IEEE ICMA 2017 Conference

Plenary Talk I

Intelligent Robotics and Automation in a Cloud-Connected World

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Abstract:

Robotics is currently undergoing a dramatic transformation. High-performance networking and cloud computing has radically transformed how individuals and businesses manage data, and is poised to disrupt the state-of-the-art in the development of intelligent machines.

This talk explores the long-term prospects for the future evolution of robot intelligence based on search, distributed computing, and big data. Ongoing research on autonomous cars and humanoid robots will be discussed in the context of how cloud-connectivity will enable future robotic systems to be more capable and useful.

Dr. Kuffner is the Chief Technology Officer at the Toyota Research Institute (TRI). Dr. Kuffner received a Ph.D. from the Stanford University Dept. of Computer Science Robotics Laboratory in 1999, and was a Japan Society for the Promotion of Science (JSPS) Postdoctoral Research Fellow at the University of Tokyo working on software and planning algorithms for humanoid robots. He joined the faculty at Carnegie Mellon University's Robotics Institute in 2002.

Dr. Kuffner is perhaps best known as co-inventor of the Rapidly-exploring Random Tree (RRT) algorithm, which has become a key standard benchmark for robot motion planning. He has published over 125 technical papers, holds more than 40 patents, and received the Okawa Foundation Award for Young Researchers in 2007.

Before joining TRI, Dr. Kuffner was a Research Scientist and Engineering Director at Google from 2009 to 2016. Dr. Kuffner was part of the initial engineering team that built Google's self-driving car. In 2010, he introduced the term "Cloud Robotics" to describe how network-connected robots could take advantage of distributed computation and data stored in the cloud. Dr. Kuffner was appointed head of Google's Robotics division in 2014, which he co-founded along with Andy Rubin.

Dr. Kuffner continues to serve as an Adjunct Associate Professor at the Robotics Institute, Carnegie Mellon University.

Additional information: https://en.wikipedia.org/wiki/James_J._Kuffner_Jr.

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Plenary Talk II

Micro-nano Mechatronics for Multiscale Interactions in the Physical World

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Abstract:

Interactions in the physical world occur in several cases, such as mechanical interactions in the caregiving tasks, in the biosignal sensing of human, in the mechanical sensing of biological small objects, as well as chemical interactions between cells in culturing, and so on. Measurement of interaction with the environment is quite important for the progress of science and technology. However, the scale of interaction extends over the multi-scale. For example, to measure the force acting on the human motion, we should consider the maximum force over 500 N. On the other hand, reaction force by the blood pressure is less than 1 N. Furthermore, for the investigation of mechanical property of cells, reaction force of the single cell is less than 1 μN. Since the size of the object is small, fine space resolution is needed as well as fine force resolution. It is quite challenging to measure several interactions over the multi-scale. To meet a variety of demands in measuring several interactions in the physical world, Micro-nano Mechatronics is quite important. In this talk, several sensing technologies will be addressed based on the micro-nano fabrication technology. Especially, force sensing in the multiscale range will be addressed, such as a wide range force sensor using Quartz Crystal Resonator(QCR), QCR force sensor probe, and vision based fine force sensing using moiré fringe. Moreover, recent progress on in-process environmental measurement using fluorescent dye will be shown with application examples in tissue engineering.

Fumihito Arai is a Professor in the Dept. of Micro-Nano Mechanical Science & Engineering at Nagoya University. He received Master of Eng. degree from Tokyo Univ. of Science in 1988. He received Dr. of Eng. from Nagoya University in 1993. Since 1994, he was an Assistant Professor of Nagoya University. Since 2005, he was a Professor of Tohoku University. Since 2010, he has been a Professor of Nagoya University. Since 2013, he has been a Director of Center for Micro-nano Mechatronics, Nagoya University. Since 2014, he has been a Professor of Institute of Innovation for Future Society, Nagoya University. He was Invited Visiting Professor of Seoul National University, Korea from 2009 to 2012. He was Visiting Professor of University of Tokyo, Japan from 2011 to 2014.
He is mainly engaging in the research fields of micro- and nano-robotics and its application to the micro- and nano-assembly, cell manipulation, and sensing & analysis, MEMS, Bio-Robotics, and intelligent robotic systems. He is the author of 345 journal papers exclusive of conference papers. He received 77 awards on his research activities, for example, Early Academic Career Award in Robotics and Automation from IEEE Robotics and Automation Society in 2000 and Best Conference Paper Award at IEEE ICRA2012. Currently, he is the Vice President for Technical Activities, IEEE Robotics and Automation Society since 2014 (until 2017).
Additional information: http://www.biorobotics.mech.nagoya-u.ac.jp/index_e.html

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Plenary Talk III

Micro Medical Robotics: Painless and Scarless

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Abstract:

Research on micro medical robotics is attracting more and more public attention and research efforts laterly. Recent revolutionary development and drastic progress in robotic technology in terms of both hardware capability and software power have made it possible for researchers to redefine what micro medical robotics is capable of achieving to facilitate complicated medical procedures with much less pain and surgical procedures without even external scars. In this talk, we will start with an introduction to how research on micro medical robotics started and what the milestone achievements are, and then move onto our own research efforts on micro medical robotics with several case study examples. Personal thoughts and ourlook on future research efforts and potentials in micro medical robotics will be outlined to conclude the talk.

Prof. Max Q.-H. Meng received his Ph.D. degree in Electrical and Computer Engineering from the University of Victoria, Canada, in 1992, following his Master's degree from Beijing Institute of Technology in 1988. He joined the Chinese University of Hong Kong in 2001 and is currently Professor and Chairman of Department of Electronic Engineering at CUHK. He was a professor in the Department of Electrical and Computer Engineering at the University of Alberta in Canada, serving as the Director of the ART (Advanced Robotics and Teleoperation) Lab and holding the positions of Assistant Professor (1994), Associate Professor (1998), and Professor (2000), respectively. He was jointly appointed as an Overseas Outstanding Scholar Chair Professor of the Chinese Academy of Sciences and the Dean of the School of Control Science and Engineering at Shandong University in China. He is currently jointly appointed as a Distinguished Chair Professor at Harbin Institute of Technology supported via the 1000 Talents Recruitment Program of Global Experts, a Distinguished Provincial Chair Professor of Henan University of Science and Technology, and the Honorary Dean of the School of Control Science and Engineering at Shandong University, in China. His research interests include robotics, perception and sensing, human-robot interaction, active medical devices, bio-sensors and sensor networks, and adaptive and intelligent systems. He has published more than 500 journal and conference papers and book chapters and led more than 40 funded research projects to completion as Principal Investigator. He has served as an editor of the IEEE/ASME Transactions on Mechatronics and an associate editor of the IEEE Transactions on Fuzzy Systems, and is currently a technical editor of a number of journals in robotics. He has served as the General Chair of several conferences, including IROS 2005, AIM 2008, WCICA 2010, and Robio 2013 conferences. He is the founder of the IEEE ICIA conference series and co-founder of the IEEE Robio conference series. He served as an Associate VP for Conferences of the IEEE Robotics and Automation Society (2004-2007), an AdCom member of the IEEE Neural Network Council/Society (2003-2006), the Co-Chair of the Fellow Evaluation Committee of the IEEE Robotics and Automation Society. He is currently serving as an elected member of the Administrative Committee (AdCom) of the IEEE Robotics and Automation Society. He is a recipient of the IEEE Third Millennium Medal award and he is a Fellow of IEEE.

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Keynote Speech I

Human Interactive Service Robots

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Professor

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Abstract:

Recent robot technology (RT) has made remarkable progress in both manufacturing and service sectors. Because of this RT advanced technology, there are growing demands to make robots work more friendly and flexible coordinated with human for service. There are many research and developing works undergoing for robot and human interaction, such as assistance and supports of human by robots in manufacturing, inspection and maintenance, entertainment, education, bio-medical applications, rehabilitation and techno-care of aged people. Robot is required to have the more flexibility and adaptation control to human behavior, more friendly robot and human interface, and estimation capability of human intention some way to make more proactive motion. There are a lot of problems to solve them with robotic sensor, actuator, control, communication and interface with human. Thus human will be able to work interactively with robots together in future and will receive assistance and support from robot, in terms of physical, skill and intelligence levels. Some examples of the on-going projects will be shown in this presentation.

Toshio Fukuda (M'83-SM'93-F'95) received the B.A. degree from Waseda University, Japan, in1971, and the M.S and Dr. Eng. from the University of Tokyo, Japan, in 1973 and 1977,respectively. In 1977, he joined the National Mechanical Engineering Laboratory. In 1982, hejoined the Science University of Tokyo, Japan, and then joined Nagoya University, Nagoya, Japan, in 1989. Currently, he is Professor of Department of Micro-Nano System Engineering at Nagoya University, and Director of Center for Micro and Nano Mechatronics, where he is mainly involved in the research fields of intelligent robotic and mechatronic system, cellular robotic system, and micro- and nano-robotic system.

Dr. Fukuda was President of IEEE Robotics and Automation Society (1998-1999), Director of the IEEE Division X, Systems and Control (2001-2002), and Editor-in-Chief of IEEE / ASME Transactions on Mechatronics (2000-2002). He was Founding President of IEEE Nanotechnology Council (2002-2005) and President of SOFT (Japan Society for Fuzzy Theory and Intelligent Informatics) (2003-2005). He is a member of Japan Council of Science (2008-).

He received the IEEE Eugene Mittelmann Award (1997), IEEE Millennium Medal (2000), Humboldt Research Prize (2003), the IEEE Robotics and Automation Pioneer Award (2004), IEEE Robotics and Automation Society Distinguished Service Award (2005), Award from Ministry of Education and Science in Japan (2005). IEEE Nanotechnology Council Distinguished service award (2007). George Saridis Leadership Award (2009), IEEE Robotics and Automation Technical Field Award (2010), Best Googol Application paper awards from IEEE Trans. Automation Science and Engineering (2007). Best papers awards from RSJ(2004) and SICE(2007), Special Funai Award from JSME(2008), IEEE Fellow (1995), SICE Fellow (1995), JSME Fellow (2001), RSJ Fellow (2004).

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Keynote Speech II

Invented the World's First Smart Desktop Robotic Arm

Liu Peichao

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Invented the world's first smart desktop robotic arm

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Abstract:
In the present market, robot arm is mainly applied in conventional manufacturing industry, such as mechanical manufacturing, automobile Industry, warship manufacturing and electric appliance manufacturing industry, etc. However, some repetitive and tedious work has to be done by labor, which is costly and poor precision. In the age of Industry 4.0, labor should be emancipated and be taken place by robot.

This talk refers to product creation process, corporate growth and futuristic visions of Yuejiang Tech and explores the long-term prospect for the future evolution of robot intelligence based on scientific research, computer programming and big data. Further research the application of desktop robot arm applied in K12 and STEAM education in China.

Liu Peichao is the Chief Executive Officer of Shenzhen Yuejiang Technology Co., Ltd (Yuejiang Tech). He received a Master Degree in Engineering from School of Mechanical Engineering Shandong University in 2014. He initially studied large conventional industrial machinery in Suzhou Institute of Biomedical Engineering and Technology Chinese Academy of Science. When he learned about some repetitive and tedious work had to be done by labor, which was costly and poor precision. He came up with an idea to create a desktop smart robot arm save, which can save labor and enhance productivity.

Up to now, Yuejiang has developed out four generations of Dobot series robot arm: Dobot V1.0, Dobot Magician, Dobot M1 and Dobot Rigit. The intelligence of Dobot robot arm embodies in usability and visual identity. With implanted opening API and 13 extensible interfaces, it can be further developed without any limitation.

What's more, combined with brain wave and myoelectricity, Dobot robot arm can conduct work as human's thought without any body movement. That's a further step in artificial intelligence, and can promote the development of Industry 4.0.

Shenzhen Yuejiang Technology Co., Ltd is a leading company in the field of smart desktop robotic arm, which is one of the first companies in the world brings the concept of smart desktop robotic arm. More than 70% of Yuejiang's staff are educated engineers from MIT and Harvard. It owns 100% core technologies and over 40 international patents. Yuejiang's long-term prospect is a high-tech provider and a right-hand assistant in everyone's daily life.