attention in CG. The particle system refers to CG technique to simulate certain fuzzy phenomena. My talk also includes pioneers of CG, my research history, and CG application related to AI.
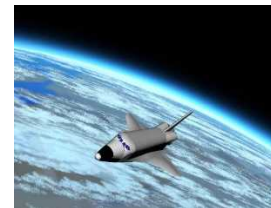
IS abstracts
IS-1 The future of Robotics Technology.

Luigi Pagliarini[1,2], Henrik Hautop Lund[1]
([1] Technical University of Denmark, Denmark, [2] Academy of Fine Arts of Macerata, Italy)

In the last decade the robotics industry has created millions of additional jobs led by consumer electronics and the electric vehicle industry, and by 2020, robotics will be a $100 billion worth industry, as big as the tourism industry.. For example, the rehabilitation robot market has grown 10 times between 2010 and 2016, thanks to advancements in rehab/therapy robots, active prostheses, exoskeletons, and wearable robotics. In short, the very next decade robotics will become vital components in a number of applications and robots paired with AI will be able to perform complex actions that are capable of learning from humans, driving the intelligent automation phenomenon. Therefore, in this paper we try to depict the direction and the fields of application of such important sector of future markets, and scientific research.
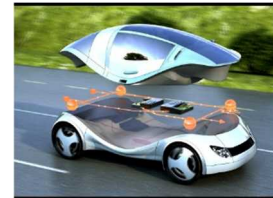
IS-2 Playware ABC: Engineering Play for Everybody

Henrik Hautop Lund (Technical University of Denmark, Denmark)

This paper describes the Playware ABC concept, and how it allows anybody, anywhere, anytime to be building bodies and brains, which facilitates users to construct, combine and create. The Playware ABC concept focuses engineering and IT system development on creating solutions that are usable by all kinds of users and contexts. The result becomes solutions, often based on modular technologies that are highly flexible and adaptable to different contexts, users, and applications.

IS-3 A combination of Machine Learning and Cerebellar models for the Motor Control and Learning of a Modular Robot

Ismael Baira Ojeda, Silvia Tolu, Moisés Pachecho, David Johan Christensen, Henrik Hautop Lund
(Technical University of Denmark, Denmark)

We scaled up a bio-inspired control architecture for the motor control and motor learning of a real modular robot. In our approach, the Locally Weighted Projection Regression algorithm (LWPR) and a cerebellar microcircuit coexist, forming a Unit Learning Machine. The LWPR optimizes the input space and learns the internal model of a single robot module to command the robot to follow a desired trajectory with its end-effector. The cerebellar microcircuit refines the LWPR output delivering corrective commands. We contrasted distinct cerebellar circuits including analytical models and spiking models implemented on the SpiNNaker platform, showing promising performance and robustness results.
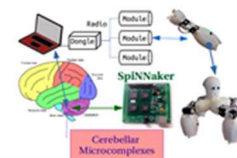
IS-4 Playware as a Disruptive Technology for Global Development

Henrik Hautop Lund (Technical University of Denmark, Denmark)

This paper describes the Playware ABC concept, and how it allows anybody, anywhere, anytime to be building bodies and brains, which facilitates users to construct, combine and create. The Playware ABC concept focuses engineering and IT system development on creating solutions that are usable by all kinds of users and contexts in our globalized society. The result becomes solutions that are highly flexible and adaptable to different contexts, users, and applications. The paper gives examples of how playware becomes a disruptive technology for global development, for instance in the health sector.

IS-5 Towards Unified Human-Robotic Societies

Peter Sapaty (Academy of Sciences, Ukraine), Masanori Sugisaka (ALife Robotics, Japan)

Takao Ito (Hiroshima University, Japan)

Large numbers of robotic facilities are accumulated worldwide, but existing robots still remain specialized devices rather than intelligent collaborators for humans. To efficiently integrate massive robotics into human societies, more general and universal approaches are needed. The presentation will reveal higher-level, semantic, model supported by Spatial Grasp Language (SGL) in which top operations and decisions in distributed spaces are expressed in extremely compact form, with traditional system management shifted to automatic SGL interpretation. Communicating SGL interpreters associated with humans and robots allow us to organize goal driven teams up to entire societies operating under unified control. Presentation will exhibit numerous scenarios in SGL from most critical applications.
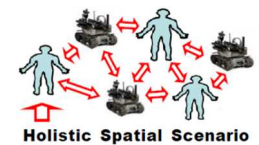
OS abstracts
OS1 Informational Narratology and Automated Content Generation (5)
OS1-1 Informational Narratology and Automated Content Generation
Takashi Ogata (Iwate Prefectural University, Japan) Yoji Kawamura (Kindai University, Japan)
Akihito Kanai (Hosei University, Japan)

Authors have been proposing a new concept called "informational narratology" or "information narratology". In this concept, we integrate narratological studies including various literary theories into information technologies, such as AI and cognitive science to mainly design and develop systems that automatically generate, create or produce digital narrative contents including a variety of existing or future genres. Under this idea's framework, the three authors respectively design and develop narrative generation systems (Ogata), advertising image processing systems (Kawamura), and narrative film processing systems (Kanai). In this paper, we propose the concept or idea of informational narratology and introduce the above three researches as concert approaches to the informational narratology.
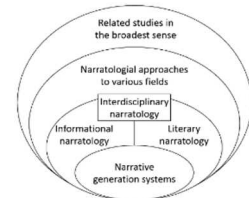
OS1-2 Analyzing Multiple Narrative Structures of *Kabuki* based on the Frameworks of Narrative Generation Systems
Takashi Ogata (Iwate Prefectural University, Japan)

Although *kabuki* is a genre of, so to speak, traditional performing arts, it has many characteristics, as a contemporary genre including various elements such as narrative, drama, dance, music, and so on, that can contribute to the design and development of digital narrative generation studies. Previously, we have surveyed and analyzed *kabuki*'s narrative structures, the generation or production and reception or consumption process from the viewpoint of the multiple narrative structures model. In the multiple narrative structures model of *kabuki*, we mean that the entire structure of *kabuki* is constructed through multiple usages of relating information. For example, the element of a "person" in *kabuki* is divided into a "character" in a narrative work, the existence of an actor with a historical flow and a name as the actor, and a real human with a true name. And this multiplicity, for instance, give a kind of multiple and deep characteristic to a person. Based on this previous studies, in this presentation, we show a method that bridges this *kabuki* analysis to system design through our two narrative generation systems: "Integrated Narrative Generation System (INGS)" and "Geino Information System (GIS)".
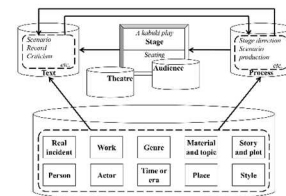
OS1-3 Rhetoric of Commercial Film and the Response of Viewers
Yoji Kawamura (Kindai University, Japan)

In this paper, firstly the way of thinking of commercial film techniques and rhetoric is shown. Next, based on the various investigations, the relationships between rhetoric of commercial film and the response of viewers are summarized. Then, by using the summarized relationship as a rule, the expression know-how of commercial film is extracted, and how to make information system is considered. By introducing a framework called "overall rhetorical type" as a combination of commercial film techniques and using the fact that there is a correlation between the overall rhetorical type and the viewer's response (favorable factor, acceptance image), it is possible to build an information system to promote the interest and purchase willingness of the viewers.

OS1-4 Comparison Between Variational Autoencoder and Encodder-Decoder Models for Short Conversation

Shin Asakawa (Tokyo Women's Christian University, Japan)
Takashi Ogata (Iwate Prefectural University, Japan)

Conversational modeling is an important task in language understanding and generation. Recent models in this area have improved their performances based on recurrent neural network model (RNN). RNN models can generate sentenses and conversation. It is not always restricted to any specified handcrafted rules. The variational autoencoder and encoder-decoder models might be considered as a promissing model among them. They were able to extract knowledge from the training dataset. Samples from the prior over these sentence representations produced diverse and well-formed sentences through simple deterministic decoding. We tried to compare them with several different data set and to reveal underlying mechanism between them. By examining paths through latent space, we are able to generate coherent novel sentences that interpolate between known sentences. Our preliminary results suggest that optimizing the wrong objective function might play a role producing some kinds of convsersation.
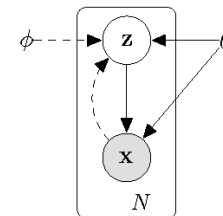
OS1-5 Changing and Transforming a Story for a Framework of an Automatic Narrative Generation Game

Jumpei Ono and Takashi Ogata (Iwate Prefectural University, Japan)

Authors has proposed an idea of a game system including an automatic story generation function based on tabletop-top role playing game (TRPG). In this idea, stories are generated or transformed through the communication between a "game manager (GM)" who controls story generation and "Players (PLs)" who change and transform the content of a story proposed by a GM. This paper focuses on the mechanism for changing and transforming a proposed story by a GM. In particular, this mechanism has various techniques from macro level techniques related to the entire structures of a story to micro level techniques related to the partial structures of a story. For instance, when a GM is a real human, these techniques in PLs who are computer agents can produce changed and transformed stories which the GM has not imagined originally.
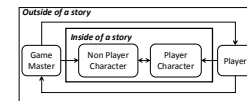
OS2 Intelligence Control Systems and Applications I (6)
OS2-1 Develop Low Cost IoT Module with Multi-Agent Method

Jr-Hung Guo, Kuo-Hsien Hsia, Kuo-Lan Su
(National Yunlin University of Science and Technology, Taiwan)

IOT (Internet of Thing) is a very hot topic recently, many of the important issues in the field of research. But to the conventional apparatus or systems and network connections, sometimes we need complex modifications or expensive costs. Therefore, this paper using the MCS-51 series single-chip integration of analog, digital signal input, and ETHERNET, WIFI and other communication interface, to develop general-purpose IoT modules. This module can be used to replace existing equipment or devices, or combination use with the original device. We also use the module in a Multi-Agent Method, we can ensure that the module in signal capture or communication failure can be replaced or assisted by other modules.
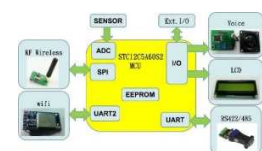
OS2-2 Based on Short Motion Paths and Artificial Intelligence Method for Chinese Chess Game

Chien-Ming Hung, Jr-Hung Guo, Kuo-Lan Su
(National Yunlin University of Science and Technology, Taiwan)

The article develops the decision rules to win each set of the Chinese chess game using evaluation algorithm and artificial intelligence method, and uses the mobile robot to be instead of the chess, and presents the movement scenarios using the shortest motion paths for mobile robots. User can play the Chinese chess game according to the game rules with the supervised computer. The supervised computer decides the optimal motion path to win the set using artificial intelligence method, and controls mobile robots according to the programmed motion paths of the chesses moving on the platform via wireless RF interface. We use enhanced A* searching algorithm to solve the shortest path problem of the assigned chess, and solve the collision problems of the motion paths for two mobile robots moving on the platform simultaneously. We implement a famous set to be called "wild horses run in farm" using the proposed method. First we use simulation method to display the motion paths of the assigned chesses for the player and the supervised computer. Then the supervised computer implements the simulation results on the chessboard platform using mobile robots. Mobile robots move on the chessboard platform according to the programmed motion paths and is guided to move on the centre line of the corridor, and avoid the obstacles (chesses), and detect the cross point of the platform using three reflective IR modules.
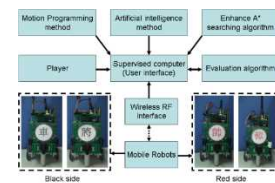
OS2-3 Design and Implementation of the SCARA Robot Arm

Jian-Fu Weng, Bo-Yi Li, Kuo-Lan Su (National Yunlin University of Science and Technology, Taiwan)

The article designs a four-joint robot arm using PLC-based control system. The control system is all in one device to be produced by the DELTA Company, and contain four axis controllers and drivers. The robot arm contains four AC servomotors, four driver devices and a vision system. The PLC-based controller also programs motion commands of the gripper to finish the assigned tasks using Ladder Diagram (LG), Function Block Diagram (FBD), Sequential Function Chart (SFC), Instruction List (LL) and Structure Test (ST). Each driver has been tuned the parameters of the PID controller for the robot arm. The human machine interface (HMI) is a touch panel to be used for the robot arm. Users can control the motion path of any joint on the user interface. In the experimental results, users can program English or Chinese words or plot assigned graphs on the human machine interface. The SCARA robot arm catches the pencil, and put down to touch the assigned position repeat on the platform, and identifies the precious of the robot arm, and catches various objects to put down the assigned positions.
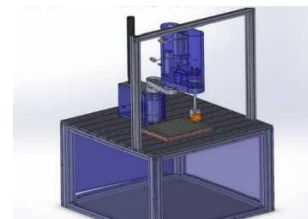
OS2-4 Transmission Power Control for Wireless Sensor Network

Kuo-Hsien Hsia[1], Chung-Wen Hung[2], Hsuan T. Chang, and Yuan-Hao Lai[2]

([1]Far East University, Taiwan) ([2]National Yunlin University of Science and Technology, Taiwan)

Wireless sensor networks can be widely applied for a security system or a smart home system. Since some of the wireless remote sensor nodes may be powered by energy storage devices such as batteries, it is a very important issue to transmit signals at lower power with the consideration of the communication effectiveness. In this paper, we will provide a fuzzy controller with two inputs and one output for received signal strength indicator (RSSI) and link quality indicator (LQI) to adjust transmission power suitably in order to maintaining a certain communication level with a reduced energy consumption. And we will divide the sampling period of a sensor node into four intervals so that the sensor node radio device does not in receiving or transmission status all the time. Hence the sensor node can adjust transmission power automatically and reduce sensor node power consumption. Experimental results show that the battery life can be extended to about 10 times for the designed sensor node comparing to a normal node.
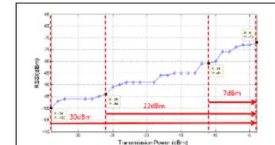
OS2-5 Mechanism of Autonomous Mowing Robot for Long Grass

Kuo-Hsien Hsia[1], Yao-Shing Huang[2], Kuo-Lan Su[2] and Jr-Hung Guo[2]

([1]Far East University, Taiwan)

([2]National Yunlin University of Science and Technology, Taiwan)

A land full of grass can be easily seen all over the world. For example, a golf course, a large playground, garden and waste plowed farmland and wild wasteland, all of above are full of grass. Almost all mowing work are operated by manpower, especially the long grass section. There have been some autonomous mowing robots for short grass up to now. However, there is almost no commodity for long grass mowing in the market. The main possible consideration may be the issue of safety. It is highly possible that a sharp mower blade may cause harm under the condition that the mower is not operated directly by a skilled person. In this paper, we will focus on the mechanism design for an autonomous mowing robot that can cut long grass safely. We will also outline the safety requirements for an autonomous mowing robot for long grass.
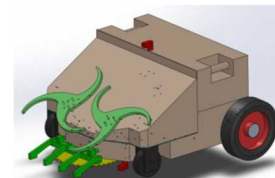
OS2-6 Design of Optimal Position Controller for Three-Phase Brushless DC Motor Applying Adaptive Sliding Mode Control

Tai-Huan Tsai, Mei-Yung Chen

(National Taiwan Normal University, Taiwan)

In this paper, we design an adaptive sliding mode controller which is applied on optimal position tracking of three-phase brushless DC motor. Consider the uncertainties and external disturbances of a three-phase brushless DC motor, we choose the sliding mode control (SMC) to be major one. Usually we can't figure out the motor's uncertainty, so we propose an adaptive control to tune the motor's uncertainty, that would be able to handle the unknown uncertainties and disturbances. Then we proof the stability of system by Lyapunov function, and the simulation results show excellent performance of this controller.

OS3 Intelligence Control Systems and Applications II (6)
OS3-1 Image Compression Using Hybrid Evolution Based Takagi-Sugeno Fuzzy Neural Network

[1]Chia-Nan Ko and [2]Ching-I Lee
([1,2] Nan Kai University of Technology)

This article proposes a model of hybrid evolution-based Takagi-Sugeno fuzzy neural networks (TSFNNs). The model is to research and analyze how to improve the efficiency of image compression. In the proposed model, the hybrid evolution method integrates the advantages of improved quantum-behaved particle swarm optimization, adaptive annealing learning, and mutation operation to train Takagi-Sugeno fuzzy neural networks. The proposed hybrid evolution-based quantum-behaved particle swarm optimization Takagi-Sugeno fuzzy neural networks (HEQPSO-TSFNNs) can improve the coding result around boundaries to enhance the coding efficiency of the lossless compression of images.
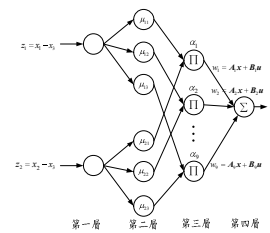
OS3-2 MQPSO Algorithm Based Fuzzy PID Control for a Pendubot System

[1]Li-Chun Lai, [2]Yu-Yi Fu, and [3]Chia-Nan Ko
([1] National Pingtung University, Taiwan)
([2,3] Nan Kai University of Technology, Taiwan)

In this study, a modified quantum-behaved particle swarm optimization (MQPSO) approach is proposed to design an optimal fuzzy PID controller for asymptotical stabilization of a pendubot system. In the fuzzy PID controller, parameters are determined by using MQPSO algorithm. The MQPSO method and other PSO methods are then applied to design an optimal fuzzy PID controller in a pendubot system. Comparing the simulation results, the feasibility of the MQPSO are verified.
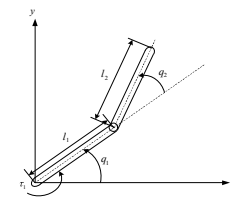
OS3-3 A Sensorless Ultra-High Speed Motor Driver

Chung-Wen Hung, Yan-Ting Yu, Bo-Kai Huang and Wei-Lung Mao
(National Yunlin University of Science and Technology, Taiwan)

An ultra-high speed motor is important in machine tools. A speed sensor-less ultra-high speed motor driver is proposed in this paper. Due to cost, only few drivers build up a closed-loop control, which could improve driver's performance. Therefore, a sensor-less speed estimation for ultra-high speed motors is developed. The design and implementation of the driver and feedback circuits are detailed in this paper. And experimental results show that the proposed system is workable.
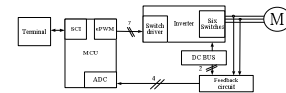
OS3-4 Android-Based Patrol Robot Featuring Automatic Vehicle Patrolling and Automatic Plate Recognition

Chian C. Ho, Shih-Jui Yang, Jian-Yuan Chen, Chang-Yun Chiang, and Hsin-Fu Chen
(National Yunlin University of Science and Technology, Taiwan)

This work develops an Android-based patrol robot featuring Automatic Vehicle Patrolling (AVP) and Automatic Plate Recognition (APR). The AVP feature integrates 3 novel methods, wheel-wheelcover-based AdaBoost wheel detection, contour-wheel-oriented vehicle approaching, and Ad-Hoc-based remote motion control. The APR feature integrates 4 novel methods, Wiener-deconvolution vertical edge enhancement, AdaBoost plus vertical-edge plate detection, vertical-edge horizontal-projection histogram-segmentation stain removal, and customized optical character recognition. Implementation results show the vehicle detection rate and plate recognition rate of the Android-based patrol robot are over 96% and over 94%, respectively, under various scene conditions. On the other hand, the average execution time of AVP and APR of the Android-based patrol robot takes at most 8 second per round and at most 0.8 second per frame, respectively.
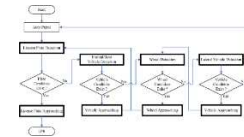
OS3-5 Adaptive CMAC Filter for Chaotic Time Series Prediction

Wei-Lung Mao, Suprapto, and Chung-Wen Hung
(National Yunlin University of Science and Technology, Taiwan)

Chaotic signal is a natural phenomenon exhibiting in every condition of dynamical system. Chaotic signals are almost unpredictable, noise-like, uncertain and irregular behavior, yet they are very useful in numerous applications of signal processing. Due to their behaviors, the quest of a good method to model and analyze of the chaotic signal is very crucial. This paper present a novel strategy to analyze chaotic signal using the cerebellar model articulation controller (CMAC) network combined with evolutionary algorithms (EAs) such as biogeography-based optimization (BBO), genetic algorithm (GA) and particle swarm optimization (PSO). Mackey-glass chaotic signal time series is tested and demonstrated by the conventional and the proposed algorithms. They are compared with each other to determine the optimal filtering and prediction. The result demonstrated that the CMAC combined with EAs could filter, predict and estimate chaotic signal time series well rather than the conventional methods. The best result of the algorithms tested for chaotic signal time series is the CMAC combined with BBO algorithm.
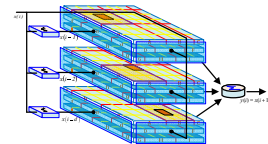
OS3-6 Surface Defect Detection for Anodized Aluminum Tube Based on Automatic Optical Inspection

Hsien-Huang P. Wu and Hsuan-Min Sun (National Yunlin University of Science and Technology, Taiwan)

This paper proposed using the automated optical inspection (AOI) technology to develop a system which can automatically detect and classify defects for the shock absorber tube (SAT) made with steel. It is a high economic product which requires high-quality even under mass production. Nevertheless, the current manual quality-inspection is not only error-prone but also very manpower demanding. Due to the strong reflective property of the surface, as well as its various sizes and subtle flaws, it is very difficult to take good quality image for automatic inspection. However, based on the surface properties and shape of the SAT, lighting and proper structure combined with line scan camera have been designed to acquire image with good quality. Methods were proposed to detect various kinds of defects, and experimental results show that all the defects can be detected in real time. We believe the proposed system can greatly increase the efficiency and accuracy of defect detection and decrease the cost of manual labor.
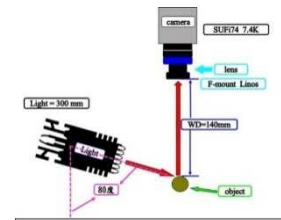
OS4 Human-In-The-Loop (HITL) Systems (4)
OS4-1 Feature Extraction for Digging Operation of Excavator

Kazushige Koiwai, Toru Yamamoto (Hiroshima University, Japan), Takao Nanjo, Yoichiro Yamazaki, Yoshiaki Fujimoto (KOBELCO Construction Machinery CO., LTD. , Japan)

Japanese Ministry of Land, Infrastructure, Transport and Tourism pushes a policy of "i-construction". The technologies of Information and Communication Technology (ICT), Internet of Things (IoT), Big Data, and AI are applied to some construction equipments based on the policy. As the result, manpower-saving are achieved. However, the manpower is still required continuously in the construction field because skilled operators are needed for complicated conditions. Those skilled operators who have the unique technique are reduced in these days. In this study, the skill difference of digging operations between the skilled operator and the novice operator are evaluated based on the view of the control engineering. The database driven human skill based PID controller is applied to the skill evaluation for the digging operation. In considering a human to be a controller, the skill can be evaluated numerically. Moreover, it would be possible to apply the skill improvement for the operation.

OS4-2 Design of a Data-Oriented Kansei Feedback System

Takuya Kinoshita, Toru Yamamoto (Hiroshima University, Japan)

In the development of the aging society, it is important for patients with hemiplegia to introduce the adaptive welfare equipment. However, it is difficult to support them by using general welfare equipment because there are a lot of individual disabilities. Therefore, an adaptive welfare equipment is needed in near future. However, it is very difficult to determine the suitable reference signal for each person. In this study, the design of a data-oriented cascade control system based on Kansei is proposed. In the proposed control system, there are two controllers which are a data-driven controller and a fixed controller. In particular, a data-driven controller is for a human and it can calculate the suitable reference signal of a welfare equipment based on Kansei. The effectiveness of the proposed scheme is verified by simulation results.
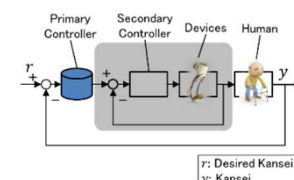
OS4-3 Parameter Estimation of Skill Evaluation Model

Kazuo Kawada, Toru Yamamoto (Hiroshima University, Japan)

n this study, the aim is to construct "teacher-student model" for optimal skill acquisition. To support the optimal skill acquisition, modeling and estimation of individual learning process are very important. The first-order system with dead time (system gain K, time constant T, and dead time L) is introduced as individual learning process model based the control engineering approach. These system parameters included in the learning process model are estimated by using a real-coded genetic algorithm (GA). In order to evaluate the effectiveness of the proposed scheme, it is employed for the classification task of fastener components.
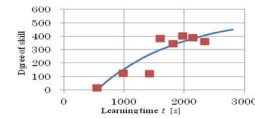
OS4-4 Human Skill Quantification for Excavator Operation using Random Forest

Hiromu Imaji, Kazushige Koiwai, Toru Yamamoto (Hiroshima University, Japan)
Koji Ueda, Yoichiro Yamazaki, Yoshiaki Fujimoto (KOBELCO Construction Machinery CO., LTD. , Japan)

In the construction field, the improvement of the work efficiency is one of important problems. However, the work efficiency using construction equipments is depend on their operation skills. Thus, in order to increase the work efficiency, operation skill is required to be quantitatively evaluated. In this study, the Random Forest (RF), one of machine learning method, is adopted as the quantitatively evaluation for the operation skill of construction equipment. Evaluated target is the operation on excavation to load onto a truck for a hydraulic excavator. The RF learns to classify some states by the pilot of expert's operation. States are defined as 'excavate', 'lift', 'dump', 'return' and 'rest'. The RF with the learning result of expert is applied to other operator's operation. It is revealed that the rate of 'rest' is related to their skill.
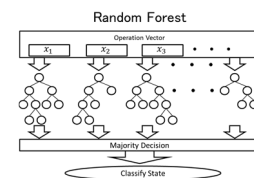
OS5 Human Interface and Content Security (5)

OS5-1 A Method for Secure Communication Using a Discrete Wavelet Transform for Audio Data and Improvement of Speaker Authentication

Kouhei Nishimura, Yasunari Yoshitomi, Taro Asada, Masayoshi Tabuse (Kyoto Prefectural University, Japan)

We developed a secure communication method using a discrete wavelet transform. Two users must both have a copy of the same piece of music to be able to communicate with each other. The music and the sender's message are encoded using the scaling coefficients obtained from a discrete wavelet transformation. The message receiver can produce the audio data similar to the sending user's speech using an inverse discrete wavelet transform, together with information on the difference between these two codes. For improving the speaker authentication accuracy, the quantization level for the scaling coefficients is increased. Furthermore, the amount of data sent to the message receiver is remarkably reduced exploiting the characteristic of those data.
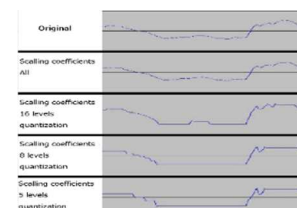
OS5-2 A Recipe Decision Support System Using Knowledge Information and Agent

Keita Saito, Taro Asada, Yasunari Yoshitomi, Ryota Kato, Masayoshi Tabuse
(Kyoto Prefectural University, Japan)

We have developed a system for recipe recommendation using collaborative filtering and impression words. As a human interface, we have adopted an agent named as MMDAgent. In the proposed system, the first recommendation process using collaborative filtering is terminated when no users in the reference list have the same preference of recommended recipe as that of a new user. Then, the second recommendation process finds the most similar recipe, by exploiting the scores for impression words, to those successfully recommended among recipes not recommended up to the moment. The recommendation accuracy of the proposed system was much better than that of random recommendation. As a final step, one recipe is selected from all successfully recommended recipes for the user by using the reputation for them in a database and interaction between the user and the agent.

OS5-3 A System for Analyzing Facial Expression and Verbal Response of a Person While Answering Interview Questions on Video

Taro Asada, Yasunari Yoshitomi, and Masayoshi Tabuse
(Kyoto Prefectural University, Japan)

We have developed a system for analyzing facial expressions of a person while answering interview questions on video. A video captured an answerer at an interview is analyzed using image processing software (OpenCV) and the previously proposed feature parameter (facial expression intensity), which is measured for an eye-part area in addition to the mouth-part area focused in our reported research. Moreover, the time to utterance of the answerer just after an interview question is measured for analyzing the mental state of the answerer. In our previously reported system for analyzing facial expression of a person during conversation with another person, facial expression intensity could be affected by (1) a conversation topic, (2) a partner and (3)the facial expression of the partner. In this study, all of (1), (2) and (3) are fixed by using an interview video. The experimental result shows the usefulness of the proposed system.
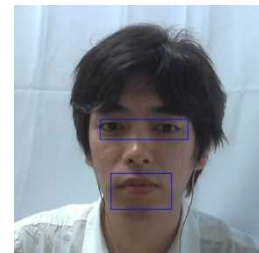
OS5-4 Real-Time System for Horizontal Asymmetry Analysis on Facial Expression and Its Visualization

Ryoichi Shimada, Taro Asada, Yasunari Yoshitomi, and Masayoshi Tabuse
(Kyoto Prefectural University, Japan)

We have been developing a real-time system for horizontal asymmetry analysis on facial expression and its visualization. The image signal input from web camera is analyzed by our real-time system using image processing software (OpenCV) and the feature parameter (facial expression intensity), which is separately measured for the left and right half regions in the mouth-part area. Our real-time system draws the graph expressing the facial expression intensity change using OpenCV. The experimental result suggests the usability of this system for a test where a real-time reaction of the facial expressions is one of important factors.
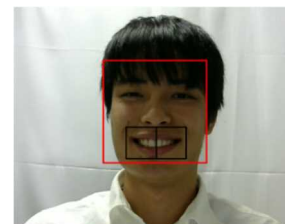
OS5-5 Development of Mouse System for Physically Disabled Person by Face Movement Using Kinect

Junpei Miyachi, Masayoshi Tabuse (Kyoto Prefectural University, Japan)

It is necessary to support of computer operation for a physically disabled person. One of the possible physical movements of the physically disabled person is facial movement. Recognition of facial movement of a person makes it possible to operate a computer. Furthermore without the adjustment for a user and adjustment for the distance from a user, it is possible to reduce the burden on a user. We developed a system to resolve these problems. In our system, Kinect is used to obtain the face direction and extract feature points of the face. Changing the face direction, we can move a mouse cursor. Recognizing an open mouth or closed eye, we can carry out an operation of mouse click. In this paper, we evaluated the effect on operability due to the face direction and recognition rate due to distance.
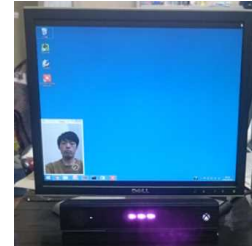
OS6 Software Development Support Method (6)
OS6-1 Development of a Tool for Extended Place/transition Net-Based Mutation Testing

Tomohiko Takagi[1], Shogo Morimoto[1], Tetsuro Katayama[2]
([1]Kagawa University, [2]University of Miyazaki, Japan)

This paper shows a tool for EPNBMT (Extended Place/transition Net-Based Mutation Testing) to evaluate and improve the quality of test cases for concurrent software. The tool consists of the following four functions: (1) an original EPN can be created to define the expected behavior of concurrent software under test, (2) mutant EPNs including intended failures can be created by applying mutation operators to the original EPN, (3) arbitrary test cases to be evaluated can be converted to execution paths on the original EPN, and (4) each mutant EPN can be executed by the converted test cases in order to calculate a mutation score. If the mutation score is not good, the test cases are improved based on mutant EPNs whose failures have not been detected.
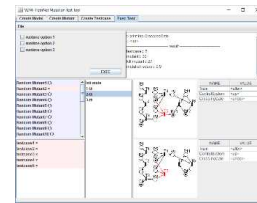
OS6-2 Improvement of Decision Table Automatic Generation Tool VDTable for let in Statement

Yinuo Huang*, Tetsuro Katayama* Yoshihiro Kita†, Hisaaki Yamaba*, Naonobu Okazaki*
(*University of Miyazaki, Japan, †Tokyo University of Technology, Japan)
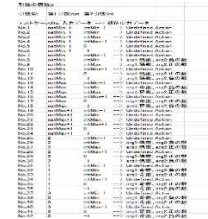
Formal methods, in software development, is one of the means to describe the specification strictly. On the other hand, the decision table is one of the testing techniques to exhaustively represent the logical combination included in software. The VDTable can automatically generate the decision table, from the specification written in specification description language VDM++ (VDM++ specification). But, the VDTable, since many VDM++ syntax is not corresponded, its usefulness is limited. To improve the usefulness, this paper expands VDTable. Specifically, VDTable is improved to be able to correspond to the statement "let in", which is one of the VDM++ syntax, that the existing VDTable does not support.

OS6-3 Prototype of Test Cases Automatic Generation Tool BWDM Based on Boundary Value Analysis with VDM++

Hiroki Tachiyama[*], Tetsuro Katayama[*] Yoshihiro Kita[†], Hisaaki Yamaba[*], Naonobu Okazaki[*]
(*University of Miyazaki, Japan, † Tokyo University of Technology, Japan)

As a method to eliminate the ambiguity and to write strictly specification, VDM++ (one of the Formal Methods) is proposed. However, it takes the time and effort of testers to design test cases and to carry out software testing, from specification written in VDM++.Therefore, to optimize testing process, we developed BWDM; the tool of automatic generation of test cases from VDM++ specification. BWDM analyzes boundary value of if-expressions and argument types in definition of functions. And, it generates test case automatically from a result of the analysis. This tool aims to optimize software testing process by both of automatically generation and designing test cases based on a boundary value analysis, which can detect statements that bugs seem to be included in.

OS6-4 Prototype of Refactoring Support Tool MCC Focusing on the Naming of Variables

Satoshi Tanoue[*], Tetsuro Katayama[*] Yoshihiro Kita[†], Hisaaki Yamaba[*], Naonobu Okazaki[*]
(*University of Miyazaki, Japan,†Tokyo University of Technology, Japan)

This research has implemented a prototype of refactoring support tool MCC(Make Clean Coder) which focuses on the naming of variables. This prototype helps to describe a clean code by static analysis for the source code written in C language. And, it can help to reduce factors that prevent programmers understanding the source code when they modify it by pointing out improper variable names. We applied some source codes written in C language to the prototype, and confirmed that it works properly. By using this prototype, because it can reduce reduction of time to understand the source code, programmers can shorten the coding time, lower the possibility of embedded bugs, and decrease in the time required to add functions.

OS6-5 Improvement of Transitions and Flow Visualization TFVIS for Exception Handling.

Takuya Sato*, Tetsuro Katayama*, Yoshihiro Kita[†], Hisaaki Yamaba*, Naonobu Okazaki*
*University of Miyazaki, Japan,†Tokyo University of Technology, Japan

In software development, it takes much time in debugging process. To find bugs in a program effectively, it's important to understand the dynamic behavior of the program. But it's difficult since the dynamic behavior of the program is generally invisible. So we developed TFVIS(transitions and flow visualization), which can visualize the dynamic behavior of Java programs. It provides visualization of data transitions in each method and flow of the whole program. But it's not useful because it visualizes only some control structures and expressions. We aim at the improvement of the usefulness by corresponding an unsupported structure. This paper focuses on Exception-handling, which is one of the feature of Java program, and especially corresponds to Try-Catch syntax.

OS6-6 Automatically Business Decision Making System for Software Developmentby using CMMI

Hnin Thandar Tun†, Tetsuro Katayama*, Kunihito Yamamori*, Khine Khine Oo†

(*University of Miyazaki, Japan, †University of Computer Studies, Myanmar)

In the current software development, business decision making system is important process to support the suggestive business goals automatically in a specified area or project. In this paper, we proposed the CMMI model that is used to define the business goals for monitoring and control measurements applied by GQM approach. This paper suggests the key processes of CMMI which is necessarily for support on business effective process improvement, needs design implementation, and needs techniques and tools for achieving the future targets of goals systematically. For this illustration purpose, we need to define the business data which will be defined goals by senior level management to come out business goals aligned with resources functionality.
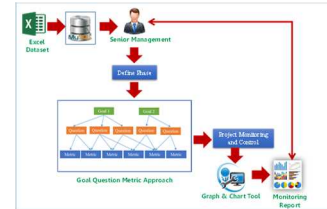
OS7 Advances in Marine Robotics and Applications (6)
OS7-1 Development of a Hydraulic Underwater Manipulator for Deep-Sea Survey AUV

Kazuo Ishii, Amir Ali Forough Nassiraei, Ivan Godler, Takashi Sonoda, Tharindu Weerakoon

(Kyushu Institute of Technology, Japan)

We are developing a group of AUVs whose mission is to capture underwater creatures or acquire in-situ biological samples in the deep sea. The AUV under developing has a hydraulic manipulator to capture the target creature, and sends underwater images that provide biologists (operators) with information to determine which creatures should be targeted and captured during the operation. In this paper, the concept and design of hydraulic actuator for 5-axis manipulator, and the mechanics of manipulator is proposed, and the experimental results of manipulator control at 10 and 20 M Pa pressure are shown.

OS7-2 Experiments of floatable UAV drone for wave dissipating block inspection(I)

Watanabe, Kazuho Mitsumura, Koshi Utsunomiya, Shiyun Takasaki (Tokai University, Japan)

Determination of underwater coordinates is important in such activities like underwater vehicle operation, installation of underwater structure and so on. The determination methods are using LBL, SSBL or an inertia navigation sensor, which are all very expensive. In his paper, a floating LBL concept is presented. The LBL system consists of at least three floating buoys each of which has a GPS, a pair of ultrasound transmitter and receiver, wireless communication device and a microcomputer board which controls the total procedure. We will introduce and explain about each module of the buoy system, ultrasound transmitter/receiver measuring distance experimental results as the first step of this research
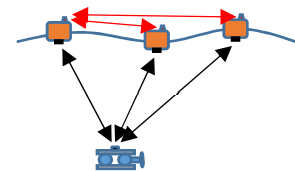
OS7-3 Experiments of floatable UAV drone for wave dissipating block inspection(II)

Keisuke Watanabe**,** Kazuho Mitsumura, Koshi Utsunomiya, Shiyun Takasaki (Tokai University, Japan)

UAV drones are an effective low cost photographing apparatus for ocean environment monitoring. Taking images is essential for these environment monitoring such as coastal line monitoring where beach erosion is severe, inspection of offshore structures like wind power stations or coral reef observation etc. In this presentation, we present our modification experience of making a drone watertight and floatable. Then we present several experiments on taking pictures considering ocean monitoring in the sea near our campus. The waterproof experiment is done from our school's pier. In this experiment, we repeated to start flying the drone from the sea surface and fall it down into the water several times. We can see the shoreline very clearly from more than 200m high as a macro image and also we can inspect the blocks looking around its stacks as well as approaching near the sea surface where waves break and wave splash washes the drone.

OS7-4 Development of self-diagnostic system of an autonomous underwater vehicle Tuna-Sand 2

Naoya Fujii, Yuya Nishida, Kazuo Ishii (Kyushu Institute of Technology, Japan)

For autonomous underwater vehicle (AUV), high autonomy is required in order to accomplish mission such as inspection, observation, manipulation under extreme environments, deep-ocean. One of necessary function for AUV is the self-diagnosis system to detect the abnormality can be said to be an important feature . In this paper, we propose a self-diagnostic system using the dynamical model of Sampling-AUV "TUNA-SAND2", where the fault device detection is carried out using the model, and evaluated through tank tests.

OS7-5 Development of Underwater Wireless Power Supply System Using resonant energy transfer

Kazuo Ishii, Hidaka Shota, [1]Keisuke Watanabe
(Kyushu Institute of Technology, [1]Tokai University, Japan)

Autonomous Underwater Vehicles (AUV) is one of the key technologies for deep ocean research. However, AUV cannot work for long time due to the limitation of battery capacity. To solve this problem, a noncontact wireless power supply is required for AUV to conduct observations for long period. In this study, we developed a resonant energy transfer system, which is mounted into a small AUV "DaryaBird" and the simulations and evaluation tests are carried out in the test tank.

OS7-6 Development of End-effector for Sampling-AUV "TUNA-SAND2"

Kazuo Ishii, Takashi Sonoda Atsushi Nishjima, [1]Keisuke Watanabe
(Kyushu Institute of Technology, [1]Tokai University, Japan)

AUV requires high autonomy to accomplish various deep-ocean observation missions, and the next AUV is expected to have sampling function of marine benthos, that is, the end-effector to catch and bring back marine creatures. However, sampling is not easy task for AUV as the shape, size, motion of targets differs. One of the effective end-effectors is the slurp-gun type device to absorb the target with water. In this research, we had developed a sampling device for deep-ocean observation and sampling AUV, Sampling-AUV TUNA-SAND2 in order to inspection of marine ecosystem.
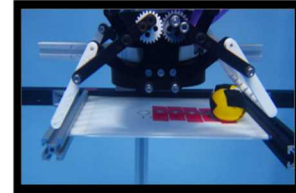
OS8 Multiagent systems and Reality Mining (4)

OS8-1 Influence of Partner Selection on Functional Differentiation: Emergence of Diversity by Isolated Interaction and Preference Change

Saori Iwanaga (Japan Coast Guard Academy, Japan), Akira Namatame (National Defense Academy, Japan)

Functional differentiation is important in nature. For example, in an ant colony, there are ants which work and does not work. I focused on how the heterogeneity emerged. I modeled that each agent can self- reinforce own preference in homogeneous population. There, the behavior reinforce the property and the property reinforce the behavior of an agent. Then, I found that interaction with steady agents enforce the properties. But, interaction with steady partners doesn't lead optimal collective behavior. We found that the partner change is good method for optimal collective behavior for both each agent and population.
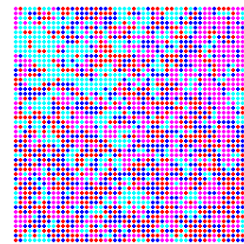
OS8-2 Beacon-based tourist information system to identify visiting trends of tourists

Akihiro Yamaguchi[1], Masashi Hashimoto[1], Kiyohiro Urata[1], Yu Tanigawa[1], Tetsuya Nagaie[1], Toshitaka Maki[1], Toshihiko Wakahara[1], Akihisa Kodate[2], Toru Kobayashi[3], Noboru Sonehara[4]
([1]Fukuoka Institute of Technology, Japan) ([2]Tsuda College, Japan) ([3]Nagasaki University, Japan)
([4]National Institute of Informatics, Japan)

In this study, we propose a system that provides tourist information and obtains trends of visiting tourists using beacons and cloud service. As part of our research, we are working on the promotion of local area tourism in cooperation with a local community. A low energy Bluetooth device is used as a beacon to transmit a universally unique identifier. In addition, beacons are placed at sightseeing spots and tourist facilities. Our proposed system comprises two application programs; one is a client-side application program that provides area-specific tourist information corresponding to the detected beacon. The other is a server-side application to record time and location information of the detected beacons. In this paper, we describe the scheme of our system, and present the results of experiments conducted using the prototype system in the local tourist area. In addition, we discuss an open platform for information collection services using beacons.
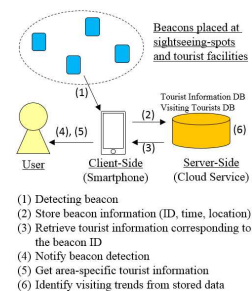
OS8-3 Analysis of Survey on Employment Trends

Masao Kubo (National Defense Academy, Japan), Hiroshi Sato (National Defense Academy, Japan), Akihiro Yamaguchi (Fukuoka Institute of Technology, Japan), Yuji Aruka (Chuo University, Japan)

Employment is a major important issue of economics and it has been difficult for the public to collect authentic information about employment because this is a sort of information should be kept secret on the both side, employer and employee. Therefore we try to reveal a trend of recent employment of Japan from Survey on Employment Trends of Japan which is a report published from Health, Labor and Welfare Ministry. This questionnaire data is mainly categorized by industrial sectors so we need extra works to know the relations and correlations over sectors. In this paper, we show results of traditional machine learning methods to this issue.
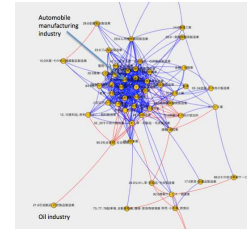
OS8-4 Direction switch behavior to enclose a target

Masao Kubo, Nhuhai Phung, Hiroshi Sato (National Defense Academy, Japan),

This paper discusses a target enclosing behavior when a part of the orbit is blocked. Usually, an orbit to enclose a target supposes to be clear. However, this situation often takes place in realistic environment. For this issue we propose an online adaptive method to enclose a target. The group of robots communicate their direction until they resolve their difficulties.

OS9 Theory and Implementation of Neuromorphic Systems (5)
OS9-1 Implementation of Multi-FPGA Communication using Pulse-Coupled Phase Oscillators

Dinda Pramanta, Takashi Morie, Hakaru Tamukoh (Kyushu Institute of Technology, Japan)

This paper proposes an implementation of multi-Field Programmable Gate Array (FPGA) communication using pulse-coupled phase oscillators. First, serial communication between two boards of FPGAs architecture are developed. First Input First Outputs (FIFOs) are used as an interface of data buffer. Second, we construct a network over two FPGAs for evaluation as shown in Fig. 1. By using a multi-FPGA as a hardware processor through the Gigabit Transceiver (GTX) clock domain, pulse-coupled phase oscillators of Winfree's model are utilized as a spike generator and we expect the ideal of model circuit will synchronize. We employ two Virtex6-Ml605 FPGA boards to construct a mult-FPGA and implement four oscillators on a hardware level. Experimental results show that each board (two oscillators) obtains the required number of resources of 16 % IOB, 434.972 MHz maximum frequency, and first spike synchronizing over two FPGAs takes 12.47 μsec with data bit speed stream 3.2 Gbps.
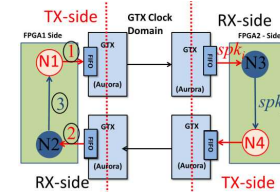
Fig.1 Communication over two FPGA boards using pulse-coupled phase oscillators

OS9-2 Multi-Valued Quantization Convolutional Neural Networks toward Hardware Implementation

Yoshiya Aratani, Yoeng Jye Yeoh, Daisuke Shuto, Takashi Morie, Hakaru Tamukoh
(Kyushu Institute of Technology, Japan)

This paper proposes a Multi-Valued Quantization (MVQ) of connecting weight for efficient hardware implementation of Convolutional Neural Network (CNN). The proposed method multiplies an input value by a multi-valued quantization weight during the forward and backward propagations, while retaining precision of the stored weights for the update process. In the both propagation processes, multipliers can be replaced with adders and shifters by setting appropriate quantized weights. We train two- to six-valued quantization CNNs with MNIST and CIFAR-10 dataset to compare the performance of them with a 32-bit floating point CNN. In the four-valued quantization, random noise is added to the quantized weight to improve the performance of generalization ability. In addition, the robustness of MVQ CNN to noise is evaluated. Experimental results show that the MVQ CNNs achieve better learning accuracy than the floating point CNN and the four-valued CNN is highly robust to the noise.
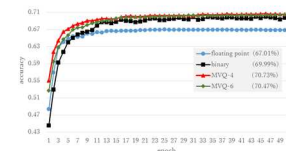
Fig.1 Comparison among floating point, BinaryConnect, MVQ-4 and -6.

OS9-3 An Improved Parameter Value Optimization Technique for the Reflectionless Transmission-Line Model of the Cochlea

Takemori Orima, Yoshihiko Horio (Tohoku University, Japan)

The reflectionless transmission-line model of the cochlea can reproduce physiological cochlear properties by adjusting its parameter values. We have employed an optimization technique to obtain good parameter values that give a desired cochlear property. However, we found that, in some case, it is difficult to find the sub-optimal parameter values because of complex dependencies between parameters. In this paper, we explicitly formulate the cochlear properties in the reflectionless transmission-line model to understand the dependencies. Furthermore, based on the results, we propose an improved optimization technique for determining the parameter values.
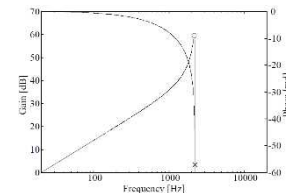
OS9-4 A parameter optimization method for Digital Spiking Silicon Neuron model

Takuya Nanami, Takashi Kohno (The University of Tokyo, Japan)

DSSN model is a qualitative neuronal model designed for efficient implementation in a digital arithmetic circuit. In our previous studies, we extended this model to support a wide variety of neuronal classes. Parameters of the DSSN model were hand-fitted to reproduce neuronal activity precisely. In this work, we studied automatic parameter fitting procedure for the DSSN model. We optimized parameters of the model by a GPU-based implementation of the differential evolution algorithm in order to reproduce waveforms of the ionic-conductance models and reduce necessary circuit resources for the implementation.
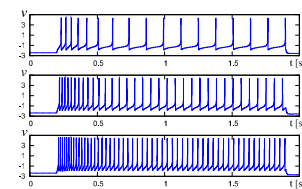
OS9-5 A Multistage Heuristic Tuning Algorithm for an Analog Silicon Neuron Circuit

Ethan Green and Takashi Kohno (The University of Tokyo, Japan)

Analog silicon neurons, electronic circuits that mimic the electrophysiological characteristics of neuronal cells, may in the future be used as fundamental building blocks of neuromorphic technologies like brain-mimetic computers. This research looks at an ultra-low power subthreshold-operated silicon neuron circuit designed with qualitative neuronal modeling. One technical challenge to future implementation of such circuits is parameter tuning—a problem stemming from temperature sensitivity of subthreshold-operated MOSFETs and the uniqueness of individual circuits in a neuronal network due to transistor variation. This research proposes a fully automated parameter tuning algorithm that combines two heuristic approaches to search for appropriate circuit parameters over a range of temperatures. The algorithm only requires the user to input the benchmark circuit characteristics and can tune the circuit to behave as a Class I or Class II neuron.
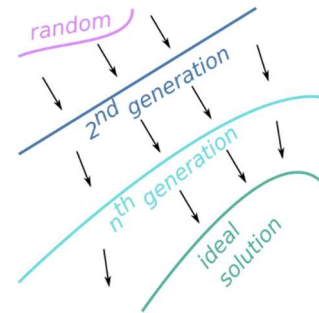
OS10 Biological Signal Sensing Technology, Device and Its Applications (5)

OS10-1 Mouse Cursor-like Control System in Consideration of the DC-EOG Signals using EOG-sEMG Human Interface

Mingmin Yan, Yu Cheng, Keiko Sakurai, Hiroki Tamura, Koichi Tanno
(University of Miyazaki, Japan)

Patients who suffered with the limb disorders cannot take care of themselves by communication barrier. However, it is possible to improve the communication abilities of the patients by using biological signal such as ocular potential and muscle potential which is caused by moving eyes or facial muscle. Therefore, we have developed the human interface using the electrooculogram (EOG) and the facial surface electromyogram (sEMG) signals which can control PC. However, this system could not control the mouse cursor in accordance with the direction and magnitude of the movement of eyes to control PC smoothly and intuitively. Thus, we proposed a new mouse cursor-like control system in consideration of the DC elements of EOG signals using the EOG-sEMG human interface. Our proposed method has both drift and blink countermeasures which had better performance in mouse cursor control, and all subjects could control the mouse cursor for both moving and clicking flexibility.
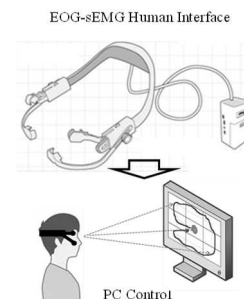
OS10-2 A Study on Eyes Tracking Method using Analysis of Electrooculogram Signals

Keiko Sakurai, Mingmin Yan, Hiroki Tamura, Koichi Tanno (University of Miyazaki, Japan)

e estimation has been an active research in the past years and it is an important technique for transmitting the intention for seriously physically handicapped person who cannot move their body. In this paper, we proposed eye tracking method using electrooculogram signals which is widely applied in medical field. The proposed method has the merit to have low burden of the patient, but there is the problem not to be so high in resolution. Therefore, we carried out the experiments by electrooculogram method to make a study the calculation method of the electrooculogram element with strong correlation for the change of the eyeball movements. Specifically, we examined by comparing next values; alternating current signals, direct current (DC) signals, integral value of DC signals and DC difference values. From these experimental results, we show the possibility of eyes tracking method using the analysis of electrooculogram signals.
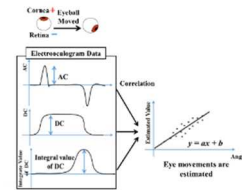
OS10-3 Development of Diagnosis Evaluation System of Facial Nerve Paralysis Using sEMG

Shogo Okazaki, Misaki Syoichizono Hiroki Tamura, Takahiro Nakashima, Eiji Kato, Tetsuya Tono
(University of Miyazaki)

In Japan, diagnostic of facial nerve paralysis is mainly used the electroneuronography (ENoG) method. However, this method has the possibility that there is variability of the diagnosis results by doctors. Therefore, it is necessary the quantitative diagnostic methodology. Previous our research showed the certain correlation between diagnosis results of ENoG and surface-electromyogram (sEMG) data. In this paper, we developed the diagnosis evaluation system of facial nerve paralysis using sEMG by software. We compared with our developed software and manual by experimental person. From simulation results, our developed software showed the correlation coefficient (R^2) between ENoG is 0.68. In our future works, we evaluate our system by the opinion of otolaryngologist.
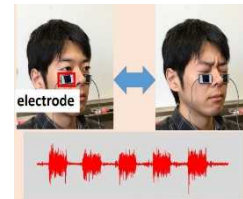
OS10-4 High CMRR and Wideband Current Feedback Instrumentation Amplifier Using Current Conveyors

Shota Mago, Hiroki Tamura, Koichi Tanno (University of Miyazaki, Japan)

This paper presents a high CMRR and wideband current feedback Instrumentation Amplifier (IA). The proposed IA architecture consist of Fully Balanced Differential Difference Amplifier (FBDDA) and Differential Difference Amplifier (DDA) based on 2nd generation current conveyor (CCII)   with a buffer. The proposed IA was evaluated by using HSPICE simulation with 1P 3M 0.6-um CMOS process. From the simulation results, the proposed IA exhibits average CMRR was 109.3 dB higher than the conventional one. Furthermore, since the current feedback based on CCII is adopted, the proposed IA can get higher closed-loop gain over a larger bandwidth than corresponding voltage feedback.
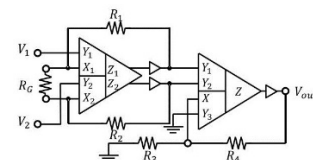
OS10-5 Voltage Rectifier Circuit with Voltage Doubler Using New Active Diode

Masayuki Uchihara, Hiroki Tamura, Kochi Tanno (University of Miyazaki, Japan)

In this paper, voltage rectifier circuit with voltage doubler using new Active Diode (AD) is proposed for battery less biological signal measurement system using smartphone. Firstly, we propose the new AD which consists of AD core circuit and Bulk Regulation Transistor (BRT). The advantage of proposed AD is insensitive to the threshold voltage of MOSFETs and very useful for low power and low voltage operation. Next, the voltage rectifier circuit with voltage doubler using the proposed ADs is presented. Thanks to the good performance of the proposed AD, the designed rectifier could operate as theory by only the sin waves from the earphone terminal of smartphone. The proposed circuits were fabricated actually using 1-P 2-M 0.6-um CMOS process. The detailed simulation and measurement results are reported in this paper.

OS11: Robot Control and Localization (4)

OS11-1 Marker Recognition System for Localization of the Rover on the Lunar Space

Na-Hyun Lee, Jang-Myung Lee (Pusan National University, South Korea)

This paper proposes a marker realization system for rover localization in lunar environment. CPU used in the space environment is not as sensitive to changes of the surrounding environment differently from normal CPU, but it has a lower performance. So it is necessary to use an algorithm reduced amount of computation. In order to reduce the amount of computation, we propose a marker-based algorithm. It has a smaller quantity of computation than map-based localization algorithm commonly used in the space environment. For constructing this algorithm, we performed a marker detection test, and then extracted the center point coordinate of the marker.

OS11-2 Dynamic Model and Finite-Time SMC and Backstepping Control of a Mabile-Manipulator System

Seongik Han, Hyunuk Ha, and Jangmyung Lee (Pusan National University, Korea)

A mobile manipulator was designed by combining three-wheeled mobile robot equipped with the DC motor and three-links manipulator equipped with dynamixel motor. The kinematic relation and dynamic model were built via nonholonomic constraint and Euler-Lagrange equation. For the decoupled model of this system, adaptive finite-time controllers sliding mode controller (SMC) and backstepping controller were designed respectively to obtain fast tracking response. Simulation and experimental results show the efficacy of the proposed control scheme.

OS11-3 Bilateral Control of Hydraulic Servo System for 1DOF Master Slave Manipulator
Jie Wang, Karam Dad and Min Cheol Lee (Pusan National University ,Korea)

In this research reaction force estimation method based on Sliding mode control with sliding perturbation observer (SMCSPO) of a bilateral control in hydraulic servo system for one degree of freedom (DOF) master-slave manipulators is proposed. 1DOF hydraulic servo system used in dismantling nuclear power plant. The reaction force at the end effector of slaver is estimated by sliding perturbation observer (SPO) without using any sensor. This research verifies through experiment that slaver can follow the trajectory of the master device using the proposed bilateral control strategy and reaction force estimation method.
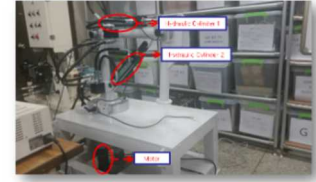
OS11-4 Advanced impedance control of haptic joystick for effective mobile robot handling
Gyung-I Choi, Jang-Myung Lee (Pusan National University, South Korea)

This paper proposes optimized structure of 6 D.O.F. haptic joystick and tele-operated mobile robot system based on haptic interfaces. Kinematic analysis of specially designed 6 D.O.F. haptic joystick derives the coordinate of end effect. The designed haptic joystick transfers operator's moving command to mobile platform with force controlled coordinate information. Attached ultra-sonic sensors detect nearby obstacles including walls and retransfer the distance between mobile platform and obstacles to the haptic joystick. Attained real-time displacement information controls DC motors between links supporting the handle for effective user handling. Practical simulations and real experiments verified proposed impedance control and its tele-operation system of intelligent haptic joystick.
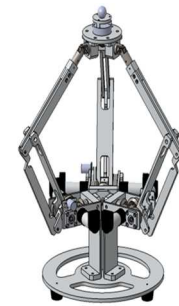
OS12 Machine Learning and Its Applications (4)
OS12-1 A Rule-Based Classification System Enhanced by Multi-Objective Genetic Algorithm
Kenzoh Azakami, Shingo Mabu, Masanao Obayashi, Takashi Kuremoto (Yamaguchi University, Japan)

Recent years, information is diversified, and the enormous amount of data is left unorganized. Data mining is a technique of extracting rules from big data. In this paper, we aim to realize a classification system using a rule extraction method named genetic network programming (GNP). However, there are some problems to be considered, that is, a large number of rules are extracted, so it is difficult to judge important rules; and even in simple classification problems, e.g., two-class problems, a variety of patterns potentially exist in each class. To select important rules and make rule clusters corresponding to the potential patterns, a rule clustering algorithm using multi-objective genetic algorithm (MOGA) is proposed to enhance our conventional classification system.

Rule clustering

OS12-2 A Method of Feature Extraction for EEG Signals Recognition using by ROC curve

Takashi Kuremoto, Yuki Baba, Masanao Obayashi, Shingo Mabu (Yamaguchi University, Japan)
Kunikazu Kobayashi (Aichi Prefectural University, Japan)

The feature extraction for EEG signal Recognition plays an important role for all kinds of classifiers. However, it is difficult to recognize the activities and mental tasks in the brain using EEG signals because the difference between individuals and the change of mental states. In this study, we propose a method of extract EEG signals using by FFT and receiver operating characteristic (ROC) curve. At first, the raw EEG data are processed by discrete Fourier transform (DFT). After that, data of frequency-spectrum of different mental tasks were compared by the value of area under the curve (AUC), and the data with higher AUC (near 1.0) were chosen as feature vectors. Experiment results using benchmark data of EEG signals showed the effectiveness of the proposed feature extraction method in the cases of self-organizing map (SOM), support vector machine (SVM) , and multi-layer perceptron (MLP).

Table 1 Mental tasks in a benchmark database.

Mental Task	Contents
Baseline	Relaxing as much as possible
Multiplication	Calculating multiplication mentally.
Letter-composing	Considering the contents of the letter
Rotation	Imagining rotation of a 3-D object
Counting	Imagining writing a number in order

OS12-3 Forecasting Real Time Series Data using Deep Belief Net and Reinforcement Learning

Takaomi Hirata, Takashi Kuremoto, Masanao Obayashi, Shingo Mabu (Yamaguchi University, Japan);
Kunikazu Kobayashi (Aichi Prefectural University, Japan)

Artificial neural networks (ANNs) typified by deep learning (DL) is one of the artificial intelligence technology which is attracting the most attention of researchers recently. However, the learning algorithm used in DL is usually with the famous error-back propagation (BP) method. BP is a very powerful parameter optimization method, however, it also learns the unpredictable noises of the data. In this paper, we adopt a reinforcement learning (RL) algorithm "Stochastic Gradient Ascent (SGA)" into a Deep Belief Nets (DBN) with multiple restricted Boltzmann machines (RBM). Prediction experiments used a benchmark of time series forecasting competition and realistic data verified the effectiveness of the proposed DL method.
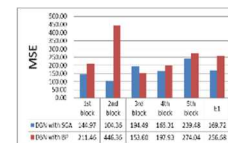
Comparison of prediction mean squared errors between different learning methods

OS12-4 Improvement of Robot's Self-localization by Using Observer View Positional Information

Yo Aizawa, Takuo Suzuki, and Kunikazu Kobayashi (Aichi Prefectural University, Japan)

This study aimed to improve the precision of the robot's self-position estimation in the standard platform league of RoboCup, i.e. a robotic soccer competition. For the precision improvement of the self-position estimation, we suggest a new technique that uses a camera out of the field for assistance. Robots in the field use the unscented particle filter that estimates their position from landmark. When a robot which is equipped with the filter cannot recognize landmarks exactly, particles spread and the estimation precision of the self-position decreases. Therefore, the overlooking camera out of the field observes each robot's position. When particles spread, the camera out of the field estimates the foot of a robot, and then the robot sprinkles particles on the neighborhood again. In this way, even if a robot cannot recognize landmarks exactly, assists of camera out of the field revise the position of particles and improve the precision.
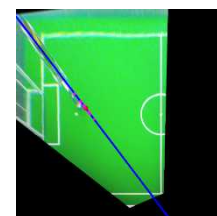
Resampled position of particles

OS13: Intelligent Control (6)

OS13-1 Modeling and Simulation for a Quadrotor Vehicle with Adaptive Wing

Qunpo Liu , Fuzhong Wang, Hongqi Wang, Jikai Si (Henan Polytechnic University, P.R.China)
Hanajima Naohiko (Muroran Institute of Technology, Japan)

This study intends to address the questions of low effective and high cost in the process of artificial sorting and packing of fruit. In this paper, a kind of automatic packaging and plastic foam net packing robot based on neural network plastic foam netting is presented. The round fruit can be filtered and classified by neural network controller based on fruit's size, skin roughness and color which are based on machine vision. And the expansion degree of plastic foam nets is adjusted adaptively according to fruit size. The system was simulated by V-REP simulation software. The simulation results showed that the system could complete the classification and packing with plastic foam mesh of round fruit.
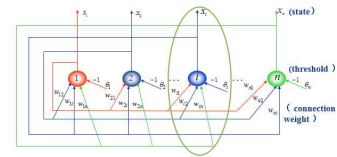
OS13-2 Fuzzy self-tuning PID control algorithm for belt conveyor driven by multi-motor

Caixia Gao, Fuzhong Wang, Ziyi Fu (Henan Polytechnic University, P.R. China)

Aiming at the problems of low efficiency when long distance and high-inclination belt conveyor driven by multi-motor is in light or idle run as well as electrical power unbalance. Control strategy for belt conveyor driven by four-motor via fuzzy self-tuning PID control algorithm was proposed. The Speed setting algorithm of belt conveyor and fuzzy self-tuning PID algorithm for speed control and power balance control are introduced. The application shows that, according to the coal flow changes of the belt conveyor in real-time, the speed can be automatically adjusted through this algorithm, making the power of the four motors convergence ,whose speed control error and the power control error both lower than 2.6%.
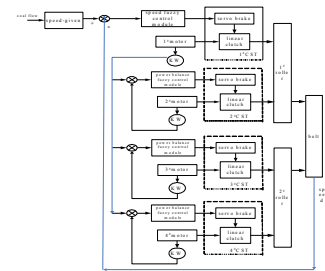
OS13-3 Continuous Non-singular Fast Terminal Sliding Mode Control for an Active Gravity Field Simulator

Jiao Jia, Yingmin Jia and Shihao Sun(Beihang University (BUAA), P.R.China)

In this study, a non-singular fast terminal sliding mode (FTSM) controller is designed for an active gravity field simulator (AGFS). Some sufficient conditions are established to guarantee the stability by using the Lyapunov theory. It is shown that the proposed controller can eliminate the chattering effect without losing the robustness property. Simulation results show that faster and high-precision tracking performance can be obtained compared with the conventional continuous sliding mode control method.
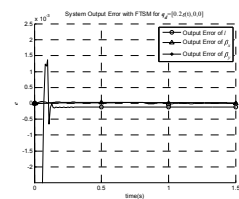
OS13-4 Weighted Multiple Model Adaptive Control for a Category of Systems with Colored Noise

Yuzhen Zhang, Qing Li and Weicun Zhang (University of Science and Technology Beijing, P. R. China)

The multiple model adaptive control (MMAC) of discrete-time stochastic system with colored noise is considered in this paper. Model set consists of a finite number of fixed and one adaptive identification models. After that, based on the output errors of the models, a simple weighting algorithm is adopted with convergence guaranteed. The proofs of global stability and the convergence of the overall system are presented. Besides, the influence of initial value selection of adaptive model on system performance is described. Finally, computer simulation results are shown to verify the theoretical results.
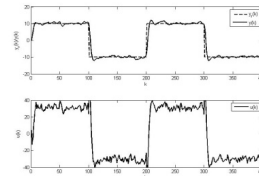
OS13-5 Neutral Networks-Based Adaptive Fixed-Time Consensus Tracking Control for Uncertain Multiple AUVs

Lin Zhao[1], Yingmin Jia[2] and Jinpeng Yu[1]
([1]Qingdao University, P.R.China; [2]BeihangUniversity (BUAA), P.R. China)

This paper is concerned with the fixed-time consensus tracking problem for multi-AUV (autonomous underwater vehicle) systems with uncertain parameters and external disturbances. Firstly, a fixed-time terminal sliding mode is proposed, which can avoid the singularity problem. Then, a continuous distributed consensus tracking control law is designed based on Neutral Networks approximation technique, which can guarantee the consensus tracking errors converge to the desired regions in fixed time. A simulation example is given to show the effectiveness of proposed methods.
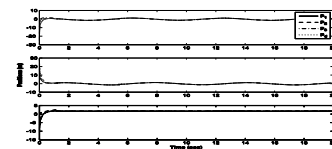
OS13-6 Conducted electromagnetic interference prediction of the Buck Converter via Neural Networks

Sumin Han, Fuzhong Wang (Henan Polytechnic University, P.R. China)

This paper proposes an approach to predict conducted electromagnetic interference (EMI) on the power supply side in the buck converter. The experimental scheme is designed to collect the input and output target samples, whose correlativity is analyzed to verify their correlation degree. The paper establishes a three-layer network including one hidden layer, whose activation function is of the hyperbolic tangent type to ensure the rapidity of convergence. The conducted EMI predicting model is established by sample training, the differential mode(DM) and common mode (CM) interference prediction waveforms is obtained and analyzed . The results demonstrate that the forecasted and measured waveform is in decent consistency of time domain and power spectrum.
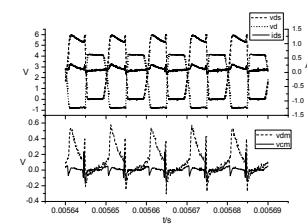
OS14 Advanced Control (5)
OS14-1 Targeting Chaos System via Minimum Principle Control
Yunzhong Song, Ziyi Fu, Fuzhong Wang (Henan Polytechnic University, P, .R.China,)

Chaos targeting via Minimum Principle Control (MPC) was suggested here, where like the already existing results, the targeting via MPC can stabilize all the non-stable equilibrium when the extra added control was introduced in the first or the second equation of the chaos system, however, unlike the already existing results, when the extra added control was introduced in the third equation of the chaos system, the non-stable equilibrium can not be stabilized at all with the already existing methods, to be unique, the MPC can still be effective when the added extra control was introduced in the third equation, albeit with the cost of switching control direction for a duration.
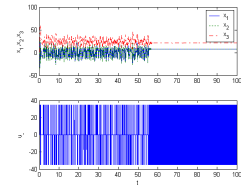
OS14-2 Three-dimensional Leader-Follower Formation Flocking of Multi-Agent System
Yongnan Jia, Weicun Zhang (University of Sciences and Technology, Beijing, China)

This paper aims to investigate the three-dimensional formation flocking problem of multi-agent system with leader-follower structure. We consider each agent as an extended unicycle. Based on the nearest neighbor interaction rules, a kind of distributed control algorithm is proposed with the combination of consensus algorithm and attractive/repulsive functions. The proposed algorithm enables all unmanned aerial vehicles asymptotically converge to fly with the same velocity and approach the expected formation with their neighbors, provided that the initial interaction network of the system is leader-follower connected. Numerical simulations are carried on the multi-agent system with large-scale to validate the functionality of the proposed algorithm.
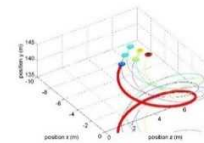
OS14-3 Leader-follower Formation Control of Mobile Robots with Sliding Mode
Wenhao Zheng and Yingmin Jia (Beihang University, P.R.China)

This paper considers the formation control of nonholonomic mobile robots. The formation problem is converted to the tracking error model based on the leader-follower structure. A sliding mode controller, which is proved to be globally finite time stable by Lyapunov stability theory, is presented in this study. In addition, a continuous reaching law is designed to reduce the chattering which caused by the computation time delays and limitations of control. The results of simulation and experiment verifies the feasibility and effectiveness of the control strategy.
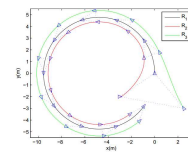
OS14-4 H_∞ Containment Control for Nonlinear Multi-agent Systems with Parameter Uncertainties and Communication Delays

Ping Wang[1], Yingmin Jia[2] ([1] North China Electric Power University, [2]Beihang University, P.R.China)

This paper considers robust containment control problem for uncertain multi-agent systems with inherent nonlinear dynamics. A distributed protocol is proposed using local delayed state information, and then the original problem is converted into an H_∞ control problem by defining an appropriate controlled output function. Based on robust H_∞ control theory, sufficient conditions in terms of linear matrix inequalities (LMIs) are derived to ensure the prescribed H_∞ containment. A numerical example is provided to demonstrate the effectiveness of our theoretical results.
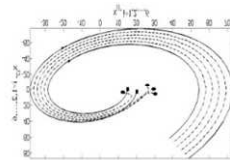
OS14-5 Stochastic Resonance in an Array of Dynamical Saturating Nonlinearity with Second-Order

Yumei Ma, Lin Zhao, Zhenkuan Pan and Jinpeng Yu (Qingdao University P.R.China)

We study the Stochastic Resonance (SR) in parallel array of dynamical saturating nonlinearities with second-order via the measure of output signal-to-noise ratio (SNR). Firstly, the numerical results demonstrate that the output SNR can be enhanced by parallel array of dynamical saturating nonlinearities with second-order by tuning the internal noise and the self-coupling coefficient. Then, the SR effects of the dynamical nonlinearity with second-order are superior to the dynamical nonlinearity with first-order.
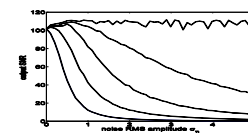
OS15 Recognition and Control (8)
OS15-1 Integral Design of Intelligent Home Equipment

Yuxing Ouyang [1], Fengzhi Dai [1*], Yiqiao Qin [1], Ce Bian [1], Bo Liu [2], Hongwei Jiao [3]
([1] Tianjin University of Science & Technology, [2] Inner Mongolia University,
[3] Tianjin Technology School of Printing and Decoration, China)

The set of equipment is designed to all household equipment network monitoring and control. Using WIFI module for wireless networking purpose is to upload information of all connected smart home devices to the server through the network, and it can be remotely controlled by the external network and monitoring of household equipment information. For simple household equipment, the control is directly taken to the built-in MCU's WIFI module, and for the complex household equipment, it is through the external MCU and WIFI module for communication control. Take the Airkiss distribution mode to connect the WIFI master module to the network, and the other WIFI module devices to adopt the ad hoc network mode for wireless networking.
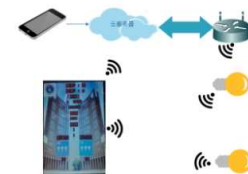
OS15-2 Research on Underwater Robot Recognition

Binhu Song[1], Fengzhi Dai[1]*, Qijia Kang[1], Haifang Man[1], Hongtao Zhang[1], Long Li[2], Hongwei Jiao[3] ([1] Tianjin University of Science and Technology, [2] Tianjin Electric Locomotive Co., Ltd, [3] Tianjin Technology School of Printing & Decoration, China)

Due to the characteristics of the underwater robot, the computer vision technology for pedestrian detection and object detection is not adapt better to a variety of underwater robots. The recognition algorithm must be more robust and extensive that can adapt to the changing environment. Support vector machine (SVM) method is a kind of good classification algorithm that is used in many aspects. Its kernel function analysis is very advanced. After the optimization, the kernel function can be adapted to a large number of underwater robot images that are difficult to be recognized by other methods.
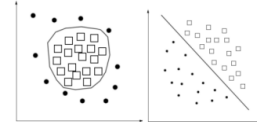
OS15-3 Design of Intellectual Vehicles with Path Memorizing Function

Yiqiao Qin [1], Fengzhi Dai [1]*, Yuxing Ouyang [1], Baochang Wei [1], Simini Chen [2], Hongwei Jiao [3] ([1] Tianjin University of Science & Technology, [2] Palace Museum, [3] Tianjin Technology School of Printing & Decoration, China)

In this paper, after analyzed the deficiencies of current intelligent transportation vehicles, the design of a new transport vehicle system that has the function of path memorization (a new algorithm to recognize the position and path of the vehicle) is proposed. It neither relies on external positioning methods such as GPS, wifi, etc, nor on the electromagnetic or photoelectric rails. This algorithm sets the starting point as the coordinate origin to recognize the position and the path, and compares its current position with the ideal path, enabling the vehicle to travel on an established path. On the basis of this algorithm, we design a kind of intelligent transportation system by NXP ARM-M4 K60 Singlechip. This system is not affected by the ground condition, so there is no need for any ground signs. Still, it can transport goods in factories scattered with water and iron scrap, and on open-air dirt roads or rainy outdoor environments.
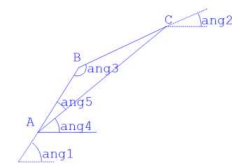
OS15-4 Action Recognition based on Binocular Vision

Yiwei Ru [1,2,*], Hongyue Du [1], Shuxiao Li [2], Hongxing Chang [2] ([1] Harbin University of Science & Technology, [2] Chinese Academy of Sciences, China)

Aimed at the problem that the recognition accuracy of the monocular camera is low, a binocular vision recognition algorithm based on CNN (convolutional neural network) is proposed. Firstly, the left and right views obtained by the binocular camera are matched to obtain the depth map of the human body under the camera coordinate system (O-XYZ). Then the depth information is projected onto the three planes of O-XY, O-YZ and O-ZX respectively in the camera coordinate system to overcome the problem that the human body motion detection is prone to error in the absence of the overhead view and the side view of the monocular camera. In order to reflect the motion of the timing information, the projection images of three directions were used to construct MHI (motion history image), and then the three MHIs were constructed as the three channels of the image to construct a new image. Using CNN to train the classifier. Experimental results show that the binocular recognition algorithm is 12% more accurate than the monocular recognition algorithm, which meets the requirements of practical application .
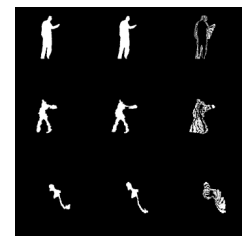
OS15-5 Analysis and Control of a Novel 4D Chaotic System

Hong Niu (Tianjin University of Science and Technology, China)

In this paper, a novel four-dimensional(4D) autonomous chaotic system is presented. For chaos control of the 4D system, a linear feedback controller only with one variable is designed via matching the variable coefficients of the Lyapunov function, so that the system is no longer chaotic or periodic but globally asymptotically converges to the equilibrium point at the origin. The numerical simulation results are given to illustrate the feasibility and effectiveness of the method.
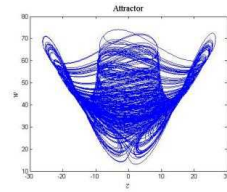
OS15-6 Analysis of a three-dimensional chaotic system and its FPGA implementation

Hefei Li, Xianghui Hu
(Tianjin University of Science and Technology, China)

In this paper, a three-dimensional chaotic system is implemented based on the Field Programmable Gate Array (FPGA). The 3-D chaotic system has a very complex chaotic characteristic with its real four-wing chaotic attractor. By means of numerical simulation, phase orbits, bifurcation diagram and Lyapunov exponents are given and analyzed to observe dynamic characteristics of the three-dimensional chaotic system. Numerical simulation and the results of implementation in FPGA show that this chaotic system really has many obvious characteristics of chaos.
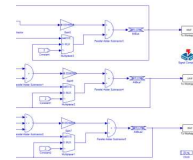
OS15-7 Image Encryption Based on Fractional-order Chaotic Model of PMSM

Wei Xue [*], Mei Zhang, Shilong Liu, Xue Li
(Tianjin University of Science and Technology, China)

The permanent magnet synchronous motor (PMSM) is a nonlinear system with multi-variable and significant coupling. When PMSM works in certain conditions, the chaotic behavior will occur. In this paper, a application of image encryption based on fractional-order PMSM chaotic model is investigated. By the mean of drawing histogram, adjacent pixels correlation, key sensitivity of the ciphertext were analyzed. The results show that the image encryption based on fractional-order chaotic model of PMSM have a large key space and high security.
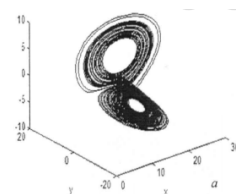
OS15-8 The Application of a Novel Fractional Hyper-chaotic in Image Encryption

Wei Xue [*], Shilong Liu, Mei Zhang, Xue Li.
(Tianjin University of Science and Technology, China)

In this paper, a novel fractional-order hyper-chaotic system is proposed, and its dynamic characteristics are analyzed by drawing the phase trajectory and Lyapunov exponent spectrum. The simulation results show that the fractional-order chaotic system has hyper-chaotic characteristic. Then, image encryption implementation based on the fractional-order hyper-chaotic system is investigated, a three-color separation of color pictures and scrambling the image pixel location, the histogram, key space, pixel distribution, correlation coefficient and key sensitivity of ciphertext are tested and analyzed. The results show that the algorithm has good security and practicability.
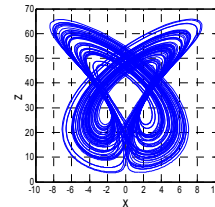
OS16 Image Recognition and Chaotic Systems (8)
OS16-1 A Method of Detecting Abnormal Crowd Behavior Events Applied in Patrol Robot

Huailin Zhao, Shunzhou Wang, Shifang Xu,Yani Zhang,
(Shanghai Institute of Technology, China) Masanori Sugisaka (ALife Robotics Corp.Ltd.)

When the ground or air patrol robot monitors a certain area, one of the important intelligent functions is to estimate the crowd density of the monitored area. This paper analyzes the typical crowd density estimation algorithm, and proposes a convolution neural network model for crowd density estimation. Combining the crowd density estimation and the crowd speed calculated by the optical flow algorithm, we can predict and detect abnormal behavior events of the crowd. The method can not only estimate the population density of the specified area, but also analyze and detect the abnormal behavior events of the crowd. This application provides an important technical support for enhancing the patrol robot monitoring effect.
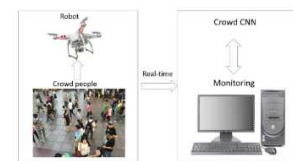
The flowchart of the whole algorithm

OS16-2 Design of the Multi-Car Collaboration System

Huailin Zhao,Yangguang Guo (Shanghai Institute of Technology, China)
Masanori Sugisaka (ALife Robotics Corp.Ltd., Japan)

With the development of the computer and electronic technology, it is an irresistible trend to make the multiple intelligent agents cooperate with each other to complete a specific complex task. Due to the high cost of real vehicles, most of the researches are based on simulation softwares. In our project, a few real small smart cars are used, and the design of multi-car cooperation system is completed. A system platform of the small smart cars is established, which can simulate the behaver such as positioning, formation and so on. In the experiment field, a global camera is used to achieve global synchronical positioning. The simulation results show that the multiple smart cars can get collaborating.
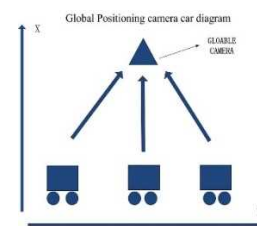
OS16-3 Research on an Algorithm of the Character Recognition with Self-learning the Recognition Errors

Huailin Zhao, Yawei Hou, Shifang Xu, Congdao Han (Shanghai Institute of Technology, China)
Masanori Sugisaka (ALife Robotics Corp.Ltd., Japan)

With the development of science and technology, the character recognition technology has been widely applied in people's daily life. The related researchers are studying on it in order to achieve the technology with higher recognition rate. In this paper, a new recognition algorithm is proposed based on self-learning the recognition errors. The method is able to identify whether the learning result is correct or not and then recognize the correctness of the learning result by itself, correct the recognition result of the error and simultaneously memorize it. When the same kind of error is recognized again, it is automatically corrected. This article has carried on the simulation verification on the Matlab platform to prove the effectiveness of this method. The simulation results show that the method can improve the character recognition rate.
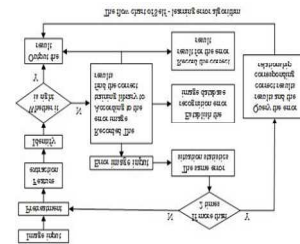
OS16-4 An Improved Method of the Power System Short Term Load Forecasting Based on the Neural Network

Shunzhou Wang, Huailin Zhao, Yani Zhang, Peng Bai
(Shanghai Institute of Technology, China)

Load forecasting is an important content of planning and operating power system. It is the prerequisite to ensure the reliable power supply and economic operation. In this paper, an improved method of short-term load forecasting for load data of two different regions is proposed. Firstly, multiple linear regression and quadratic regression are used to analyze the regression relationship between weather factors and load, and then the greatest impact on load of weather factors are selected. The Elman neural network is used to predict unknown one-week load data taking into account without whether factors situation and whether factors situation. In the predicting situation of considering whether factors, the multi-weather factors are integrated with the temperature and humidity index , which are used as the neural network input training samples. The prediction result is good.
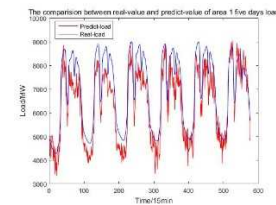
OS16-5 Improvement on LEACH Agreement of Mine Wireless Communication Network

Liu Yun-xiang and Zhang Wei (Shanghai Institute of Technology, China)

According to the features of mine communication with wireless sensor network, a routing algorithm called LEACH-KPPE based on K-means++ was proposed. The clustering was optimized. According to the energy and distance factors, the selection of cluster head node was optimized. The problem of uneven distribution of cluster head node, network stability and energy inequality on the LEACH algorithm was improved effectively. The simulation results show that the LEACH-KPPE algorithm could better improve the energy consumption of the whole network, improve the utilization of energy and effectively prolong network life cycle.
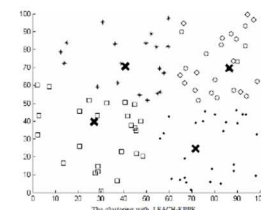
OS16-6 A New Four-Wing Chaotic System Generated by Sign Function

Hongyan Jia, Shanfeng Wang,Yongjun Wu
(Department of Automation, Tianjin University of Science and Technology, China)

In the paper, a new chaotic system is obtained by adding a Sign Function to a three-dimensional chaotic system. Its some basic characteristics including the equilibrium point, phase trajectory, bifurcation diagram, Lyapunov exponent and so on, are subsequently calculated. Moreover, the dynamic characteristics of the new chaotic system is also analyzed with the variation of the system parameters. In the end, the paper design an analog circuit to implement the chaotic system, the results from the circuit are consistent with those from the numerical analysis, and thus the chaotic characteristics of the new system is verified physically. The new chaotic system can provide a new model for engineering applications.
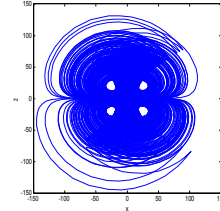
OS16-7 A Three-Dimensional Chaotic System Generating Single-wing or Two-Wing Chaotic Attractors

Hongyan Jia, Yongjun Wu, Shanfeng Wang.
(Department of Automation, Tianjin University of Science and Technology, China)

In this paper, a three-dimensional chaotic system is proposed based on a simple 3-D autonomous system by adding a linear piecewise function. It is very interesting is that the new three-dimensional chaotic system can generate single-wing or two-wing chaotic attractors with variation of parameter. Several basic characteristics of the system, such as bifurcation diagram, phase orbits, and Lyapunov exponents are given to investigate different chaotic motions for the new system. The new system is found to be chaotic in a wide parameter range, and to show many complex dynamical behaviors. That is, the results obviously show the system is chaotic and its dynamics are very complex.
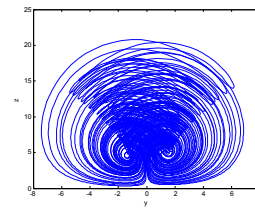
OS16-8 Circuit implementation of a new fractional-order hyperchaotic system

Xuyang Wu, Hongyan Jia, Ning Bai, Weibo Jia
(Department of Automation, Tianjin University of Science and Technology, China)

In the paper, some basic dynamic properties of a new fractional-order hyper-chaotic system are firstly investigated, such as the equilibrium point, phase trajectory, bifurcation diagram, Lyapunov exponent, and so on. Then the paper design an analog circuit to implement the fractional-order hyper-chaotic system, the results from the circuit are consistent with those from the numerical analysis, and thus the hyper-chaotic characteristics of the new fractional-order system is verified physically. It is very important to implement fractional-order hyper-chaotic system with more complicated dynamics for theoretical research and practical application. The new hyper-chaotic system can provide a new model for engineering applications.
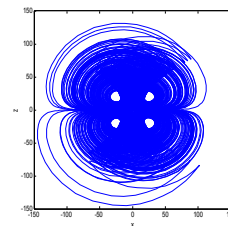
OS17 Natural Computing and Biology (4)

OS17-1 Molecular Artificial Intelligence by using DNA reactions

Yasuhiro Suzuki, Rie Taniguchi (Nagoya University, Japan)

We have developed molecular Artificial Intelligence system by using DNA molecules, where "intelligence" means that the reaction system can "select" DNA molecules to sustain their reactions. We have bio-chemically implemented the reaction system by using the DNA strand-displacement reaction and have obtained several mutated DNA sequences that can sustain the reactions and we have investigated behaviors of reactions when there are several mutated DNA sequences.
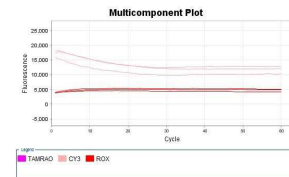
OS17-2 Neural Networks by using Self-Reinforcement Reactions

Yasuhiro Suzuki (Nagoya University, Japan)

We consider a chemical reaction network model in which selections of reaction are stochastic and depend on past history. In this chemical reaction network, we found the emergence of Auto-Catalytic Sets (ACS) and complex dynamics in which ACS are repeatedly created and destroyed; we have called this reaction system as the Self-Reinforcement Reactions, SRR. We developed a neural-networks system by using SRR and confirm the neural network of SRR can solve a linear classification problem.
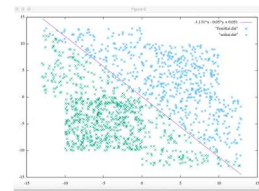
OS17-3 Artificial Chemistry by Sound Waves

Yasuhiro Suzuki (Nagoya University, Japan)

We have proposed an Artificial Chemistry based on a rewriting system on multisets and developed various models such as computational protocells in Artificial Life. However, such an Artificial Chemistries are implemented in silico and cannot interact with its environment out of the silico (e.g. a computer system). Hence we have transformed and Artificial Chemistry, Abstract Rewiring System on Multisets, ARMS into sound waves interactions systems; where every abstract chemical is a sound waves and artificial chemical reaction is interaction with sound waves. By using this system, the artificial chemical reactions inside silico is able to interact with its environment through sound waves.
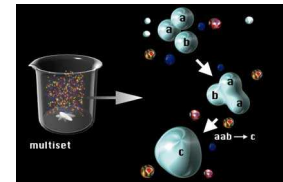
OS17-4 Variants of spiking neural P systems with energy control

Rudolf Freund, Marion Oswald (TU Wien, Vienna, Austria)

We consider several variants of spiking neural P systems (SNPSs), theoretical frameworks for brain modeling. Whereas the original variant only allows for one kind of spikes, in this paper special emphasis is laid on SNPSs with different colors or SNPSs with anti-spikes. Moreover, instead of choosing the rules in the neurons based on the current contents being in a regular set, we (also) consider the way of choosing the rule to be applied in each neuron consuming the maximal energy. This choice can be accomplished by assigning energy values to each rule or by assigning (different) energy directly to the colored spikes.
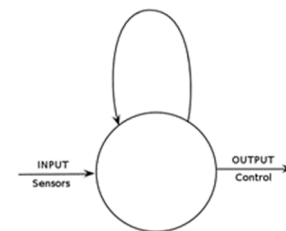
OS18   Advanced Management and Technology (4)

OS18-1 Development of English Text for the engineers to preserve the environment of North-East Asia

Yuji Minami, Kenji Fukuchi, Shinya Tagawa (National Institute of Technology, Ube)

Our research began in 2007 as a part of the activities of 'Good Practice' for Education of Engineers in cooperation with the UMICNEA, that is, "Union of Machinery Industrial Cities in North-East Asia".   Through our study, we found it necessary to acquire the knowledge of 'Fish Breeding Forest' when developing and preserving the area of North-East Asia, where the river Amur plays an important role for sustaining the environment of this region. We made the research of the origin of the river Amur, named 'the river Onon', located in the area of 'Strictly Protected Area' in Mongolia by the agreement of Mongolia, Russia, and China in 2005.   We plan to make it clear that future engineers should find a good way of cooperation through English as a communication tool for the purpose of playing an active part together.

OS18-2 Measuring Fragility and its Implications in Networked Systems

Tsutomu Ito*, Katsuhiko Takahashi, Katsumi Morikawa, Takao Ito (Hiroshima University, Japan), Rajiv Mehta (New Jersey Institute of Technology, USA), Seigo Matsuno (Ube National College of Technology, Japan), Makoto Sakamoto (University of Miyazaki, Japan)

A survey the literature reveals that a plethora of network analytic facets, such as degree, eigenvalue, density, block, cluster, have been developed and employed to further our understanding of network structures. To extend our understanding of network systems, additional dimensions need to be identified that shed light on the dynamic processes among individual member nodes within network structures. Specific to the context of networked systems, this paper proposes a new concept of fragility. Specifically, it develops and empirically tests a mathematical model of fragility from the standpoint of how ties among network members significantly influence corporate performance. Using data drawn from two well-known network organizations, Mazda and Toyota, this research attempts to calculate the relationship between degree and fragility, thus confirming the validity of the new concept. Furthermore, the relationship between fragility and corporate performance is also assessed. This paper makes a contribution to extant thought by: 1) Defining fragility, 2) Discussing the nature of the relationship between fragility and corporate performance, and 3) Empirically testing the dimensional differences among fragility and corporate performance, thus enabling a contrast between Mazda and Toyota. Based on the findings, the managerial implications are discussed, the study limitations are identified and directions for further research are suggested.
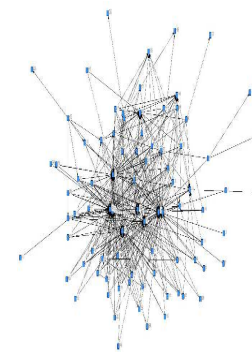
OS18-3 A Formation of Standard Setter to Transplant Global Standards into Domestic Institution

Kensuke Ogata (University of Nagasaki, Japan)

Japanese accounting standard setter, the ASBJ, developed lots of domestic accounting regulations to converge with the global standards in the period of 2005-2008, which substantially differs from the period of 2001-2004. A general organizations theory states that organizations make a change in their strategy and structure aimed at changing their performance. Based on this theory, we analyzed the change in organizational structure of the ASBJ using social network analysis. According to our result, the ASBJ formed a network in which accounting professions played a central role. The reason could be that the ASBJ made use of knowledge and wisdoms on the global standards Japanese big accounting firms has through their global networks.
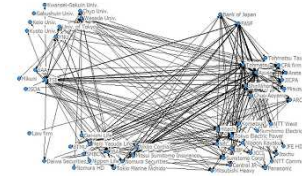
OS18-4 A Comparison Study on the Vertical Integration and Horizontal Specialization of Chinese ICT Companies

Yunju Chen (Shiga University, Japan), Yousin Park (Prefectural University of Hiroshima, Japan)
Iori Nakaoka (National Institute of Technology, Ube College, Japan)

The debate between vertical integration vs. horizontal specialization appears to be reinvigorated. The decision of vertical integration or horizontal specialization affects a firm's profit and competitive advantage, especially in the ICT industry which is difficult to create added value due to the commoditization of digital products. The ongoing commoditization of smartphone brings the arising of Chinese ICT companies but these companies adopt different operation systems to create their own competitive advantages.   In this paper, we focus on top-shared Chinese companies in global smartphone industry, Huawei and Xiaomi, to examine how they design their operation systems in R&D and gain competitive advantages, also to compare their systems with each other.   The patent information of these two companies is used to visualize their technical orientations and operation systems in R&D by text mining

The patent (inventors)
network of Xiaomi

OS19 Kansei Engineering and Applications (4)
OS19-1 Histogram Matching Based on Gaussian Distribution Using Regression Analysis Variance Estimation

Yusuke Kawakami (DynaxT Co., Ltd., Japan)
Tetsuo Hattori, Yoshiro Imai, Kazuaki Ando, Yo Horikawa (Kagawa University, Japan)
R. P. C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

This paper describes an improved method for variance estimation which is used in Histogram Matching based on Gaussian Distribution (HMGD). In the previous papers, based on curvature computation, we have described that how to estimate the variance of reference histogram, which is used in HMGD processing. However, we have considered that the histogram of original image is not always ideal shape. And the variance estimation method based on curvature computation might not have high reliability. In this paper, we propose improvement variance estimation method using regression analysis. As for the method, first, we detect the histogram peak of original image by using curvature computation; next, we perform regression analysis using approximation formula of curvature. Then, we illustrate processing results through some experimentation.
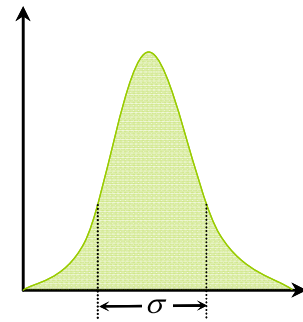
OS19-2 Histogram Matching Based on Gaussian Distribution Using Variance Estimation -- Comparison between Curvature Computation and Regression Analysis –

Yusuke Kawakami (DynaxT Co., Ltd., Japan)
Tetsuo Hattori, Yoshiro Imai, Kazuaki Ando, Yo Horikawa (Kagawa University, Japan)
R. P. C. Janaka Rajapakse (Tainan National University of the Arts, Taiwan)

This paper describes variance estimation method comparing between regression analysis and curvature computation which is used in Histogram Matching based on Gaussian Distribution (HMGD). In the previous paper, we have described and illustrated that the variance estimation method have been considered of value for HMGD processing results. Though we have considered that histogram of original image is not always ideal. So, in this paper we propose improvement variance estimation method using regression analysis. First of all, we describe the principle of variance estimation methods using curvature computation, and regression analysis. Then, through some HMGD processing experiment, we compare between curvature computation results and regression analysis.
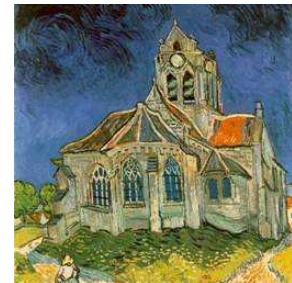
OS19-3 An Extended Optimal Stopping Method for Structural Change Point Detection Problem

Yoshihide Koyama, Tetsuo Hattori, Yoshiro Imai, Yo Horikawa (Kagawa University, Japan)
Hiromichi Kawano (NTT advanced technology Company Ltd,, Japan)
Yusuke Kawakami (DynaxT Co., Ltd., Japan)

Previously, we have proposed and formulated the SCPD (Structural Change Point Detection) problem in time series data as an Optimal Stopping one using the concept of DP (Dynamic Programming). And also we have shown the solution theorem in the form of inequality. In this paper, based on the relation between the solution of Optimal Stopping and SPRT (Sequential Probability Ratio Test), we present the extended Optimal Stopping Method in order to obtain more practical one, considering a loss cost and an action cost involved by failure prediction.
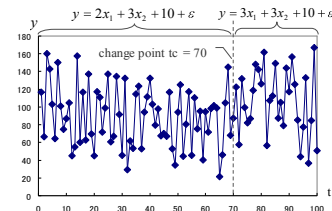
OS19-4 A Study of Sentimental Value Analysis for Tweeting Message

Shunsuke Doi, Shinya Hara, Yoshiro Imai, Tetsuo Hattor (Kagawa University, Japan)
Yusuke Kawakami (DynaxT Co., Ltd., Japan)

This paper focuses on Twitter used by students of universities, and analyzes tweeting data (messages) by students from Twitter, and calculates sentimental values from the according data. It also investigates existence of some relations between calculated sentimental values and practical thought of students. Moreover, this paper discusses whether the above procedure and analysis can visualize conventionally hidden relationship between contents of tweeting messages and characteristic behavior of students in categorized universities.
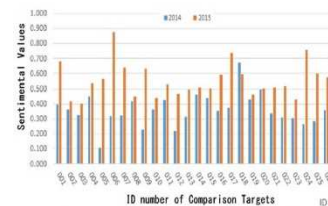
OS20: Image Processing and Computer Graphics (6)
OS20-1 An effective method for detecting snatch thieves in video surveillance

Hiroaki Tsushita, Thi Thi Zin (University of Miyazaki, Japan)

Nowadays, a tremendous amount of accidents and terrorisms has been occurred all over the world no exception Japan. Thus, detection of suspicious activities in public areas such as railway stations, shopping malls and many other areas using video surveillance becomes important. However, very little has been achieved regarding real-time event recognition of two person interactions such as snatch theft events. Moreover the way of snatch theft has been increasing like using a motorcycle and so on. In this paper, we propose an effective method for detecting the snatch theft event between two persons. Specifically, the proposed method consists of several steps: pedestrian tracking, feature computation and snatch theft detection. For feature computation, shape and motion features are used. To confirm the validity of proposed method some experimental results in a various situations are shown by using some collected video sequences.

OS20-2 Color and Shape based Method for Detecting and Classifying Card Images

Cho Nilar Phyo, Thi Thi Zin (University of Miyazaki, Japan) Hiroshi Kamada (Kanazawa Institute of Technology, Japan) Takashi Toriu (Osaka City University, Japan)

In this paper we propose an effective method for detecting and classifying card images by using color and shape features. Generally, color card images have been widely used for teaching and learning programing languages in interactive classrooms lessons. For this purpose, we first extract the area of card color by squeezing from the entire image by using the color information. Then we remove the regions of low possibility with the aids of shape features particularly aspect ratios. Moreover, by taking the classroom size and the distance from the camera, we classify the image according to the sizes. Thus our method can extract even quite small cards in the classroom activities. In order to confirm the proposed method, we conduct a sequence of experiments by taking our own video sequences. Our experimental results show that the proposed method is very promising compared to some existing methods.

OS20-3 Automatic Assessing Body Condition Score from Digital Images by Active Shape Model and Multiple Regression Technique

Nay Chi Lynn, Thi Thi Zin, Ikuo Kobayashi (University of Miyazaki, Japan)

Body Condition Scoring is a magnificent indicator for determining nutritional status, energy reserves, fatness or thinness of cows. The purpose of this study is to assess body condition scores (BCS) of dairy cattle by exploiting digital images of back view of cows. To determine back shape of the cows and its tail head area, anatomical landmark points labelling is performed. Next, active shape model is used to extract the angle features from these cow's tail head contours. In this study, we choose the hook and tail head depression angle from the cow's tail head area. Those angle features with their respective BCS are used to estimate body condition scores by employing multiple regression analysis. Using threshold value on the residuals between the actual BCS and predicted BCS is determined to confirm the proposed method. Moreover, the experimental results show that the proposed system is promising compared to some existing methods.

OS20-4 General Image Categorization Using Collaborative Mean Attraction

Hiroki Ogihara, Masayuki Mukunoki (University of Miyazaki, Japan)

In this paper, we apply Collaborative Mean Attraction (CMA) method, which has been developed for person re-identification problem with multi-camera, to general image categorization problem. CMA is a generic identification method, so once training images are given, CMA can identify test images into a class of the training images. It means that CMA can be used for image categorization. Experimental results using the caltech101 dataset reveal that CMA shows better categorization accuracy than standard SVM method, particularly in the case when the size of training data is relatively small. We also apply CMA to caltech256 dataset, which is more difficult to categorize than caltech101. Even for caltech256, CMA shows better results than other methods, especially for small training data. Furthermore, we discuss the parameter settings for CMA through several experiments.
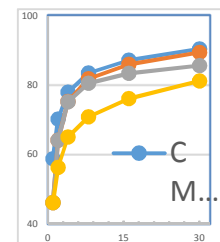
OS20-5 Consideration on the Photo-Realistic Rendering of Fruits by 3DCG

Haruka Tsuboi, Makoto Sakamoto, Sho Yamada, Kensuke Ando, Chongyang Sun,
Makoto Nagatomo (University of Miyazaki, Japan)
Koshiro Mitsuhashi, Yukari Kodama ⸜Miyazaki Multimedia Academy, Japan)

Three-dimensional computer graphics (3DCG) is the technique of creating an image having a stereoscopic effect by converting an object in the virtual three-dimensional space into two-dimensional information. It is also possible to produce an image that cannot be distinguished from the real thing by using the 3DCG. 3DCG is expected for the application to visual representations very much. However, it is difficult to express the "freshness" of fresh food by 3DCG.Therefore, expressiveness of 3DCG is considered to be improved by overcoming this weakness. In this paper, we consider the photo-realistic rendering of fruits by 3DCG. The algorithm is implemented by using the Visual C++ 2010 and C on a personal computer. Through this trial, we hope to improve the representation in photo-realistic rendering by 3DCG.
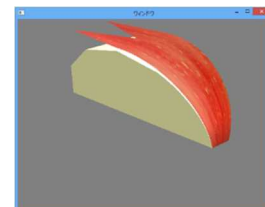
OS20-6 Consideration for the Possibility to the Tourism by the AR Technology

Masamichi Hori, Makoto Sakamoto, Takeshi Tanaka, Mihoko Fukushima, Chikashi Deguchi,
Masahiro Yokomichi, Masayuki Mukunoki, Kunihito Yamamori (University of Miyazaki, Japan)
Yukari Kodama, Koshiro Mitsuhashi (Miyazaki Multimedia Academy, Japan)
Atsushi Iiboshi, Takachiho (Muratabi Co., Ltd., Japan)

The promotion of the tourism nation became the important problem of our country, and we expect increase of the number of the foreign tourists visiting Japan. Therefore, we have to make sightseeing spots of our country more attractive them, so we must contribute plain guidance information to the foreigners who cannot understand Japanese, guidance markers, and so on. On the other hand, AR (augmented reality) is becoming the boom recently, but this is information technology to let the reality world compose the virtual world. In this paper, when we use the AR technology for tourism and sightseeing, we inspect what kind of possibilities we have through some experiments.

OS21 Computer Science and Information Processing (5)
OS21-1 Consideration on the Recognizability of Three-Dimensional Patterns

Chongyang Sun, Makoto Sakamoto, Makoto Nagatomo, Yu-an Zhang, Shinnosuke Yano, Satoshi Ikeda (University of Miyazaki, Japan) Takao Ito, Tsutomu Ito (Hiroshima University, Japan) Yasuo Uchida (Ube National College of Technology, Japan) Tsunehiro Yoshinaga (Tokuyama college of Technology, Japan)

Due to the advances in computer vision, robotics, and so forth, it has become increasingly apparent that the study of three-dimensional pattern processing should be very important. Thus, the study of three-dimensional automata as the computational model of three-dimensional information processing has been significant. During the past about thirty years, automata on a three-dimensional tape have been obtained. On the other hand, it is well-known that whether or not the pattern on a two- or three-dimensional rectangular tape is connected can be decided by a deterministic one-marker finite automata. As far as we know, however, it is unknown whether a similar result holds for recognition of the connectedness of patterns on three-dimensional arbitrarily shaped tape. In this paper, we consider whether or not the pattern on a three-dimensional arbitrarily shaped tape is connected can be decided by a deterministic multi-marker finite automaton.
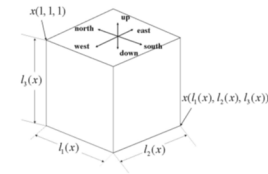
OS21-2 Some Properties of Four-Dimensional Homogeneous Systolic Pyramid Automata

Makoto Nagatomo, Makoto Sakamoto, Yu-an Zhang, Chongyang Sun, Shinnosuke Yano, Satoshi Ikeda (University of Miyazaki, Japan) Takao Ito, Tsutomu Ito (Hiroshima University, Japan) Yasuo Uchida (Ube National College of Technology, Japan) Tsunehiro Yoshinaga (Tokuyama college of Technology, Japan)

The question of whether processing four-dimensional digital patterns is much more difficult than three-dimensional ones is of great interest from the theoretical and practical standpoints. Thus, the study of four-dimensional automata as a computational model of four-dimensional pattern processing has been meaningful. Cellular automata were investigated not only in the viewpoint of formal language theory, but also in the viewpoint of pattern recognition. Cellular automata can be classified into some types. A systolic pyramid automaton is also one parallel model of various cellular automata. In this paper, we propose a homogeneous systolic pyramid automaton with four-dimensional layers (4-*HSPA*), and investigate some properties of real-time 4-*HSPA*.
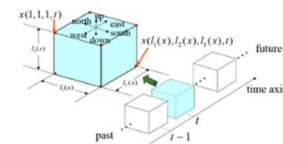
OS21-3 Reduction of the search space to find perfect play of 6×6 board Othello

Yuki Takeshita[1], Makoto Sakamoto[1], Takao Ito[2], Tsutomu Ito[2], Satoshi Ikeda[3] ([1]University of Miyazaki, [2]Hiroshima University, Japan)

In 1993, mathematician Feinstein found out perfect play on 6×6 board of Othello gives 16-20 loss for the first player by using computer. He reported on the Web that it took two weeks to search forty billion positions in order to obtain the result. In our previous papers, we confirmed the perfect play he found is correct. And we also found another perfect play different from the one he found to search 884 billion positions. In order to search efficiently, we attempted to reduce the search space to find some perfect play. In this paper, we introduce some techniques to solve 6×6 Othello by searching about fifteen billion positions.
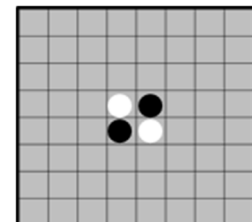
OS21-4 A comparative study on the delisting ratings of firms from the UN Global Compact in the international management environment

Kanako Negishi (National Institute of Technology, Ube college, Japan)

This paper explores the international management environment for Japanese manufacturing firms' sustainability strategies. In particular, it clarifies firms' positioning and characteristics in the environment. Firms have adopted voluntary standards for environmental protection provided by NGOs and international institutions like the GRI and United Nations. Although there are various standards without legal binding, there is a recent trend toward integration to achieve comparability for firms' international management of sustainability. It then bound firms' management as a de facto standard. This paper discovers Japanese firms' unique characteristics related to the environment though the comparison.

Comparison of the average delisting ratings from the UN Global Compact		
Country	Firm type	Ratio
Japan	Company	0.00%
	SME	77.59%
Spain	Company	41.10%
	SME	48.17%
USA	Company	34.86%
	SME	63.43%
China	Company	58.66%
	SME	57.38%

OS21-5 Application of ViSC to the Natural Grazing in Qinghai Tibet Plateau

Cheng-shui Niu[1], Bing-fen Li[1], Yu-an Zhang[1], Makoto Sakamoto[2]
([1]Qinghai University, P.R. China, [2]University of Miyazaki, Japan)

"Sanjiangyuan Region" is a complex ecosystem with typical characteristics of alpine grassland, which the livestock production mainly relies on the yak grazing. In recent years, artificial destruction were due to grassland degradation, the reduction of herdsmen income and on-going deterioration of the ecological environment. It is necessary to establish a grazing mode which ecological animal husbandry and grassland sustainable development. In this study applying the ViSC that combined with optimization theory, we establish sustainable grazing system in alpine grassland yak, which provides a theoretical basis for scientific grazing.
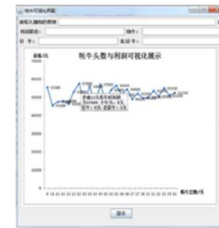
OS22 Robotic Technology for Competition (4)
OS22-1 Development of a Tomato Harvesting Robot

Bingh Li, Shinsuke Yasukawa, Takashi Sonoda, Kazuo Ishii (Kyushu Institute of Technology, Japan)

Most of commercialized robots are for industry, and the robots for agriculture, forestry and fisheries are under developing and not commercialized yet. The reasons for the difficulty are caused by cost-efficiency of the robotization, safety ensuring of the works using robots, outdoor operations, and knowledge transfer problem from farmers to computer so on. Tomato is one of important fruit vegetables and most tomatoes are produced in the greenhouses, or large-scale farms, where the high temperature and humidity, and long harvest age force the farmers heavy works. With an aim to promote the automation of tomato harvesting, we have organized the tomato harvesting robot competition and developed a tomato harvesting robot. In this paper, we propose the system of tomato harvesting robot.

OS22-2 Development of SOM algorithm for Relationship between Roles and Individual's Role in Rugby 2nd Reports: University Rugby teams analysis using Physical and Psychological data

Yasunori Takemura (NishiNippon Institute of Technology, Japan)

Victory or defeat in team sports depends on each player's technique, physical strength, and psychological condition. It follows that team performance depends on the player's adaptation to (suitability for) a certain role (position in the team) and the relationships between different roles. We assume that team performance is related to physical and psychological features. Many researchers have proposed that physical features determine a player's suitability for a position. Psychological features have also been researched as factors of position adaptation. However, each feature has been investigated independently. The present research aims to develop a clustering method that considers both physical and psychological features in judging an individual's role and adaptation in the game. This paper reports the concept of the algorithm and result of analysis using both physical data and psychological data.
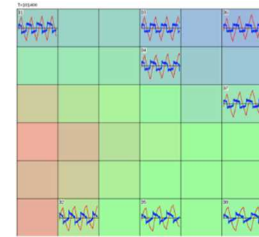
OS22-3 Ball Dribbling Control for RoboCup Soccer Robot

Shota Chikushi, Kenji Kimura, Kazuo Ishii (Nippon-Bunri University, Kyushu Institute of Technology)

RoboCup is a platform designed to promote the research fields such as Artificial Intelligent (AI) and robotics. We also organize a RoboCup team "Hibikino-Musashi", and working on co-operated behavior control system using multiple autonomous mobile vehicles. In this paper, motion analysis and control of a ball operated by two active wheels mounted on upper side of the ball is discussed. Based on the analysis and simulation, a ball dribbling mechanism is developed. The kinetics of ball and two-active wheels is derived and evaluated using the developed ball dribbling mechanism.

OS22-4 Strategy Analysis of RoboCup Soccer Teams Using Self-Organizing Map

Moeko Tominaga, Yasunori Takemura, Kazuo Ishii
Kyushu Institute of Technology, NishiNippon Institute of Technology

In the soccer games, the player's behavior changes depending on the game situation such as wining or losing, score gap, remaining time. The players act more offensive when their team is losing, or more defensive when their team is winning with minimum score difference. Currently most of robot teams keep the same strategy during the game so that the result of game depends on the ability of each player like speed of robot, quality of localization, obstacle avoidance and ball handling. Next issue for the robot intelligence is collaborated team behavior and strategy. In this paper, the team strategy is analyzed based on parameters such as the positions of robots, the number of robots in play, scores, time and actions of robots using Self-Organizing Map.
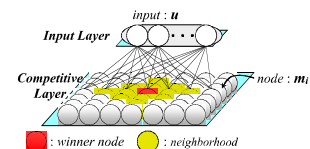
GS abstracts
GS1 Artificial Neural Network & Bio-Signal Controlled Robotics (3)
GS1-1 Obstacle Avoidance Method for Electric Wheelchairs Based on a Multi-Layered Non-Contact Impedance Model

Haruna Kokubo, Taro Shibanoki (Ibaraki University, Japan),
Takaaki Chin (Hyogo Rehabilitation Center, Japan), and Toshio Tsuji (Hiroshima University, Japan)

This paper proposes an obstacle avoidance method based on a multi-layered non-contact impedance model for the biosignal-controlled electric wheelchair. The proposed system can calculate a virtual repulsive force before the collision by multi-layered impedance fields, which have different impedance parameters, covered around the robot. In this way, this system regulates desired path to avoid obstacles in a variety of situations such as a natural evasion and an emergency avoidance. In the simulation and practical experiments, the mobile robot moved to a desired position, and some obstacles were appeared on their moving paths. The results showed that the robot passed through obstacles smoothly, and could stop emergently to avoid the obstacle in front of the robot owing to virtual forces calculated by the proposed model
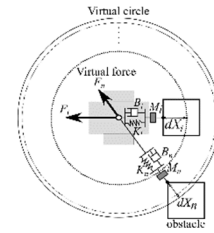
GS1-2 A Voice Signal-Based Manipulation Method for the Bio-Remote Environment Control System Based on Candidate Word Discriminations

Taro Shibanoki (Ibaraki University, Japan), Go Nakamura, Takaki Chin
(Hyogo Rehabilitation Center, Japan), and Toshio Tsuji (Hiroshima University)

This paper proposes a voice signal-based manipulation method for the Bio-Remote environment control system. The proposed system learns relationships between multiple candidate words' phonemes extracted by a large-vocabulary speaker-independent model and control commands for domestic appliances based on a self-learning look-up table (self-learning LUT). This allows the user to control various devices even if false recognition results are extracted because of slurred speech. The efficacy of the proposed system was demonstrated through speech recognition for slurred words and domestic appliance control experiments conducted with healthy male participants. The results showed that the method could be used to accurately discriminate seven slurred words (average discrimination rate: 93.9 ± 2.2 [%]), and that the subject was able to voluntarily control domestic appliances as intended.
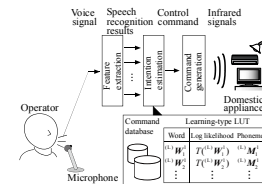
GS1-3 Experiments on classification of electroencephalography (EEG) signals in imagination of direction using Stacked Autoencoder

Kenta Tomonaga, Takuya Hayakawa, Jun Kobayashi (Kyushu Institute of Technology, Japan)

This study presents experimental results of classification methods for brain activity in the imagination of direction. We used a wireless portable electroencephalography (EEG) headset to collect EEG data from subjects in experiments, during which the subjects imagined arrows indicating one of the four direction: up, down, right, left. The classification methods estimated the direction that the subjects imagined on the basis of their brain wave signals measured by an electrode on the portable EEG headset. The classification methods implemented in our previous studies consisted of a band-pass filter, fast Fourier transformation, principal component analysis (PCA), and neural network. The PCA works for feature extraction and selection. In this study, we have implemented Stacked Autoencoder (SAE) for EEG signal classification. The SAE carries out not only feature extraction but also classification in the form of multi-layered neural network. Experimental results showed that the SAE outperformed the previous classifier with PCA.

GS2 Automated Guided Vehicles I (6)

GS2-1 Adaptive Negotiation-rules Acquisition Methods in Decentralized AGV Transportation Systems by Reinforcement Learning with a State Space Filter

Masato Nagayoshi, Simon Elderton (Niigata College of Nursing),
Kazutoshi Sakakibara (Toyama Prefectural Univ.), Hisashi Tamaki (Kobe Univ.)

In this paper, we introduce an autonomous decentralized method for multiple Automated Guided Vehicles (AGVs). Transportation route plans of AGVs are expected to minimize the transportation time without collisions between the AGVs in the systems. In our proposed system, each AGV as an agent computes its transportation route by referring to the static path information. route. Once potential collisions are detected, one of the two agents chosen by a negotiation rule modifies its route plan. The rules are improved by reinforcement learning with a state space filter. Then, the performance is confirmed with regard to the adaptive negotiation rules.
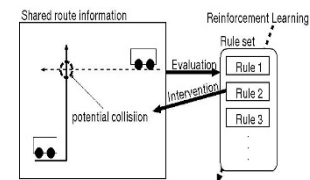
GS2-2 Modeling and Control of a Quadrotor Vehicle Subject to Disturbance Load

Jun Wang, Song Xin, Yuxi Zhang (Beihang University, P. R. China)

In this paper, a dynamic model of quadrotor, an unmanned aerial vehicle (UAV), is derived for theoretic and practical evaluation. Four transfer functions in different channels are converted from the state equations. To study the behavior of quadrotor subject to the external disturbance load, a fuzzy logic controller (FLC) is designed to compare with the PID (proportional-integral-derivative) control method. Subsequently, Liapounov function is applied for stability analysis. Finally, simulation results are presented to illustrate the performance between FLC and PID. Considering model error, the evaluation simulations are divided into two parts, which describe the ability for rejecting external disturbance, setpoint tracking and disturbance rejection respectively. The simulation scheme demonstrates the FLC method outperforms the PID control scheme.

GS2-3 A multithreaded algorithm of UAV visual localization based on a 3D model of environment: implementation with CUDA technology and CNN filtering of minor importance objects

Alexander Buyval, Mikhail Gavrilenkov (Bryansk State Technical University, Russia)
Evgeni Magid (Kazan Federal University, Russia)

Visual based navigation plays an important role in localization and path planning, especially in GPS-denied environments. This paper presents a visual based localization algorithm for a UAV within an indoor environment. The algorithm uses multithreaded computing CUDA technology and CNN-preprocessing filtering, which is responsible for filtering out minor importance objects. We assume that while an initial 3D model of environment is available, the scene may undergo minor dynamical changes, e.g., new objects may appear in the scene as the time passes. The localization is performed in two steps. Initially, a neural filtering module detects new objects in the scene and filters them out. Next, the filtered data is passed to a multithreaded edge-computing module, which compares it with the initial 3D model. The algorithm is simulated in ROS/Gazebo environment with two different approaches – one uses CPU only and the other uses CPU and GPU - and their performance is compared.
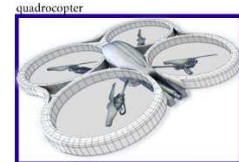
GS2-4 Modelling a crawler-type UGV for urban search and rescue in Gazebo environment

Maxim Sokolov, Aidar Gabdullin, Roman Lavrenov, Ilya Afanasyev (Innopolis University, Russia)
Leysan Sabirova, Evgeni Magid (Kazan Federal University, Russia)

A long-standing goal of robotics is to substitute humans in unreachable or dangerous environments. One of the most dangerous and human unfriendly environments is urban search and rescue (USAR) domain, where a rescue robot is used for victims search and environment monitoring purposes. To deal with USAR tasks we have selected a novel Russian crawler robot "Engineer", and this paper presents our first successful steps toward modelling the robot in ROS/Gazebo environment. We convert the provided by "Engineer" developers CAD models into workable ROS-based 3D simulation and incorporate physical parameters of the mechanisms into the model. Robot motion and relative interplay of its visible mechanical parts is visualized in RViz software. The proposed model is integrated into a ready-to-use ROS navigation stack and the model's behavior is thoroughly investigated while navigating through static obstacles populated scene in Gazebo environment.
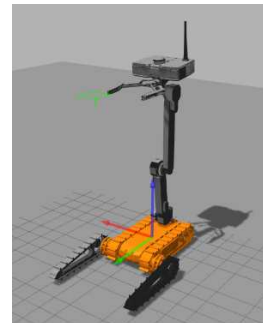
GS2-5 Development of Autonomous Robot for Laborsaving of the Forestry - Positioning of the Robot using IMU, GPS, and Encoder -

Sho Yamana, and Eiji Hayashi (Kyushu Institute of Technology, JAPAN)

This paper presents about the positioning of the autonomous robot using IMU, GPS, and encoder devices. Using acceleration and orientation from IMU sensor that is used to calculate the position of the robot. To locate the position, need to know the distance when the robot moved. Distance is calculated by integrating of velocity and also the velocity is considered by integrating of acceleration. Results showed distance measured using only IMU. It shows the difficulty of locating using only IMU. Therefore, GPS and encoder devices need to be combined into the system for position measurements.

GS2-6 Development of Autonomous Robot for Laborsaving of the Forestry - Detection of young plants by RGB and Depth Sensor -

Nobuo Miyakawa , and Eiji Hayashi

(Kyushu Institute of Technology, Japan)

Nowadays In Japan, the forest industry have problem about safety and labor shorting. This research is about development of the autonomous moving robot in the forest focused on solving the problem. As the first phase of automation of forest industry, autonomous movement control system must be developed. Because, the environment surrounding the robot changes every moment in forest. For example, the tree and weed in forest is growing every day. So this dynamic environment has to be considered for the robot to continue moving in the forest. Therefore we aim at the development of autonomous system that movement in the forest in this study.   This paper proposes to detect plants of autonomous robot system in the forest.

GS3 Automated Guided Vehicles II (3)
GS3-1 Motion Improvement of Four-Wheeled Omnidirectional Mobile Robots for Indoor Terrain

Amornphun Phunopas (King Mongkut's University of Technology, Thailand)
Shinichi Inoue (Kyushu Institute of Technology, Japan)

The four-wheeled omnidirectional platform is great to use for an indoor mobile robot. It can increasingly move and change heading direction. However, The robot is easy to slip when it is moving. As well as, one or more wheels are sometimes not touching the ground. Therefore the robot may miss the planned path, or in the worst case, the robot possibly gets stuck due to unrecognized circumstances. This paper approaches to solving the problems by computational simulation in locomotion. Mathematical models simulate the robot movement. The robot struggles to go to the target with randomly simulated slip and inactive wheel circumstances. The robot can estimate the positions using the Kalman filter and readjust itself to the planned path. Consequently, this paper demonstrates the motion improvement and compare the results of decreasing error.
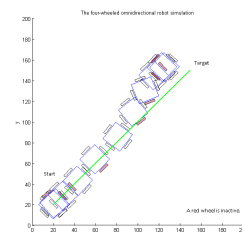
GS3-2 An Improved Algorithm for Obstacle Avoidance by Follow the gap method combined Potential Field

Chakhrit La-orworrakhun, Suriya Natsupakpong (Institute of Field Robotics, King Mongkut's University Technology Thonburi, Thailand)

This paper proposes a novel obstacle avoidance algorithm for boat survey. The proposed algorithm, "Follow the Gap Plus", for boat navigation is presented by combining the "Follow the Gap" method and adapting the "Potential Field" method with an attractive field of obstacles. Then the simulation environment for testing system and algorithm are generated in various situations and similar real-world environment. The results show that the survey boat simulation with proposed algorithm can go to the desired destination with better performance than "Follow the Gap" method in the environment with obstacles about 4.47 percentage of total distance, about 7.63 percentage of total time used, and about 54.33 percentage of average change of direction.

GS3-3 Study on the target positioning for an Omni-directional 3 DOF mobile manipulator based on machine vision

Jiwu Wang, Yao Du, Wensheng Xu (Beijing Jiaotong University, China)

Masanori Sugisaka (ALife Robotics Corporation Ltd, Japan)

The omni-directional mobile robot with multi DOF, because the operation posture and operation accuracy of the manipulator can be better controlled in a narrow or crowded workplace compared with the general manipulator, is getting more interested in practical applications. The present problem is to improve its flexibility for operating multiple different targets. Target recognition with image processing is an effective solution. Based on the image processing, the position and posture of the target can be determined. Then the signal will be sent to the arm control system. In this paper, the illumination conditions, distortion, etc. are studied in the target recognition. The target position with image processing, is verified with real coordinates. The experiments show target recognition with image processing can effectively improve the flexibility of our robot
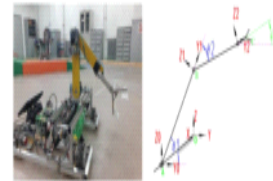
GS4 Biological Systems (4)

GS4-1 Force and Motion Analysis of larval zebrafish (*Danio rerio*) using a body dynamics model

Naohisa Mukaidani, Zu Soh, Toshio Tsuji ([1]Hiroshima University, Japan)

Shinichi Higashijima (National Institutes of Natural Sciences, Japan.)

Larval zebrafish are often employed as a vertebrate model to study the phenomena during the stages of development. This study proposes a method of body dynamics analysis for larval zebrafish incorporating a viscoelastic body model and a fluidic environment model to support the study of development mechanisms in motion generation. An algorithm for estimation of the external drag forces acting on larval zebrafish enabled calculation of thrust forces resulting from body motion. The results showed that the estimated fluid drag coefficients enabled the body dynamics model to approximate the paths of actual larvae with a high accuracy level of 0.76 ± 0.74 [%] of the total length. Based on the analysis results, we found that the fins generate dominant forces at the initiation of swimming, but have little role during swimming.

GS4-2 Behavior Analysis on Boolean and ODE models for Extension of Genetic Toggle Switch from Bi-Stable to Tri-stable.

Masashi Kubota, Manabu Sugii, Hiroshi Matsuno (Yamaguchi University, Japan)

The artificial genetic circuit (AGC) is a gene network in which its expression timing, period and function are designed by computational and biological technique. The AGCs for the functions of electronic circuits like a toggle switch and an oscillation circuit were realized in E.coli by Gardner and Elowitz in 2000, respectively. We visualized and verified the structure and behavior of Boolean network (BN) and ordinary differential equation (ODE) models for 2-variable genetic toggle switch in the phase plane by using GINsim and Scilab. ODE has been the most widely used formalism for biological processes, but BN model allows us to easily understand mathematical expression of biological processes. Then, we extended the models for 3-variable genetic toggle switch from the 2-variable ones, and we demonstrate a mathematical formalization by showing correspondence between state transitions of BN and trajectory paths of ODEs in the phase space.
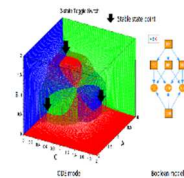
GS4-3 Boolean modeling of mammalian cell cycle and cancer pathways
Hideaki Tanaka, Hiroshi Matsuno, Adrien Fauré (Yamaguchi University, Japan)

The cell division cycle is controlled by a complex molecular network: a recent model of the cell cycle and cancer pathways includes close to a hundred genes [Fumiã and Martins, 2013]. To cope with such complexity, different approaches have been used by modelers. Recently, Deritei et al [2016] have emphasized modularity as a key organizational principle. Their model however, includes only 22 components. This raises the question how the approach would fare on larger models such as the one published by Fumiã and Martins. To explore that question we first convert these two models to a common modeling framework [Naldi et al., 2009]. Preliminary results show that there is only limited overlap between the two models, with shared variables being controlled by different regulators. This suggests that at this stage module definition may still depend on the modeler and thus may not yet reflect actual biological organization.
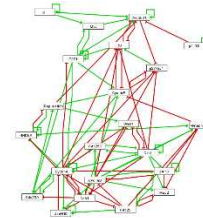
GS4-4 An Estimation Method for Environmental Friction Based on Body Dynamic Model of *Caenorhabditis elegans*
Zu Soh (Hiroshima University, Japan), Michiyo Suzuki (National Institutes for Quantum and Radiological Science and Technology, Japan), Toshio Tsuji (Hiroshima University, Japan)

Caenorhabditis elegans is a small worm which is approximately 1.3 mm in length. For the reason of technological limits, it has been difficult to measure the friction between the body and environments. The present study proposes an estimation method for frictional force using locomotion information obtained from video analysis of actual worms. The results indicate that the body model driven by the estimated frictional force can trace the locomotion of the worm within 4% of the body length. The proposed method may be able to be applied to analyze the relationship between friction and gait control.
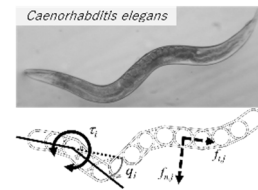
GS5 Filtering & Control Systems (2)
GS5-1 An Application of Collaborative Filtering in Student Grade Prediction
Chaloemphon Sirikayon and Panita Thusaranon (Dhurakij Pundit University, Thailand)

This research proposed the process of student performance prediction by using the collaborative filtering (CF) technique. The benefit of this research includes assist instructor to identify student performance, personalized advising, and student degree planning. The CF technique composes of similarity calculation and prediction. In our experiments, different techniques are compared to calculate students' similarity. We also found that a prior course clustering with heuristic knowledge can be used to enhance predictability. The data used for this study obtained from Dhurakij Pundit University with enrollments of 200 undergraduate students between 2012 and 2016 from the Faculty of Information Technology. The performance of each student has been predicted since semester 2, 2014 by using existing grades available at that time. The A-F letter grades were converted to the 4–0 scale, which is actually discrete. In additional, we also conducted the experiment by using actual score from each courses.

GS5-2 An improved detection method for railway fasteners

Jiwu Wang, Yan Long (Beijing Jiaotong University, China)
Sugisaka Masanori (ALife Robotics Corporation Ltd, Japan)

Aiming at the disadvantages of low efficiency and poor stability of the existing methods of fastener detection, this paper proposes a method of fastener detection based on template matching. Firstly, the image is processed by noise reduction, this method does not need to be based on histogram can match template directly. We choose a standard fastener image as template, read template firstly, then slide the image blocks on the input image to match the template and the input image. Experimental results show that this method can effectively detect the flaw, deformation and obstacles of railway fastener occlusion. This method has a fast matching speed and a good robustness, it's detection accuracy is up to 96%
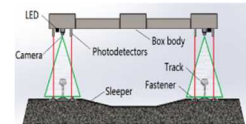
GS6 Human-Welfare Robotic System & Medical Application (5)
GS6-1 Virtual surgery system with realistic visual effects and haptic interaction.

Vlada Kugurakova, Murad Khafizov, Ruslan Akhmetsharipov, Alexei Lushnikov, Diana Galimova, Vitaly Abramov (Kazan Federal University, Russia)
Omar Correa Madrigal (University of Informatic Sciences, Cuba)

Currently, educational processes in medical surgery field involve not only theoretical in-class studies that are immediately followed by practical lessons in mortuaries and hospitals, but also involve simulations of various levels of reality. This paper describes our current progress in Virtual Surgery System development, which is targeted to support educational processes in medical surgery. With this system, all surgery operations are performed using a virtual reality headset and haptic manipulators with force feedback. The main feature of our approach is applying a voxel data structure of a human body that provides an opportunity to simulate realistic behavior of the body. Thus, cutting, sewing, and welding of human tissues processes become realistic. Together with a realistically simulated virtual surgery scene, these will significantly speed up educational processes.

GS6-2 A Human Reaching Movement Model for Myoelectric Prosthesis Control

Go Nakamura[1, 5], Taro Shibanoki[2], Yuichiro Honda[1], Futoshi Mizobe[3], Akito Masuda[4], Takaaki Chin[1], Toshio Tsuji[5]
[1](Robot Rehabilitation Center in The Hyogo institute of Assistive Technology, Japan)
[2](Ibaraki University, Japan) [3](Hyogo Rehabilitation Center, Japan)
[4](Kinki Gishi Corporation, Japan) [5](Hiroshima University, Japan)

This paper proposes a human reaching movement model for myoelectric prosthesis control. The main purpose of the proposed model is to generate desired trajectories provided in a reaching training system for myoelectric prosthesis control. First, an experiment was performed to observe reaching movements with a healthy subject and a myoelectric prosthesis user (upper limb amputee). Then, we found several distinctive features shown in reaching movements for the myoelectric prosthesis user, and constructed a model considering the observed characteristics by using a logistic function. The proposed model can generate three different types of hand trajectory such as straight line paths, circular arc paths and S-shaped paths with bell-shaped speed profile by adjusting only a few parameters. It was indicated that the proposed model could generate both hand trajectories of the healthy subject and the myoelectric prosthesis user from the comparison results between observed and simulated trajectories.
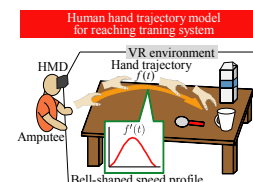
GS6-3 Re-creation of a membrane puncture's sense of an object constituted of liquid and an outer membrane by a haptic device and a deformation simulation of the virtual objects

Takahiro Okada, Eiji Hayashi (Kyusyu Institute of Technology, Japan)

Technologies that can accurately perform minute work are now being sought for medical treatment and bio-technology field. Such minute work is improved by using micromanipulators, but their operation is difficult because the operator has no sense of force. The operator relies only on sight through a microscope. As a result, a person skilled in the use of this technology is needed for all minute work. For the efficiency of minute work, we used a haptic device and amplified the force feedback from a minute sample. The purpose of this research is to develop a combined sense system that uses both force feedback and visual feedback on a deformation simulation. Especially, I focused a way to recreate a membrane puncture's sense of salmon rows assumed a cell.
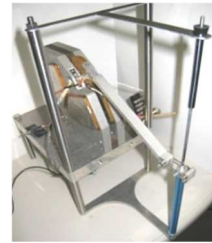
GS6-4 Exercise classification using CNN with image frames produced from time-series motion data

Hajime Itoh, Naohiko Hanajima (Muroran Institute of Technology, Japan)
Yohei Muraoka, Makoto Ohata (Steel Memorial Muroran Hospital, Japan)
Masato Mizukami, Yoshinori Fujihira (Muroran Institute of Technology, Japan)

To enhance the strength of the elderly is important for the care prevention. Exercise support systems for the elderly have been developed and some were equipped with a motion sensor. Normally it provides three-dimensional time-series data of over 20 joints. It is important to integrate such large data and evaluate the motion of the users. In this study, we propose to apply Convolutional Neural Network (CNN) methodology to the motion evaluation. The deep learning has a success in integrating big data, for example, image classification. Our main idea is to convert the motion data of one exercise interval into one gray scale image by taking joint types for the row direction and time for the column direction and by changing the data into the gray scale value. From simulation results, the CNN was possible to classify the images into specified motions. It can potentially be used for exercises classification.

GS6-5 Proposal and Evaluation of the Gait Classification Method using Arm Acceleration Data and Decision Tree

Kodai Kitagawa, Yu Taguchi, Nobuyuki Toya
(National Institute of Technology, Kushiro Collage, Japan)

We have been developed a system to classify gait patterns based on stride length and foot clearance by acceleration sensors of Smartphone as simple sensors for fall prevention. This system places a Smartphone around an arm as a convenient location. In this paper, we propose gait classification method using arm acceleration data and decision tree. Also, we evaluate whether decision tree using three-axis accelerations as feature quantities can classify three gait patterns. (Three gait patterns are "Normal", "High step" and "Long step".) The result showed that this method can classify three gait patterns of some subjects. Besides, it was found that x-direction accelerations and composite accelerations were important feature quantities for gait classification by decision tree.

GS7 Micro-Machines & Robotics I (6)
GS7-1 Estimation and Categorization of Errors in Error Recovery Using Task Stratification and Error Classification

Akira Nakamura[*1], Kazuyuki Nagata[*1], Kensuke Harada[*2] and Natsuki Yamanobe[*1]
([*1] National Institute of Advanced Industrial Science and Technology (AIST), [*2] Osaka University, Japan)

In manipulation tasks of plant maintenance and industrial production, error recovery is an important research theme for robots. However, systematical methods of error recovery have not been appeared yet. We have proposed error recovery using the concepts of both task stratification and error classification. In the error recovery, the judgment of the error is carried out on a process of the practice of the system. In our method, classification of errors that occurred is carried out based on an estimated cause. Specifically, errors are classified into several categories such as sensing errors, modeling errors, planning errors and execution errors. When an error is classified correctly, a possibility that the most suitable recovery is performed becomes high. In this paper, a procedure of the categorization of the error that we have considered is described..
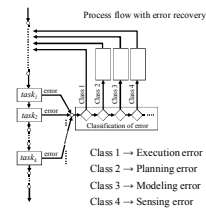
GS7-2 The Suitable Timing of Visual Sensing in Error Recovery Using Task Stratification and Error Classification

Akira Nakamura[*1], Kazuyuki Nagata[*1], Kensuke Harada[*2] and Natsuki Yamanobe[*1]
([*1] National Institute of Advanced Industrial Science and Technology (AIST) [*2] Osaka University, Japan)

In manipulation tasks of industrial production and housework, the techniques of error recovery become important since robots need to perform complicated tasks. We have proposed error recovery using the concepts of task stratification and error classification. In the error recovery, the judgment of the error is performed in processes of the practice of the system. Ideally, it is desirable for the judgment of the error to be carried out in many timings. However, in that case, many sensors are needed and it leads to disturb a workflow. Therefore it becomes important to be judged by the most suitable timing in a little number of times. In this paper, an efficient timing of visual sensing in an error recovery is described.
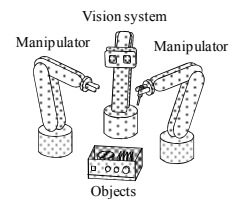
GS7-3 Hexapod Type MEMS Microrobot Equipped with an Artificial Neural Networks IC

Kazuki Sugita, Taisuke Tanaka, Yuya Nakata, Minami Takato, Ken Saito, Fumio Uchikoba
(Nihon University, Japan)

This paper proposes the hexapod type microrobot controlled by the artificial neural networks. The silicon based structural component of microrobot is produced by micro electro mechanical systems (MEMS). The rotary actuator is constructed from the artificial muscle wire of shape memory alloy (SMA) material. The actuator generates the locomotion of the microrobot by supplying the electrical current to artificial muscle wires. The microrobot was controlled by using artificial neural networks IC. The IC includes cell body models, inhibitory synaptic models and current mirror circuits. In addition, the artificial neural networks IC outputs the electric current whose pulse waveform. We installed the lead wires in the microrobot's interior. When the driving circuit is equipped on the MEMS microrobot, the internal placements of the lead wires reduced the wiring length, and achieved excellent weight balance and structurally stable performance of the MEMS microrobot.
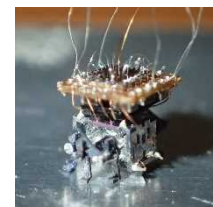
GS7-4 Heat Distribution of Current Output Type Artificial Neural Networks IC for the MEMS Microrobot

Taisuke Tanaka, Yuya Nakata, Kazuki Sugita, Minami Takato, Ken Saito, Humio Uchikoba
(Nihon University, Japan)

Heat distribution of the artificial neural networks IC developed to driving circuit of microrobot were described in this paper. We previously constructed the microrobot imitating the insects with micro electro mechanical systems (MEMS) technology. The rotary actuator of MEMS microrobot is composed of shape memory alloy (SMA) based artificial muscle wires. The rotary motion is generated by passing an electric current through artificial muscle wires. We constructed artificial neural networks on IC chip as a driving circuit for the MEMS microrobot. The current mirror circuits also constructed, for the actuator is electric current driven type. The design rule of the IC was 4 metal 2 poly CMOS 0.35μm. We measured the heat distribution in the two types ICs having different stage number of the current mirror circuits by thermography. In addition, we examined heat generation mechanisms.
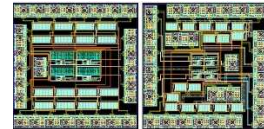
GS7-5 AGV with Mind and its production simulations for autonomous decentralized FMSs

Masato Chikamatsu, Hidehiko Yamamoto, Takayoshi Yamada (Gifu University, Japan)

The autonomous decentralized FMS does not have a management mechanism to integrate the entire system and each agent like Automated Guided Vehicles (AGVs) autonomously determine the acts by recognizing other agents. This study controls AGVs moving by using a mind model in order to avoid AGVs' interference in an autonomous decentralized FMS. The mind model can avoid the AGVs' interference by repeating the two types of mind changes, the arrogant mind and modest mind. AGV with the arrogant mind takes the action to approach forcibly at the destination. AGV with the modest mind takes the action to make way for other AGVs. By applying the mind to several FMSs, the production simulations were carried out. As a result, AGVs can avoid the path interference flexibly even if the shape of the production floor is changed and it is ascertained that the mind model is able to control the AGV actions of autonomous decentralized FMSs.
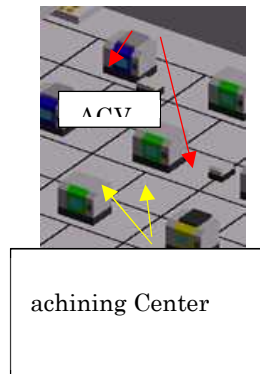
GS7-6 UNARM System to Decide Units Locations of Cell-type Assembly Machines with Robots Arms

Hirotaka Moribe, Hidehiko Yamamoto and Takayoshi Yamada (Gifu University, Japan)

This study develops the system called Units-layout Nomination for Assembly with Robot Mechanism (UNARM).UNARM assists a production engineers when they design an assembly machine with a both arms robot. To design the assembly machine, the engineers must decide the locations of parts and assembly jig (we call them as units) which become the objects assembled in the assembly machine. By using UNARM, every unit location can be automatically decided. To develop UNARM, we adopt Reinforcement Learning as a key technology. UNARM's characteristics are not only to decide the units locations but also to incorporate the both arms waiting time concept so that the both arms collisions do not occur. We applied UNARM to the assembly machine for the inline motor of an electric vehicle. The machine has 8 units in total. After carrying out UNARM simulations, the assembly time was decreased and the usefulness of UNARM was ascertained.
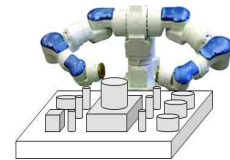
GS8 Micro-Machines & Robotics II (3)
GS8-1 Development of arm trajectory planning of Seamless Robot

Teedanai Pramanpol, Eiji Hayashi (Kyushu Institute of Technology, Japan)

This paper presents arm trajectory planning of Seamless Robot. The Seamless Robot is a Human Support Robot (HSR) which is the ongoing developed project at Hayashi Laboratory, this robot is consist of three main parts base, body and arms, this paper will focus on controlling arm movement. Each arm has been designed with four degrees of freedom with a limitation of each joint is set to values close to a human arm. In order to solve for each joint angle the Levenberg Marquardt method is used for solving the inverse kinematic problem for calculating point to create a trajectory planning of robot`s arms. The result of trajectory planning has been proven in simulation and compare with the experimental result from the robot.

GS8-2 Localization Method of Autonomous Moving Robot for Forest Industry

Ayumu Tominaga, Eiji Hayashi(Kyushu Institute of Technology, Japan), T. Sasao(Meiji University., Japan)

In the past, the working time of labor was spent too much for the forest management and maintenance. Particularly, survey of a forest and elimination of weed plants place a huge burden on the workers. We would like to propose an autonomous moving robot, which has the weeding mechanism. The robot can achieve the large labor-saving of forest industry. In this study, we are developing an autonomous moving robot for labor-saving of forest industry. Traditional forest management and maintenance consumes excessive labor time. Particularly, the survey and weeding in the forest place large labor burden on the workers. Therefore, the robot which has the weeding mechanism can achieve to reduce the workload. We installed a depth sensor into an all-terrain vehicle. The trajectory path of the robot is determined from the obtained depth information. In addition, we are using the Monte Carlo Localization for localize of the robot in the forest. Experimental results that show the feasibility of an autonomous moving in the real environment.

GS8-3 Dynamic Modeling and Motion Control of an RRR Robotic Manipulator

Jinho Kim[1], Kevin Chang[1], Brian Schwarz[1], Andrew S. Lee[1], S. Andrew Gadsden[1,2]
([1]University of Maryland, USA) ([2]University of Guelph, Canada)

This paper presents the dynamic modeling and motion control of a three-link robotic manipulator, also known as the RRR robot. The Kinect motion capture system by Microsoft is used in conjunction with the manipulator. Kinect is used to capture the motion of a user's arm and tracks certain angles made by parts of the arm. We consider a pinhole camera model to generate reference angles as per the Kinect model in our simulations. These desired angles are fed into the controller and are used by the RRR robot in an effort to copy the movement of the user. A proportional-integral-divider (PID) controller is developed and applied to the manipulator for improved trajectory tracking. The RRR robot manipulator is dynamically modeled and the results of the proposed control strategy demonstrate good trajectory following.
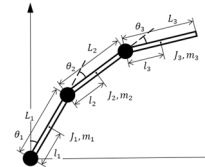
Fig 1. Configuration of the RRR robotic manipulator.

GS9 Neuromorphic Robotic Systems (5)
GS9-1 Development of Cloud Actions for Seamless Robot Using Backpropagation Neural Network

Wisanu Jitviriya (King Mongkut's University of Technology, Thailand)
Jiraphan Inthiam, Eiji Hayashi (Kyushu Institute of Technology, Japan)

This paper presents the cloud actions for a five DOF Seamless robotic arm using the inverse kinematics solution based on artificial neural network (ANN). Levenberg-Marquardt method is used in training algorithm. The desired position and orientation of the end effector is defined as the input pattern of neural network. In addition, we propose the cloud actions which are the movement patterns of the robotic arm. The cloud actions platform is created in order to perform the basic behaviors of the Seamless robot such as "Catch", "Approach", "Interest", "Look around", "Alert" and "Avoid" actions. Experimental results show the suitable structure of artificial neural network used for solving the inverse kinematics equation, and the testing points in the robot's workspace were verified with the robotic arm.
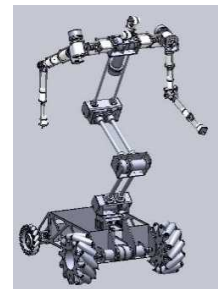
GS9-2 Mathematical modelling of human fear and disgust emotional reactions based on skin surface electric potential changes

Kristina Gaisina, Ruslan Gaisin (Kazan Federal University, Russia)

An appropriate numerical representation of neurotransmitters' level allows applying numerical methods for a study of psycho-emotional human reaction to various external stimuli, which could be further integrated into artificial life and robotic systems to reproduce human emotions and reactions. This paper deals with skin surface electric potential data registration of a human while the human is watching specially selected videos that are supposed to activate basic emotions of fear and disgust. We describe the selected video materials and data logging process and present human emotional reactions model, which was implemented with numerical methods. We demonstrate experimental results for fear and disgust psycho-emotional states that were obtained from 100 respondents. We believe that our findings might be applied for conditional measuring of neurotransmitters' levels.
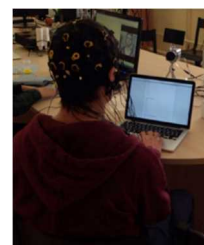
GS9-3 Neuromorphic Robot Dream: A Spike Based Reasoning System
Alexander Toschev, Max Talanov, Salvatore Distefano (Kazan Federal University, Russia)
Alexander Tchitchigin (Innopolis University & Kazan Federal University, Russia)

Re-implementation of bio plausible processes in a real-time robotic system is one of challenging problems. We propose a novel approach for an integration of biologically plausible simulation of a mammalian brain with a real-time/semi-real-time autonomous robotic system using metaphor of "wake" and "dream" phases of a mammalian life. During the "wake" phase the robotic system makes its decisions applying a light-weight rule-based system and stores inbound sensory information in a form of pseudo-neuronal activities. During the "dream" phase the "sleeping brain" plays-back the stored pseudo-neural activities over a simulated spiking neural network and later via the "reverse translation" translates the updated neuronal structures in the form of light-weight rules of the robotic system. We call the proposed architecture the "Robot dream"
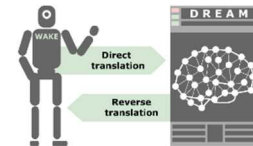
GS9-4 Development of Behavioral Robot using Imitated Multiplex Neurotransmitters System
Saji Keita[1], Wisanu Jitviriya[2] and Eiji Hayashi[1]
([1]Kyushu Institute of Technology, Japan)
([2]King Mongkut's University of Technology, Thailand)

This paper presents the design of robot's behavior by using the Imitated Multiplex Neurotransmitter system. The major neurotransmitter that consists of Dopamine, Noradrenaline and Serotonin, which called monoamine neurotransmitter and it is related to motivation for behavior and feeling. The proposed system is based on Wundt's three-dimensional theory of feeling. So, Dopamine is applied as a comfort dimension, Noradrenaline is defined as a tense dimension, Serotonin is considered as an energetic dimension. In our robot, three neurotransmitters are generated in each of different factors and the motivation is calculated. Next, the robot's motivation and some external information are classified into behavior and emotion by Self-Organizing Map learning. Finally, robot's behavior and emotion are decided by Markov's stochastic model.
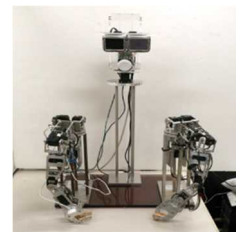
GS9-5 Nonlinear Estimation Strategies Applied on an RRR Robotic Manipulator
Jacob Goodman[1], Jinho Kim[1], Andrew S. Lee[1], S. Andrew Gadsden[1,2]
[1]University of Maryland, USA) [2]niversity of Guelph, Canada)

Nonlinear estimation strategies are important for accurate and reliable control of robotic manipulators. This paper studies and compares two strategies known as the extended Kalman filter (EKF) and the smooth variable structure filter (SVSF). An overview of the two strategies, including their advantages and disadvantages, are provided. The algorithms and pseudocode are also included. The EKF and SVSF are applied to a dynamically modelled three-link (RRR) robotic manipulator. The results of the paper demonstrate that the EKF provides good state estimates, however lacks robustness to modeling uncertainties and disturbances. The SVSF provides sub-optimal estimates, yet is very robust to uncertainties and disturbances. Suggestions for future estimation and robotics research is also provided.
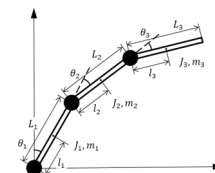
Fig 2. Configuration of the RRR robotic manipulator.

GS10 Reinforcement & Evolutionary Computations (4)
GS10-1 The Optimized Function Selection Using Wolf Algorithm for Classification
Duangjai Jitkongchuen, Worapat Paireekreng (Dhurakij Pundit University, Thailand)

Several classification techniques have been widely explored during the past decade. One of the novel approaches is Nature Based Algorithm. The focus of Nature Based Algorithm mostly is related to selection the optimized functions for self-learning. However, Some Nature Based Algorithms are suitable for general situation, some may be suitable for customized situation. This research proposes the Featured-Wolf (F-Wolf) algorithm to optimize the function selection problem in classification. The proposed algorithm applies the movement of a wolf and characteristics of wolves' leaders which can be more than one leader in a pack. Therefore, the pack can have more than one dominant leader which can help to select the most optimized functions to selection the most relevant features in the dataset. The experiment shows the comparison among other popular Nature Based Algorithms such as Ant Colony Optimization. The preliminary results show that F-Wolf performs comparable results in terms of F-measure**.**
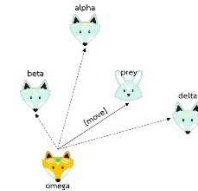
GS10-2 Tell Agent Where to Go: Human Coaching for Accelerating Reinforcement Learning
Nakarin Suppakun, Suriya Natsupakpon, Thavida Maneewarn
(King Mongkut's University of Technology Thonburi, Thailand)

In this work, we proposed a method to accelerate learning by allowing a human to coach a robot behavior by inserting an intermediate goal at the early phase of the reinforcement learning. By using an intermediate goal, the different pair of policy and reward function was temporarily used to select an action that most likely to drive the robot toward the intermediate location, while the global reward function is still used for updating the state-action value. Q learning algorithm was used to test with the proposed method on three learning tasks: ball following, obstacle avoidance, and mountain car. The proposed technique resulted in less number of accumulated failed episodes than the traditional RL
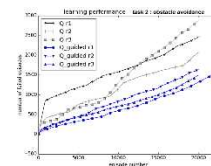
GS10-3 Fall Risk Reduction for Elderly Using Mobile Robots Based on the Deep Reinforcement Learning
Takaaki Namba (Nagoya University, Japan)

Slip-induced fall is one of the main factors causing serious fracture among the elderly. This paper proposes a deep learning based fall risk reduction measurement by the mobile assistant robot for the elderly. First, we collect preparatory data regarding past incidents and accidents data as input data to analyze fall risks and to learn examples of risk reduction measurement. Second, we use a deep convolutional neural network to analyze fall risks of elderly. Third, we apply a deep reinforcement learning to control mobile robots and reduce slip-induced fall risks of elderly. Moreover, we evaluate the effect of risk reduction. The results suggest that the applicability of our method to other cases of the fall and other cases of accidents.
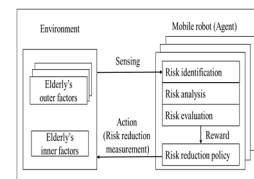
Fig. 1 Deep reinforcement learning for fall risk reduction of elderly.

GS11 Others (12)

GS11-1 Clinical Evaluation of UR-System-PARKO for Recovery of Motor Function of Severe Plegic Hand after Stroke

Hirofumi Tanabe (Shonan University of Medical Sciences, Japan)
Yoshifumi Morita (Nagoya Institute of Technology, Japan)

The first author has developed TANABE therapy for severe hemiplegic stroke patients. In the therapy, he performed repeated facilitation training using his hands on patients to help them recover their motor function and achieved a good treatment outcome. In this paper we developed a training system (UR-System-PARKO) on the basis of TANABE therapy. The clinical test of the therapeutic effect of the UR-System-PARKO was performed in severe plegic hand. As a result, the active ranges of motion of finger extension were improved, and Electromyogram ignition increased after the training. Moreover, the Modified Ashworth Scale scores of finger extension were increased. These results show the effectiveness of the training by the UR-System-PARKO for recovery of motor function for finger extension of the severe plegic hand.

GS11-2 A Piston Finger Device for Restoring the Motor Function of Chronic Plegic Fingers: Analysis of the Piston Finger Technique

Mengsu Wang (Nagoya Institute of Technology: Nitech, Japan), Hirofumi Tanabe (Shonan University of Medical Sciences, Japan), Kenji Ooka (Nitech, Japan), Yoshifumi Morita (Nitech, Japan)

The second author has developed Piston Finger Technique (PFT) for restoring motor function of chronic plegic fingers and has achieved a good treatment outcome, namely reduction of spasticity and improvement of muscle shortening. In this paper, before developing a piston finger device (PFD) simulating the PFT, we analyzed the PFT by the second author by using a motion capture system. The patent's finger motion of a chronic plegic index finger was investigated when the patient received two types of treatment based on the PFT. As a result, the ranges of motion of the proximal interphalangeal joint and the metacarpophalangeal joint of the index finger as well as the vibration width and frequency during treatment were revealed. These results will be useful for developing a PFD in the near future.

GS11-3 Verifying the Sleep-Inducing Effect of a Mother's Rocking Motion in Adults

Hiroaki Shibagaki, Keishi Ashida, Yoshifumi Morita (Nagoya Institute of Technology, Japan), Ryojun Ikeura (Mie University, Japan) and Kiyoko Yokoyama (Nagoya City University, Japan)

In our previous study, from subjective experimental results, we have found that, of the ten types of rocking motions examined, the linear motion component of a mother's rocking motion was the most effective rocking motion for inducing sleep in adults. This motion was referred to as the candidate rocking motion. In this study, we confirmed that the candidate rocking motion was effective for inducing sleep by using electroencephalogram analysis in comparison with the case without rocking motion. Moreover, we also compared the candidate rocking motion and aromatherapy. As a result, in the case of aromatherapy the effectiveness for inducing sleep varied between individuals. In the case of the candidate rocking motion individual variation in the effectiveness was small. We concluded that the candidate rocking motion was effective.

GS11-4 Design of Automated Real-Time BCI Application Using EEG Signals

Chong Yeh Sai, Norrima Mokhtar, Hamzah Arof, Masahiro Iwahashi
(University of Malaya, Malaysia / Nagaoka University of Technology, Japan)

This study proposed a design of real time BCI application using EEG recording, pre-processing, feature extraction and classification of EEG signals. Recorded EEG signals are highly contaminated by noises and artifacts that originate from outside of cerebral origin. In this study, pre-processing of EEG signals using wavelet multiresolution analysis and independent component analysis is applied to automatically remove the noises and artifacts. Consequently, features of interest are extracted as descriptive properties of the EEG signals. Finally, classification algorithms using artificial neural network is used to distinguish the state of EEG signals for real time BCI application.
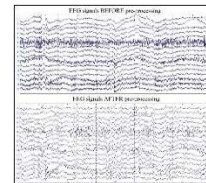
GS11-5 A Hybrid Simulated Kalman Filter - Gravitational Search Algorithm (SKF-GSA)

Badaruddin Muhammad, Zuwairie Ibrahim, Mohd Falfazli Mat Jusof (Universiti Malaysia Pahang, Malaysia)
Nor Hidayati Abdul Aziz, Nor Azlina Ab. Aziz (Multimedia University, Malaysia)
Norrima Mokhtar (University of Malaya, Malaysia)

In this paper, simulated Kalman filter (SKF) and gravitational search algorithm (GSA) are hybridized in such a way that GSA is employed as prediction operator in SKF. The performance is compared using CEC2014 benchmark dataset. The proposed hybrid SKF-GSA shown to perform better than individual SKF and GSA algorithm.
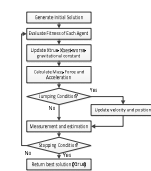
GS11-6 Simulated Kalman Filter with Randomized Q and R Parameters

Nor Hidayati Abdul Aziz, Nor Azlina Ab. Aziz (Multimedia University, Malaysia)
Zuwairie Ibrahim, Saifudin Razali, Mohd Falfazli Mat Jusof (Universiti Malaysia Pahang, Malaysia)
Khairul Hamimah Abas, Mohd Saberi Mohamad (Universiti Teknologi Malaysia, Malaysia)
Norrima Mokhtar (University of Malaya, Malaysia)

Inspired by Kalman filtering, simulated Kalman filter (SKF) has been introduced as a new population-based optimization algorithm. The SKF is not a parameter-less algorithm. Three parameter values should be assigned to P, Q, and R, which denotes error covariance, process noise, and measurement noise, respectively. While analysis of P has been studied, this paper emphasizes on Q and R parameters. Instead of using constant values for Q and R, random values are used in this study. Experimental result shows that the use of randomized Q and R values did not degrade the performance of SKF and hence, one step closer to the realization of a parameter-less SKF.
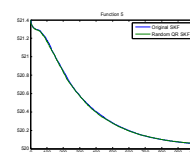
GS11-7 Real Detection of 3D Human Hand Orientation Based Morphology

Abadal-Salam T. Hussain, Hazry D., Waleed A. Oraibi, M.S Jawad, Zuradzman M. Razlan, A. Wesam Al-Mufti, S. Faiz Ahmed, Taha A. Tah, Khairunizam WAN, Shahriman A.B
(Universiti Malaysia Perlis, Malaysia)

This paper describes a new methodology to track a human hand movements in 3D space and estimate its orientation and position in real time. The objective of this algorithm development is to ultimately using it in robotic spherical wrist system application. This method involves image processing and morphology techniques in conjunction with various mathematical formulae to calculate the hand position and orientation. The advantage of this technique is that, there is no need for continuous camera calibration which is required in other conventional methods in similar applications. The result of proposed method shows correctly identifying a large number of hand movements and its orientations. The proposed method could therefore be used with different types of tele operated robotic manipulators or in other human-computer interaction applications. This method is more robust and less computationally expensive, unlike other approaches that use costly leaning functions. The high performance is achieved during experiments testing because of its accurate hand movement identification and the low computational load.
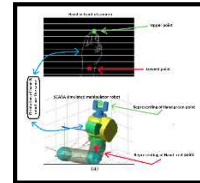
GS11-8 Multilevel Non-Inverting Inverter Based Smart Green Charger System

Abadal-Salam T. Hussain, Waleed A. Oraibi, Hazry D, Zuradzman M. Razlan, S. Faiz Ahmed, Taha A. Taha, Khairunizam WAN & Shahriman AB (Universiti Malaysia Perlis, Malaysia)

This paper discusses about the development of low cost efficient battery charging system using PIC Microcontroller. The demand of efficient battery charging system are going increase day by day, because of its usage in various applications such as it use in Hybrid electric cars, PV solar electric generation system, other energy storage systems and many more. In this paper an efficient and cost effective battery charging system is presented that use buck-boost converter topology. First, the software (PIC Programming) simulation is performed using Micro C software and then hardware is developed and tested to check the performance of the developed battery charger system. The efficiency of circuit is 85.66% and it can be use in any battery charging application
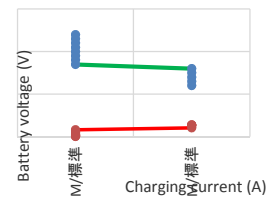
GS11-9 Design A New Model of Unmanned Aerial Vehicle Quadrotor Using The Variation in The Length of The Arm

Yasameen Kamil, D. Hazry, Khairunizam Wan, Zuradzman M. Razlan, Shahriman AB
(Universiti Malaysia Perlis, Malaysia)

The direction of technological advancement toward autonomous aerial vehicle is increased. As a consequence of this evolution, the quad rotor used to accomplish a complex task in several fields. This paper presents the dynamic model of this miniature aerial vehicle in altitude and new dynamic model for yaw attitude movement, based on varying the arm length of quadrotor instead of varying the speed of motors to obtain a rotation around z-axis. This achieved by fixed a stepper motor in the arm of quadrotor to increase or decrease the length of the arm according to controller command for yawing movement. The controller command achieved by design PID controller with specific parameters to maintain the stability of the quadrotor in the flight path. The equipped energy to the motors during flight and maneuvering is reduced by selecting the motors' speed. The MATLAB software code used to evaluate and presents the comparison between the proposed and conventional quadrotor dynamic model. Simulation results show the robustness performance of the proposed model due to the movement around the z-axis with high system stability.
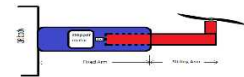
GS11-10 Development of Automatic Take Off and Smooth Landing Control System for Quadrotor UAV

Syed. F. Ahmed (Universiti Kuala Lumpur, British Malaysian Institute, Malaysia
Universiti Malaysia Perlis, Malaysia)
D. Hazry (Universiti Malaysia Perlis, Malaysia)
Kushsairy Kadir (University Kuala Lumpur, British Malaysian Institute, Malaysia)
Abadal Salam T. Hussain, Zuradzman M. Razlan, Shahriman AB
(Universiti Malaysia Perlis, Malaysia)

This paper covers the development of automatic takeoff and smooth landing control system for UAV Quadrotor. This paper includes development, simulation, mathematical modeling and experimental results of flight test. In the developed UAV model has a system to stabilize the quadrotor. Altitude stabilization in quadrotor make the quadrotor can perform take off and smooth landing perfectly and can avoid crash during landing which was proved during experiment. Yaw, pitch, and roll in quadrotor body is detected by gyro sensor when flying is balanced by gyro sensor. Gyro sensor act as input that detect stabilization problem and input data will be sent to microcontroller to make new output for quadrotor.
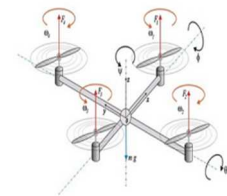
GS11-11 Auto Pilot Ship Heading Angle Control Using Adaptive Control Algorithm

Abadal-Salam T. Hussain (Hazry D., S. Faiz Ahmed, Wail A. A. Alward, Zuradzman M. Razlan & Taha A. Taha (Universiti Malaysia Perlis, Malaysia)

In this paper discussed about development of an auto pilot system for ships using adaptive filter. Adaptive filter in the application of auto pilots for ships is presented for controlling the ship such that it follows its predetermined trajectory. Due to random environmental effects such as wind speed or direction and sea current, the path of the ship may alter. The objective of this research is to investigate that whether proposed system will adapts to the random changes and maintain the desired ship trajectory. The proposed auto pilot system is developed using Least Mean Square algorithm (LMS) adaptive filter. The performances of the system are analyzed based on accuracy and computational times. MATLAB Simulink model tool is used for execute the simulations of the auto pilot system for ships.
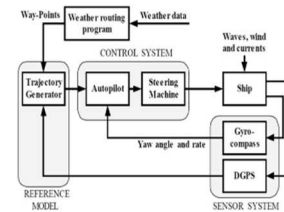
GS11-12 Classification of Hippocampal Region using Extreme Learning Machine

Muhammad Hafiz Md Zaini, Mohd Ibrahim Shapiai (Universiti Teknologi Malaysia)
Ahmad Rithauddin Mohamed (Hospital Kuala Lumpur)
Norrima Mokhtar (University of Malaya)
Zuwairie Ibrahim (Universiti Malaysia Pahang)

Important brain parts like hippocampal usually being manually segmented by doctors. But with the introduction of hybrid between machine learning along with neuroimaging technique, it has proved to shows some promising results regarding on segmenting subcortical structures. However, it is known that Extreme Learning Machine (ELM) is to be superior machine learning technique. This study will investigate on the usage of ELM to segment hippocampal by using various hidden nodes configuration. This study also will address on the usage of full image and region of interest (ROI) using ELM. Bag of features is used as a feature extractor where it will segment the hippocampal of the MRI in order to get its visual words. ELM will used it to learn its feature. Results shows that with suitable hidden nodes, it could achieve up to 100% performance on both cases for full image and ROI in hippocampal segmentation.
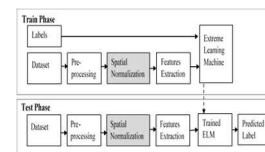
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Notation of session name

PS: Plenary Session IS: Invited Session, OS: Organized Session, GS: General Session,

Note: 33/90 = (page no. in Technical Paper Index) / (page no. in Abstracts)

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				Kobayashi	Jun	GS1-3	31/	
[K]				Kobayashi	Kunikazu	OS12-2	37/63	
Kadir	Kushsairy	GS11-10	39/			OS12-3	37/63	
Kamada	Hiroshi	OS20-2				OS12-4	37/	
Kamil	Yasameen	GS11-9	38/	Kobayashi	Ikuo	OS20-3		
Kanai	Akihito	OS1-1	36/	Kobayashi	Toru	OS8-2	32/	
Kang	Qijia	OS15-2	22/	Kodama	Yukari	OS20-5	27/	
Katayama	Tetsuro	OS6-1				OS20-6	27/	
		OS6-2	26/	Kodate	Akihisa	OS8-2	32/	
		OS6-3		Kohno	Takashi	OS9-4	22/	
		OS6-4	26/			OS9-5	22/	
		OS6-5		Koiwai	Kazushige	OS4-1	30/	

		OS4-4	30/
Kokubo	Haruna	GS1-1	31/
Koyama	Yoshihide	OS19-3	35/
Kubo	Masao	OS8-3	32/
		OS8-4	32/
Kubota	Masashi	GS4-2	32/
Kugurakova	Vlada	GS6-1	20/
Kuremoto	Takashi	OS12-1	36/
		OS12-2	37/63
		OS12-3	37/63

[L]

La-orworrakhun	Chakhrit	GS3-2	36/
Lai	Li-Chun	OS3-2	19/
Lai	Yuan-Hao	OS2-4	20/
Lavrenov	Roman	GS2-4	28/
Lee	Andrew S.	GS8-3	29/
		GS9-5	28/
Lee	Ching-I	OS3-1	19/
Lee	Jangmyung	OS11-1	31/
		OS11-2	31/
		OS11-4	31/
Lee	Min Cheol	OS11-3	31/
Lee	Na-Hyun	OS11-1	31/
Li	Bing-fen	OS21-5	37/
Li	Bingh	OS22-1	
Li	Bo-Yi	OS2-3	20/
Li	Hefei	OS15-6	23/
Li	Long	OS15-2	22/
Li	Qing	OS13-4	
Li	Shuxiao	OS15-4	23/
Li	Xue	OS15-7	23/
		OS15-8	23/
Liu	Bo	OS15-1	22/

Liu	Qunpo	OS13-1	29/
Liu	Shilong	OS15-7	23/
		OS15-8	23/
Liu	Yun-xiang	OS16-5	23/
Long	Yan	GS5-2	26/
Lund	Henrik Hautop	IS-1	19/
		IS-2	18/
		IS-3	19/
		IS-4	
Lushnikov	Alexei	GS6-1	20/
Lynn	Nay Chi	OS20-3	

[M]

Ma	Yumei	OS14-5	18/
Mabu	Shingo	OS12-1	36/
		OS12-2	37/63
		OS12-3	37/63
Madrigal	Omar Correa	GS6-1	20/
Magid	Evgeni	GS2-3	28/
		GS2-4	28/
Mago	Shota	OS10-4	33/
Maki	Toshitaka	OS8-2	32/
Man	Haifang	OS15-2	22/
Maneewarn	Thavida	GS10-2	32/
Mao	Wei-Lung	OS3-3	19/
		OS3-5	19/
Masuda	Akito	GS6-2	21/
Matsuno	Hiroshi	GS4-2	32/
		GS4-3	32/
Matsuno	Seigo	OS18-2	34/
Mehta	Rajiv	OS18-2	34/
Minami	Yuji	OS18-1	34/
Mitsuhashi	Koshiro	OS20-5	27/
		OS20-6	27/

Mitsumura	Kazuho	OS7-2	25/				GS7-2	
		OS7-3		Nagatomo	Makoto	OS20-5	27/
Miyachi	Junpei	OS5-5	22/			OS21-1	37/
Miyakawa	Nobuo	GS2-6	28/			OS21-2	37/
Mizobe	Futoshi	GS6-2	21/	Nagayoshi	Masato	GS2-1	28/
Mizukami	Masato	GS6-4	21/	Nakamura	Akira	GS7-1	24/
Mohamed	Ahmad	GS11-12	39/			GS7-2	24/
	Rithauddin			Nakamura	Go	GS1-2	31/
Mohamad	Mohd Saberi	GS11-6	38/			GS6-2	21/
Mokhtar	Norrima	GS11-4	38/	Nakaoka	Iori	OS18-4	34/
		GS11-5	38/	Nakashima	Takahiro	OS10-3	33/
		GS11-6	38/	Nakata	Yuya	GS7-3	24/
		GS11-12	39/			GS7-4	24/
Moribe	Hirotaka	GS7-6	24/	Namatame	Akira	OS8-1	32/56
Morie	Takashi	OS9-1	22/	Namba	Takaaki	GS10-3	34/
		OS9-2	22/	Nanami	Takuya	OS9-4	22/
Morikawa	Katsumi	OS18-2	34/	Nanjo	Takao	OS4-1	30/
Morimoto	Shogo	OS6-1		Nassiraei	Amir Ali	OS7-1	25/40
Morita	Yoshifumi	GS11-1	38/		Forough		
		GS11-2	38/	Natsupakpong	Suriya	GS3-2	36/
		GS11-3	38/			GS10-2	32/
M. Razlan	Zuradzman	GS11-7	38/	Negishi	Kanako	OS21-4	37/
		GS11-8	38/	Ning	Xiaojun		
		GS11-9	38/	Nishida	Yuya	PS1	
		GS11-10	39/			OS7-4	
		GS11-11	39/	Nishjima	Atsushi	OS7-6	
Muhammad	Badaruddin	GS11-5	38/	Nishimura	Kouhei	OS5-1	21/
Mukaidani	Naohisa	GS4-1	32/	Nishita	Tomoyuki	PS2	33/
Mukunoki	Masayuki	OS20-4		Niu	Cheng-shui	OS21-5	37/
		OS20-6	27/	Niu	Hong	OS15-5	23/
Muraoka	Yohei	GS6-4	21/				
					[O]		
[N]				Obayashi	Masanao	OS12-1	36/
Nagaie	Tetsuya	OS8-2	32/			OS12-2	37/63
Nagata	Kazuyuki	GS7-1				OS12-3	37/63

Ogata	Kensuke	OS18-3	34/	Pramanta	Dinda	OS9-1	22/
Ogata	Takashi	OS1-1	36/				
		OS1-2	36/	**[Q]**			
		OS1-4	36/	Qin	Yiqiao	OS15-1	22/
		OS1-5	36/			OS15-3	23/
Ogihara	Hiroki	OS20-4					
Ohata	Makoto	GS6-4	21/	**[R]**			
Oka	Yuuki			Rajapakse	R. P. C.	OS19-1	35/
Okada	Takahiro	GS6-3	21/		Janaka		
Okazaki	Naonobu	OS6-2				OS19-2	35/
		OS6-3		Razali	Saifudin	GS11-6	38/
		OS6-4	26/	Ru	Yiwei	OS15-4	23/
		OS6-5					
Okazaki	Shogo	OS10-3	33/	**[S]**			
Ojeda	Ismael Baira	IS-3	19/	Sai	Chong Yeh	GS11-4	38/
Ono	Jumpei	OS1-5	36/	Sabirova	Leysan	GS2-4	28/
Oo	Khine Khine	OS6-6		Saito	Keita	OS5-2	21/
Ooka	Kenji	GS11-2	38/	Saito	Ken	GS7-3	
Oraibi	Waleed A.	GS11-7	38/			GS7-4	
		GS11-8	38/	Saji	Keita	GS9-4	
Orima	Takemori	OS9-3	22/	Sakakibara	Kazutoshi	GS2-1	
Oswald	Marion	OS17-4	35/	Sakamoto	Makoto	OS18-2	34/
Ouyang	Yuxing	OS15-1	22/			OS20-5	27/
		OS15-3	23/			OS20-6	27/
						OS21-1	37/
[P]						OS21-2	37/
Pachecho	Moisés	IS-3	19/			OS21-3	37/
Pagliarini	Luigi	IS-1	19/			OS21-5	37/
Paireekreng	Worapat	GS10-1	34/	Sakurai	Keiko	OS10-1	33/
Pan	Zhenkuan	OS14-5	18/			OS10-2	33/
Park	Yousin	OS18-4	34/	Sapaty	Peter	IS-5	33/
Phung	Nhuhai	OS8-4	32/	Sasao	T.	GS8-2	
Phunopas	Amornphun	GS3-1	35/	Sato	Hiroshi	OS8-3	32/
Phyo	Cho Nilar	OS20-2				OS8-4	32/
Pramanpol	Teedanai	GS8-1		Sato	Takuya	OS6-5	

Schwarz	Brian	GS8-3	29/			OS21-2	37/
Shapiai	Mohd Ibrahim	GS11-12	39/	Sun	Hsuan-Min	OS3-6	20/
				Sun	Shihao	OS13-3	
Shibagaki	Hiroaki	GS11-3	38/	Suppakun	Nakarin	GS10-2	32/
Shibanoki	Taro	GS1-1	31/	Shuto	Daisuke	OS9-2	22/
		GS1-2	31/	Suprapto		OS3-5	19/
		GS6-2	21/	Suzuki	Michiyo	GS4-4	32/
Shimada	Ryoichi	OS5-4	21/	Suzuki	Yasuhiro	OS17-1	35/
Si	Jikai	OS13-1	29/			OS17-2	35/
Sirikayon	Chaloemphon	GS5-1				OS17-3	35/
Soh	Zu	GS4-1	32/	Suzuki	Takuo	OS12-4	37/
		GS4-4	32/	Syoichizono	Misaki	OS10-3	33/
Sokolov	Maxim	GS2-4	28/				
Sonehara	Noboru	OS8-2	32/	**[T]**			
Song	Binhu	OS15-2	22	Tabuse	Masayoshi	OS5-1	21/
Song	Yunzhong	OS14-1	18/			OS5-2	21/
Sonoda	Takashi	PS1				OS5-3	21/
		OS7-1	25/40			OS5-4	21/
		OS7-6				OS5-5	22/
		OS22-1		Tachiyama	Hiroki	OS6-3	
Su	Kuo-Lan	OS2-1	20/	Tagawa	Shinya	OS18-1	34/
		OS2-2	20/	Taguchi	Yu	GS6-5	21/
		OS2-3	20/	Taha	Taha A	GS11-7	38/
		OS2-5	20/			GS11-8	38/
Sugii	Manabu	GS4-2	32/	.		GS11-11	39/
Sugisaka	Masanori	IS-5	33/	Takagi	Tomohiko	OS6-1	
		GS3-3	36/	Takahashi	Katsuhiko	OS18-2	34/
		GS5-2	26/	Takasaki	Shiyun	OS7-2	25/
		OS16-1	23/			OS7-3	
		OS16-2	23/	Takato	Minami	GS7-3	
		OS16-3	23/			GS7-4	
Sugita	Kazuki	GS7-3		Takemura	Yasunori	OS22-2	
		GS7-4				OS22-4	30/
Sun	Chongyang	OS20-5	27/	Takeshita	Yuki	OS21-3	37/
		OS21-1	37/	Talanov	Max	GS9-3	

Tamaki	Hisashi	GS2-1				GS4-1	32/
Tamukoh	Hakaru	OS9-1	22/			GS4-4	32/
		OS9-2	22/			GS6-2	21/
Tamura	Hiroki	OS10-1	33/	Tsushita	Hiroaki	OS20-1	27/
		OS10-2	33/	Tun	Hnin Thandar	OS6-6	
		OS10-3	33/				
		OS10-4	33/	**[U]**			
		OS10-5	33/	Uchida	Yasuo	OS21-1	37/
Tanabe	Hirofumi	GS11-1	38/			OS21-2	37/
		GS11-2	38/	Uchihara	Masayuki	OS10-5	33/
Tanaka	Hideaki	GS4-3	32/	Uchikoba	Fumio	GS7-3	
Tanaka	Taisuke	GS7-3				GS7-4	
		GS7-4		Ueda	Koji	OS4-4	30/
Tanaka	Takeshi	OS20-6	27/	Ura	Tamaki	PS1	
Tanigawa	Yu	OS8-2	32/	Urata	Kiyohiro	OS8-2	32/
Taniguchi	Rie	OS17-1	35/	Utsunomiya	Koshi	OS7-2	25/
Tanno	Koichi	OS10-1	33/			OS7-3	
		OS10-2	33/				
		OS10-4	33/	**[W]**			
		OS10-5	33/	Wakahara	Toshihiko	OS8-2	32/
Tanoue	Satoshi	OS6-4	26/	Wan	Khairunizam	GS11-7	38/
Tchitchigin	Alexander	GS9-3				GS11-8	38/
Thusaranon	Panita	GS5-1				GS11-9	38/
Tolu	Silvia	IS-3	19/	Wang	Fuzhong	OS13-1	29/
Tominaga	Moeko	OS22-4	30/			OS13-2	29/
Tominaga	Ayumu	GS8-2				OS13-6	29/
Tomonaga	Kenta	GS1-3	31/			OS14-1	18/
Tono	Tetsuya	OS10-3	33/	Wang	Hongqi	OS13-1	29/
Toriu	Takashi	OS20-2		Wang	Jie	OS11-3	31/
Toschev	Alexander	GS9-3		Wang	Jiwu	GS3-3	36/
Toya	Nobuyuki	GS6-5	21/			GS5-2	26/
Tsai	Tai-Huan	OS2-6	20/	Wang	Jun	GS2-2	
Tsuboi	Haruka	OS20-5	27/	Wang	Mengsu	GS11-2	38/
Tsuji	Toshio	GS1-1	31/	Wang	Ping	OS14-4	18/
		GS1-2	31/	Wang	Shanfeng	OS16-6	24/

Zhang	Hongtao	OS15-2	22/
Zhang	Mei	OS15-7	23/
		OS15-8	23/
Zhang	Wei	OS16-5	23/
Zhang	Weicun	OS13-4	
		OS14-2	18/
Zhang	Yani	OS16-1	23/
		OS16-4	23/
Zhang	Yu-an	OS21-1	37/
		OS21-2	37/
		OS21-5	37/
Zhang	Yuxi	GS2-2	
Zhang	Yuzhen	OS13-4	
Zhao	Huailin	OS16-1	23/
		OS16-2	23/
		OS16-3	23/
		OS16-4	23/
Zhao	Lin	OS13-5	29/
		OS14-5	
Zheng	Wenhao	OS14-3	18/
Zin	Thi Thi	OS20-1	27/
		OS20-2	
		OS20-3	

2nd Floor