# ***Japan-UK Robotics and Artificial Intelligence Seminar 2016***

18th February 2016

Embassy of Japan in the UK

# Programme

15:00 Doors Open

**15:30 Opening Remarks**

- H.E. Keiichi Hayashi, Ambassador of Japan
- Professor Robin Grimes, Chief Scientific Adviser to the Foreign and Commonwealth Office

## Session 1 Overview of policy setting and funding arrangements in Japan and the UK

15:40 Brief introduction to recent policy trends in Japan

*- Ms Kanae Kurata, First Secretary (Science and Technology), Embassy of Japan in the UK*

15:50 Brief introduction to recent trends in the UK

*- Dr Kedar Pandya, Head of the Engineering Theme for the Engineering and Physical Sciences Research Council*

*- Professor Guang-Zhong Yang, Imperial College London, UK-RAS Network*

16:10 Q&A

## Session 2 Cutting-edge research projects in Japan and the UK

16:15 Introduction *Dr Fumiya Iida, Department of Engineering, University of Cambridge* (Facilitator)

16:20 *Professor Hiroshi Ishiguro, Intelligent Robotics Laboratory, University of Osaka*

16:30 *Professor Kerstin Dautenhahn, School of Computer Science, University of Hertfordshire*

16:40 *Dr Komei Sugiura, Senior Researcher, National Institute of Information and Communications Technology*

16:50 *Professor Tadahiro Taniguchi, Department of Human & Computer Intelligence College, Ritsumeikan University*

17:00 *Professor Sethu Vijayakumar FRSE; Director, Edinburgh Centre for Robotics, University of Edinburgh*

17:10 *Professor Tetsuya Ogata, Laboratory for Intelligent Dynamics and Representation, Waseda University*

17:20 *Professor Roberto Cipolla FREng, Department of Engineering, University of Cambridge*

17:30 *Professor Yoshihiko Nakamura, Department of Mechano Informatics, University of Tokyo*

## Session 3 Socio-economic impact

17:40 New business innovations

- *Mr Llewelyn Morgan, Service Manager, Localities Policies and Innovation, Oxfordshire County Council*
- *Mr Shohei Hido, Chief Research Officer, Preferred Networks*

18:00 Future social impact

- *Dr. Anders Sandberg, James Martin Research Fellow, Future of Humanity Institute, Oxford Martin School, University of Oxford*

**18:10 Q&A**

**18:30 Closing**

**Networking Reception**

**- Abstracts and Biographies -**

## Professor Robin Grimes

Chief Scientific Adviser to the Foreign and Commonwealth Office
Professor of Materials Physics, Imperial College London

### Biography

Robin Grimes is currently Professor of Materials Physics at Imperial College. His research is focussed on the use of high performance computing techniques to understand the behaviour of materials for energy applications including nuclear fission and fusion, fuel cells, batteries and solar cells. He is also Principal Investigator of the Research Council's UK Nuclear Fission consortium project.

Professor Grimes has advised the House of Lords Science and Technology Committee's inquiry into nuclear research requirements, and was part of the Scientific Advisory Group for Emergencies (SAGE) that provided official advice on the 2011 Fukushima disaster. He has considerable experience of high-level international work with HMG, including overseas missions to India, Vietnam, South Korea, Malaysia and Japan.

## Ms Kanae Kurata

First Secretary, Science and Technology,
Embassy of Japan in the UK


### Biography

As First Secretary for Science and Technology at the Embassy, Kanae is promoting partnerships between Japanese and UK academia and industry in the field of science & technology and civil nuclear energy. Before joining the Embassy in July 2014, she worked for the Ministry for Education, Culture, Sports, Science and Technology (MEXT) for the years, and covered several areas including the internationalisation of Japanese universities, space technology and nuclear technology.

### ***Recent Policy Trends in the field of Robotics and AI in Japan***

The Government of Japan published its "New Robot Strategy" in January 2015, followed by the establishment of The Artificial Intelligence Research Centre in May 2015, and will establish a new project called "Advanced Integrated Intelligence Platform Project" in 2016.

**AIP: Advanced Integrated Intelligence Platform Project**

Integrated project of artificial intelligence/big data/IoT/cyber security

**Global trends**

- **Accumulated big data, and quantitatively and qualitatively expanded sensors** in each field (IoT: Internet of Things)
- Significant technological breakthrough in **Artificial Intelligence** (that captures characteristics by itself)
- At the same time, a growing need to **ensure cyber security** (Developing human resources is vital for responding to increasing threats)

**Response by MEXT (Ministry of Education, Culture, Sports, Science and Technology)**

(1) Creating new value by **analyzing big data** possessed by MEXT (cohort data, environmental data, and so on)
(2) To achieve the above target, **developing and utilizing innovative new Artificial Intelligence technologies**
(3) To collect big data, utilizing advanced **sensors/IoT technologies**, while establishing a robust **security system**

**Collaborating with METI (Ministry of Economy, Trade and Industry) and MIA(Ministry of Internal Affairs and Communications)** to establish an integrated system from basic research to social application.

**AIP Center (RIKEN)** 1.5 billion yen (FY2016)

I. Developing innovative new AI technologies learned from human intellectual activities
II. Utilizing Artificial intelligence and big data to advance science in many fields
III. Implementation in many application fields that create social/economic value
IV. Addressing ethical/social issues in a society where artificial intelligence is widely spread
V. Developing human resources for data science and cyber security

collaboration

**Japan Science and Technology Agency's Research Funding (Strategic Basic Research Program)** 4 billion yen (FY2016)

Widely soliciting for proposals from researchers and establishing a temporary cross-organization/cross-field research system to support creative research

# Dr Kedar Pandya

Head of Engineering
Engineering and Physical Sciences Research Council (EPSRC)

## Biography

Kedar Pandya received his Master of Engineering and PhD from Imperial College, London in 1996 and 2000 respectively. He then worked as a Research Fellow for BP Chemicals in Grangemouth before joining EPSRC in 2011.

Kedar is currently Head of the Engineering Theme at EPSRC. He is responsible for research, training and impact strategy across Engineering. A particular focus in recent year has to been to identify and support community-inspired Grand Challenges where UK Engineering can take a lead. Examples include clean water for all, sustainability of future cities and resilience of engineered systems. Prior to that he led the Cross-disciplinary Interfaces, Life Sciences Interface and Basic Technology programmes.

Kedar leads the Robotics and Autonomous Systems strategy for EPSRC, working with partners in business, academe and government. EPSRC has significant RAS investments, including c.£25M in capital investments, c.£20M in Centres for Doctoral Training and a number of critical mass research investments. He was part of the group working with Professor David Lane and colleagues to help develop the UK national strategy for robotics, which is informing thinking across UK government.

## ***UK Strategy for Robotics and Autonomous Systems***

This presentation will outline the robotics and autonomous systems landscape in the UK, including within it academic, industrial and government perspectives. The presentation will describe the aims of the UK national strategy and future opportunities arising from this.

# Professor Guang-Zhong Yang

Professor, Imperial College London, UK-RAS Network

## Biography

Professor Guang-Zhong Yang is director and co-founder of the Hamlyn Centre for Robotic Surgery, Deputy Chairman of the Institute of Global Health Innovation, Imperial College London, UK. He pioneered the concept of perceptual docking for robotic control and led the development of a number of medical robot platforms. He is a recipient of numerous international awards and currently leads the EPSRC UK-Robotics and Autonomous Systems (RAS) Network. His is also a member of the WEF Global Agenda Council on Artificial Intelligence and Robotics. Prof Yang is a Fellow of the Royal Academy of Engineering, fellow of IEEE, IET, AIMBE, IAMBE, CGI, MICCAI, a recipient of the Royal Society Research Merit Award and listed in The Times Eureka 'Top 100' in British Science.

### *The Hamlyn Centre*

The Hamlyn Centre (http://www.imperial.ac.uk/hamlyn-centre/) has been established for developing safe, effective and accessible imaging, sensing and robotics technologies that can reshape the future of healthcare for both developing and developed countries. Focusing on technological innovation but with a strong emphasis on clinical translation and direct patient benefit with a global impact, the centre is at the forefront of research in imaging, sensing and robotics for addressing global health challenges associated with demographic, environment, social and economic changes. The Centre plays an active role in international collaboration and outreach activities, as well as in the training of surgeons and engineers in robotic technologies, thereby facilitating a fully integrated clinical approach. It has extensive research, engineering laboratory spaces at the South Kensington campus of Imperial, large pre-clinical facilities at Northwick Park with state-of-the art imaging and surgical equipment for in vivo validation, and comprehensive clinical laboratories at the Surgical Innovation Centre at Imperial College St Mary's Hospital.

## ***Robotics research in the UK***

Robotics and Autonomous Systems (RAS) is one of the Eight Great Technologies identified by the UK government, which will propel the UK to future growth. Under this initiative and funded by the Engineering and Physical Sciences Research Council (EPSRC), the UK-RAS Network (www.ukras.org) was established to provide academic leadership in RAS, expand collaboration with industry and international organisations and integrate and coordinate activities at EPSRC funded RAS capital facilities, Centres for Doctoral Training (CDTs) and partner universities.

The Network organises a wide range of activities including network and strategic roadmap events such as the UK Robotics Week (www.roboticsweek.uk), symposia and focused workshops, public engagement and exhibitions. It also have extensive online engagement activities using social media and web and user forums. The Network plays an active role in strengthening the relationship with industry. It supports interdisciplinary mobility and industrial secondment and developing proof-of-concept (PoC) projects. There is also a strong emphasis on government policy and high-level engagement with international stakeholders.

## Dr Fumiya Iida

University Lecturer
Department of Engineering, University of Cambridge


Biography

Fumiya Iida is a university lecturer at Department of Engineering, University of Cambridge. He received his bachelor and master degrees in mechanical engineering at Tokyo University of Science (Japan, 1999), and Dr. sc. nat. in Informatics at University of Zurich (2006). In 2004 and 2005, he was also engaged in biomechanics research of human locomotion at Locomotion Laboratory, University of Jena (Germany). From 2006 to 2009, he worked as a postdoctoral associate at the Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology in USA. In 2006, he awarded the Fellowship for Prospective Researchers from the Swiss National Science Foundation, and in 2009, the Swiss National Science Foundation Professorship hosted by ETH Zurich. In 2014 he moved to the University of Cambridge as the director of Bio-Inspired Robotics Laboratory. His research interest includes biologically inspired robotics, embodied artificial intelligence, and soft robotics, where he was involved in a number of research projects related to dynamic legged locomotion, dexterous robotic manipulation, and self-reconfigurable evolutionary robotics.
URL: http://divf.eng.cam.ac.uk/birl

### ***Challenges and perspectives in Biologically Inspired "Soft" Robotics***

There has been an increasing interest in the use of soft functional materials in the robotic systems of various kinds. Unlike the conventional rigid systems, soft robots are able to flexibly vary their structures for complex and uncertain tasks and environments. As the machines become more flexible and safer, in addition to fast, strong and precise, the applications of robotics technologies broaden much closer to human users including co-working and wearable robots.

# Professor Hiroshi Ishiguro

Distinguished Professor of Osaka University
Visiting Director of ATR Hiroshi Ishiguro Laboratories

## Biography

Hiroshi Ishiguro (M') received a D.Eng. in systems engineering from Osaka University, Japan in 1991.

He is currently Professor of Department of Systems Innovation in the Graduate School of Engineering Science at Osaka University (2009-), Distinguished Professor of Osaka University (2013-) and visiting Director (2014-) of Hiroshi Ishiguro Laboratories at the Advanced Telecommunications Research Institute and an ATR fellow.

His research interests include distributed sensor systems, interactive robotics, and android science. He has published more than 300 papers in major journals and conferences, such as Robotics Research and IEEE PAMI. On the other hand, he has developed many humanoids and androids, called Robovie, Repliee, Geminoid, Telenoid, and Elfoid. These robots have been reported many times by major media, such as Discovery channel, NHK, and BBC. He has also received the best humanoid award four times in RoboCup. In 2011, he won the Osaka Cultural Award presented by the Osaka Prefectural Government and the Osaka City Government for his great contribution to the advancement of culture in Osaka. In 2015, he received the Prize for Science and Technology (Research Category) by the Minister of Education, Culture, Sports, Science and Technology (MEXT).

He was also awarded the Sheikh Mohammed Bin Rashid Al Maktoum Knowledge Award in Dubai in 2015.

## ***Studies on humanlike robots***

We, humans, have innate brain function to recognize humans. Therefore, very humanlike robots, androids, can be ideal information media for human-robot/computer interaction.

The speaker has developed various types of interactive robots and androids. Geminoid that is a teleoperated android of an existing person can transmit the presence of the operator to the distant place. The operator recognizes the android body as his/her own body after talking with someone through the geminoid and has virtual feeling to be touched when someone touches to the geminoid.

However, the geminoid is not the ideal medium for everybody. For example, elderly people often hesitate to talk with adult humans and the adult androids. A question is what the ideal medium for everybody is. In order to investigate it, the speaker proposes the minimum design of interactive humanoids. It is called Telenoid. The geminoid is the perfect copy of an existing person and it is the maximum design of interactive humanoids. On the other hand, the minimum design looks like a human but we cannot judge the age and gender. Elderly people like to talk with the Telenoid very much. In this talk, the speaker discusses the design principles for the robots and their effects to conversations with humans.

# Professor Kerstin Dautenhahn

Professor of Artificial Intelligence
University of Hertfordshire

## Biography

Kerstin Dautenhahn, Senior Member IEEE, is Professor of Artificial Intelligence in the School of Computer Science at University of Hertfordshire in U.K. where she coordinates the Adaptive Systems Research Group. She has published more than 300 research articles (h-index 61). Prof. Dautenhahn has edited several books and frequently gives invited keynote lectures. She has been Principal Investigator of her research team in several European, nationally and internationally funded projects. Prof. Dautenhahn is Founding Editor in Chief of the journal Interaction Studies: Social Behaviour and Communication in Biological and Artificial Systems, as well as Associate Editor of Adaptive Behaviour (Sage Publications), the International Journal of Social Robotics (Springer), IEEE Transactions on Affective Computing and the IEEE Transactions on Autonomous Mental Development.

## ***Robots in Human Society: Challenges and Opportunities***

My talk will focus on robots that fulfil roles in human society as assistants and companions. In this context, companion robots are defined as autonomous robots that provide cognitive, physical or social support and that are carrying out those tasks in a socially acceptable manner. Designing and implementing social skills for autonomous robots is a great effort, but in some application areas those are crucial to the success of the robot and its acceptance as a useful contribute to human society. Two application areas that I have been involved in are home assistance robots providing support for elderly residents as part of a smart home, and the use of robots as therapeutic and educational tools for children with autism. In both areas fundamental questions of perception, action, cognition and learning need to be addressed, as well as practical, social and ethical issues in terms of integrating such system in a real environment, such as a school or a home environment as part of an existing network of care.


## Dr. Komei Sugiura

Senior Researcher

National Institute of Information and Communications Technology (NICT)


Biography

Komei Sugiura is a Senior Researcher at National Institute of Information and Communications Technology (NICT), Japan. He received his B.E. degree in electrical and electronic engineering, and M.S. and Ph.D. degrees in informatics from Kyoto University in 2002, 2004, and 2007, respectively. From 2006 to 2008, he was a research fellow at Japan Society for the Promotion of Science. In 2008, he joined Universal Communication Research Institute, NICT.

His research interests include robot dialogues, service robots, machine learning, cloud robotics, imitation learning, spoken dialogue systems, information retrieval, and recommender systems. Besides scientific publications in major journals and conferences, he has developed several domestic service robots, web/smartphone applications, and cloud services.

URL: http://komeisugiura.jp/

### ***Cloud Robotics for Human-Robot Dialogues***

In my talk, I will focus on spoken dialogues with service robots that mainly work in domestic environments.

To build conversational robots, roboticists are required to have deep knowledge of both robotics and spoken dialogue systems. Building a cloud platform especially for the robotics community will help robot developers to access high-quality speech recognition and synthesis engines that are optimized for human-robot interactions. This is challenging because we need to build a wide variety of functionalities ranging from a stable cloud platform to high-quality multilingual speech recognition and synthesis engines. In this talk, I will introduce rospeex, which is a cloud robotics platform for multilingual spoken dialogues with robots. Over 30,000 unique users have used rospeex since it was launched.

## Professor Tadahiro Taniguchi

Associate Professor, College of Information Science and Engineering,
Ritsumeikan University
Visiting Associate Professor, Electrical & Electronic Engineering
Imperial College London (Temporally)

Biography

He received the ME and PhD degrees from Kyoto University, in 2003 and 2006, respectively. From April 2005 to March 2006, he was a Japan Society for the Promotion of Science (JSPS) Research Fellow (DC2) at the Department of Mechanical Engineering and Science, Graduate School of Engineering, Kyoto University. From April 2006 to March 2007, he was a JSPS Research Fellow (PD) at the same department. From April 2007 to March 2008, he was a JSPS Research Fellow at the Department of Systems Science, Graduate School of Informatics, Kyoto University. From April 2008 to March 2010, he was an Assistant Professor at the Department of Human and Computer Intelligence, Ritsumeikan University. Since

April 2010, he has been an Associate Professor at the same department. He has been engaged in research on machine learning, emergent systems, and symbol emergence in robotics.

### ***Symbol Emergence in Robotics and Unsupervised Machine Learning for Language Acquisition***

Humans can acquire language through physical interaction with their environment and speech interaction with other people. It is critical to understand how humans can form a symbol system and obtain semiotic skills through their autonomous mental development from the viewpoint of a computational model. We are challenging to construct a robotic system and machine learning method which can acquire language through embodied multimodal interaction. In this talk, I introduce the approach of symbol emergence in robotics and recent results about unsupervised machine learning for language acquisition by a robot.

# Professor Sethu Vijayakumar FRSE

Director, Edinburgh Centre for Robotics
Royal Academy of Engineering - Microsoft Research Chair in Robotics
School of Informatics, University of Edinburgh

Biography

Sethu Vijayakumar is the Professor of Robotics in the School of Informatics at the University of Edinburgh, UK and Director of the Edinburgh Centre for Robotics. Since August 2007, he holds the prestigious Senior Research Fellowship of the Royal Academy of Engineering, co-funded by Microsoft Research. He also holds additional appointments as an Adjunct Faculty of the University of Southern California (USC), Los Angeles. Prof. Vijayakumar has pioneered the use of large scale machine learning techniques in the real time control of large degree of freedom anthropomorphic robotic systems including the SARCOS and the HONDA ASIMO humanoid robots, KUKA-DLR robot arm and iLIMB prosthetic hand. His latest project involves a collaboration with NASA Johnson Space Centre on humanoid robots being prepared for unmanned robotic pre-deployment missions to Mars. His research interest spans a broad interdisciplinary curriculum ranging from statistical machine learning, adaptive control, and actuator design to human motor control and computational neuroscience. He is the author of over 160 highly cited publications in these fields and the winner of the IEEE Vincent Bendix award, the Japanese Monbusho fellowship, 2013 IEEE Transaction on Robotics Best Paper Award and several paper awards from leading conferences. He has been the scientific coordinator and lead PI for several national, EU and international research projects, attracting over £25M in research funding over the past 10 years besides serving on numerous EU and NSF grant review panels and program committees of leading machine learning and robotics conferences. He is a Fellow of the Royal Society of Edinburgh and a keen science communicator with a significant annual outreach agenda. He has been awarded the 2015 Tam Dalyell Award for excellence in engaging the public with science.

**Webpage**: http://homepages.inf.ed.ac.uk/svijayak

**Contact**: 1.28 Informatics Forum, 10 Crichton Street, Edinburgh, EH8 9AB, United Kingdom

## ***Shared autonomy for interactive robotics: Closing the loop***

The next generation of robots are going to work much more closely with humans, other robots and interact significantly with the environment around it. As a result, the key paradigms are shifting from isolated decision making systems to one that involves sharing control -- with significant autonomy devolved to the RAS systems; and end-users in the loop making only high level decisions. The key questions is: what is the optimal trade-off between autonomy and control that we are comfortable with? This talk will look at technologies ranging from robust multi-modal sensing, shared representations, compliant actuation and real-time learning and adaptation that are enabling us to reap the benefits of increased autonomy while still feeling securely in control.

Domains where this debate is relevant now include self-driving cars, mining, shared manufacturing, exoskeletons for rehabilitation, active prosthetics, large scale scheduling (e.g. transport) systems as well as Oil and Gas exploration to list a few.

## Professor Tetsuya Ogata

Professor

School of Fundamental Science and Engineering, Waseda University


### Biography

Tetsuya Ogata received the BS, MS and DE degrees in Mechanical Engineering, in 1993, 1995 and 2000, respectively, from Waseda University. From 1999 to 2001, he was a Research Associate in Waseda University. From 2001 to 2003, he was a Research Scientist in the Brain Science Institute, RIKEN. From 2003 to 2012, he was an Associate Professor in the Graduate School of Informatics, Kyoto University. Since 2012, he has been a Professor of the Faculty of Science and Engineering, Waseda University. From 2009 to 2015, he was a JST (Japan Science and Technology Agency) PRESTO Researcher (5 years). Since 2016, he has been a visiting researcher of the Artificial Intelligence Research Center (AIRC), AIST. His research interests include human-robot interaction, dynamics of human-robot mutual adaptation and inter-sensory translation in robot systems with neuro-dynamical models.

### ***Neural Models for Behaviours and Communication of Robots***

In this talk, I will present two topics of our research on neuro-dynamical models, which enable robot systems to recognize the environment and to interact with human beings. The first topic is a multi-modal integration model of humanoid robot using time-delay deep auto-encoders. The proposed mechanism enables the humanoid to handle different objects by integrating the raw camera images, raw sound spectrums and motor joint angles without any dedicated feature extraction mechanism. By retrieving temporal sequences over the learnt different modalities, the robot can generate and predict the object manipulation behaviours or camera images from the current sensory-motor states. I'll also introduce the reinforcement learning with a recurrent neural net (RNN) for continuous motor learning. The other topic is a linguistic communication model of the robot following a sequence-to-sequence manner with an RNN model. In the proposed neural model after the network receives a verbal input, its internal state changes according to the first half of the attractors with branch structures corresponding to semantics. Then, the internal state shifts to the second half of the attractors for generating the appropriate behaviour. The model achieves immediate and repeatable response to linguistic directions. Finally, the future problems for the robot application will be discussed.

# Professor Roberto Cipolla FREng

Professor of Information Engineering
University of Cambridge

## Biography

Professor Roberto Cipolla FREng is Professor of Information Engineering at the Department of Engineering in the University of Cambridge and Director of Toshiba's Cambridge Research Laboratory.

Roberto Cipolla obtained a B.A. (Engineering) from the University of Cambridge in 1984 and an M.S.E. (Electrical Engineering) from the University of Pennsylvania in 1985. From 1985 to 1988 he studied and worked in Japan at the Osaka University of Foreign Studies (Japanese Language) and Electrotechnical Laboratory. In 1991 he was awarded a D.Phil. (Computer Vision) from the University of Oxford and from 1991-92 was a Toshiba Fellow and engineer at the Toshiba Corporation Research and Development Centre in Kawasaki, Japan. He joined the Department of Engineering, University of Cambridge in 1992 as a Lecturer and a Fellow of Jesus College. He became a Reader in Information Engineering in 1997 and a Professor in 2000.

His research interests are in computer vision and robotics and include the recovery of motion and 3D shape of visible surfaces from image sequences; object detection and recognition; novel man-machine interfaces using hand, face and body gestures; real-time visual tracking for localisation and robot guidance. See publications: http://mi.eng.cam.ac.uk/~cipolla/publications_selected.htm

## ***Making Machines See***

Computer vision is the science and technology of making machines that see. It is concerned with the theory, design and implementation of algorithms that can automatically process visual data to recognize objects, track and recover their shape and spatial layout.

The talk will begin with a simple introduction to the 3R's of computer vision: registration, reconstruction and recognition. This will be followed by a review of the state-of-the-art in using geometry to recover accurate 3D shape and machine learning for real-time semantic segmentation of video (see demonstration: http://mi.eng.cam.ac.uk/projects/segnet/)

More information: http://mi.eng.cam.ac.uk/~cipolla/

## Professor Yoshihiko Nakamura

Professor, Department of Mechano-Informatics,
School of Information Science and Technology, The University of Tokyo

### Biography

Yoshihiko Nakamura received the B.S., M.S., and Ph.D. degrees from Kyoto University in 1977, 1979, and 1985 respectively. He was Assistant Professor at Automation Research Laboratory, Kyoto University for 1982-1987, and Assistant and Associate Professor at Department of Mechanical and Environmental Engineering, University of California, Santa Barbara for 1987-1991. Dr. Nakamura joined Department of Mechano-Informatics, University of Tokyo, Japan in 1991, and is currently Professor. Dr. Nakamura's robotics research started on the basis of kinematics, dynamics, and control. Humanoid robotics, cognitive robotics, neuro-musculoskeletal human modeling, biomedical systems, and their computational algorithms are the current fields of his research. His book publication includes "Advanced Robotics: Redundancy and Optimization" (1991 Addison-Wesley), "Building the Robot Brain" (2003 Iwanami), and "Robot Motion" (coauthored with M. Uchiyama, 2004 Iwanami) for which Publication Award was presented by Society of Instrument and Control Engineers in 2005. Dr. Nakamura was a recipient of King-Sun Fu Memorial Best Transactions Paper Award, IEEE Transaction of Robotics and Automation in 2001 and 2002. He was appointed as Distinguished Lecture for 2006-2008 of Robotics and Automation Society of IEEE and received the Most Active Distinguished Lecture Award in 2007. He was President of International Federation for the Promotion of Mechanism and Machine Science (2012-2015). He is a founding member and a co-chair of IEEE-RAS Technical Committee on Robotics and Automation in Nuclear Facilities (2012-). Dr. Nakamura is Foreign Member of Academy of Engineering Science of Serbia, and TUM Distinguished Affiliated Professor of Technische Universität München. Dr. Nakamura is Fellow of Japan Society of Mechanical Engineers, Fellow of Robotics Society of Japan, Fellow of IEEE, and Fellow of World Academy of Arts and Science.

### ***Supercomputing for Robotics, Biomechanics, and Neuroscience***

Mathematical computing for bigdata, realworld, realtime, and complex systems will boost the paradigm change of human-robot interaction and human simulation. This talk will show the recent studies for human modelling and its supercomputing including semiotic and linguistic approach for human behaviours, and neuro biomechanical modelling of the human whole body and overviews the their implications for our lives and society.

## Mr Llewelyn Morgan

Service Manager, Localities Policies and Innovation
Oxfordshire County Council


Biography

Llewelyn leads a service area within Oxfordshire County Council that encompasses transport, planning policy and strategy and early stage scheme development. As part of the service area a forward looking Local Transport Plan has been developed and adopted, which includes the ambition for a Zero Emissions Zone in Oxford by 2020. Llewelyn has also built an outward focused Research and Innovation team, leading on developing a more innovative mobility strategy, which includes autonomous vehicles as part of the future solutions, called Oxford Science Transit. The Service also leads on development and support of innovative collaboration projects such as MobOx, Culham City (AV Test Bed) IUK projects such as the One Transport data platform and Catch user focused intelligent mobility platform, IOT and data H2020 projects and Urban Data to Decide sentiment analysis projects. These are delivered in partnership with Oxford's and other UK/international Universities and private sector partners. Llewelyn leads work on developing collaborative approaches to real world problems; along with City Council Colleagues he established the Oxford Smart City group with Oxford's Universities, LEP and businesses to establish the vision for the Oxford City Region and develop collaborations with a number of major international organisations providing the opportunity for innovative organisations to meet Oxfordshire's challenges and at the same time develop worldwide market opportunities.

### ***Robotics and AI – Helping to Solve the Challenges of Local Government***

Presentation will provide background of how Oxfordshire is developing its approach to utilise the disruption in the transport sector, with a focus on the role of robotics and AI in helping to solve the existing and future challenges Local Government faces. The focus will be on Transport and in particular Autonomous Vehicles, how does local government support and plan for this developing technology and what impact will it have? The presentation will also touch on emerging use of basic AI such as machine learning which provides immediate opportunities to utilises data in a way that helps Local Government to better understand problems and to develop ways of managing them in an real time interactive way.

## Mr Shohei Hido

Chief Research Officer
Preferred Networks


Biography

Shohei Hido is Chief Research Officer of Preferred Networks America, Inc. He received M.S in Informatics from Kyoto University in Japan, 2006. Since then, he has worked at IBM Research in Tokyo for six years as a staff researcher in machine learning and its applications to many industries. After joining Preferred Infrastructure, Inc. in 2012, he has worked as the leader of Jubatus project, an open source software framework for real-time, streaming machine learning. Currently, he is the product manager of Deep Intelligence in Motion, software for using deep learning in IoT applications. Preferred Networks was established as a spinout company from Preferred Infrastructure in 2014.

### ***How AI revolutionizes Industrial Robots and Automotive***

The current rise of artificial intelligence has begun at large IT companies such as Google, Facebook, Microsoft, and Amazon. In particular, everyone knows deep learning is extremely powerful in speech recognition, natural language processing, and image understanding as proven by such companies. Preferred Networks tries to extend the power of deep learning into other industries such as automotive, robotics, and manufacturing. However, it is difficult for software start-ups to independently build a hardware product and distribute it. On the other hand, manufacturing companies are looking for outsiders who can bring and integrate AI technologies into their products. Therefore, Preferred Networks is collaborating closely with world-leading partners in each industry, such as Toyota motors for autonomous cars, Panasonic for driving safety, FANUC for factory robots, and Cisco for network infrastructure. In this talk, I will show initial results of the joint projects with Toyota at CES2016 and with FANUC at International Robot Exhibition, and present our open-source deep learning framework named Chainer.

# Dr. Anders Sandberg

James Martin Research Fellow
Future of Humanity Institute, Oxford Martin School,
University of Oxford

## Biography

Anders Sandberg's is James Martin Research fellow at the Future of Humanity Institute at the University of Oxford. His research there centers on management of low-probability high-impact risks, societal and ethical issues surrounding human enhancement, estimating the capabilities of future technologies, and very long-range futures. He is currently senior researcher in the FHI-Amlin industry collaboration on systemic risk of risk modelling. He is research associate to the Oxford Martin Programme on the Impacts of Future Technology, the Oxford Uehiro Centre for Practical Ethics, the Oxford Centre for Neuroethics and the Institute of Future Studies (Stockholm). He is on the advisory boards of a number of organizations and often debates science and ethics in international media.

Anders has a background in computer science, neuroscience and medical engineering. He obtained his Ph.D. in computational neuroscience from Stockholm University, Sweden, for work on neural network modelling of human memory.

## ***Living with robots: the future social impact of AI***

Automation and robotics challenges us humans by creating devices that act autonomously, unpredictably, and (sometimes) more efficiently. Conversely intelligent systems need to deal with humans: hard to understand beings with opaque goals. The future success of robotics hinges on developing systems that are robust and beneficial, not just capable. This brief talk will discuss some opportunities for creating a great positive impact from smart systems.