
Beyond AlphaGo

DATE & LOCATION
October 27–28, 2016
aT Center, Seoul, Korea
Gangnam-daero 27, Seocho-gu, Seoul

ORGANIZERS
Hosted by
Korea Ministry of Science, ICT, and Future Planning

Sponsored by
Korean Institute of Information Scientists and Engineers

Supported by
Korean Society for Cognitive Science
Brain Engineering Society of Korea
Korea Robot Society
IEEE Computational Intelligence Society
National Association of Cognitive Science Industries
Korean Academy of Science and Technology
National Information Society Agency
**AIMS AND SCOPE**

The International Symposium on Perception, Action, and Cognitive Systems (PACS) is a premier venue for science and engineering for embodied cognitive systems – natural and artificial - that sense, act, feel, think, reason, communicate, learn and evolve in real-world environments. The fundamental significance of embodied cognitive systems has long been recognized in science, but its industrial importance has realized only recently with new technologies such as the Internet of things, mixed reality, wearable devices, personal robots, and autonomous cars. The goal of PACS is to bring international researchers from academia and industry together to present recent progresses and discuss new frontiers in interdisciplinary research and technology for embodied cognitive systems. The topics of PACS cover on the following (not exhaustive):

- Action Science
- Anticipatory Systems
- Artificial Intelligence
- Augmented Cognition
- Autonomous Learning
- Brain-like Systems
- Cognitive Architectures
- Cognitive Robots
- Complex Adaptive Systems
- Conversational Agents
- Cyber-Physical Systems
- Embodied Cognition
- Emotion Machines
- Haptic Interfaces
- Human-Robot Interaction
- Human-Level AI
- Intelligence Augmentation
- Internet of Things
- Machine Cognition
- Mind Machines
- Perceptual Computing
- Personal Robots
- Self-aware Systems
- Smart Machines
- Wearable Agents

**Hosted by** Korea Ministry of Science, ICT, and Future Planning  
**Sponsored by** Korean Institute of Information Scientists and Engineers (KIISE)  
**Patrons:** Institute for Information and Communications Technology Promotion, ETRI, Samsung, LG, SK Telecom, Naver, Doosan, POSCO, Google Korea, Microsoft Korea, Qualcomm Korea, Nvidia Korea, Robotis, Yujin Robot, Future Robot, Surromind Robotics, Seoul National University Institute of Cognitive Science, Cognitive Robotics and Artificial Intelligence Center, Yonsei Cognitive Engineering Square, Mirae Asset Financial Group, Shinhan Financial Group, KB Financial Group, Deloitte

**PROGRAM**

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<td>Welcome and Introduction</td>
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<td>Choong Seon Hong, General Co-Chair &amp; President of KIISE</td>
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<td>Matthias Scheutz</td>
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<td>Director, Human-Robot Interaction Laboratory</td>
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<td>Aaron Sloman</td>
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<td>Natural and Artificial Intelligence: Towards Neuromorphic Computational Systems</td>
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<td>Digital Companions for Seamless Co-Creation</td>
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<td>Andreas Dengel</td>
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<td>A Bayesian Perspective of Intelligence</td>
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<td>Senior Research Scientist, Artificial Intelligence Research Center(AIRC), AIST, Japan</td>
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<td>15:00 - 15:30</td>
<td>Coffee Break</td>
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<td>17:30 – 18:00</td>
<td>Award &amp; Farewell</td>
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Instructible Social Robots
Matthias Scheutz
Director, Human-Robot Interaction Laboratory
Tufts University

ABSTRACT
There are many ways for social robots to learn new information, from unsupervised data-driven approaches to supervised instruction-based approaches. In this presentation, I will focus on social robots that can interact with humans in natural language and can acquire new knowledge from dialogue-based natural language instructions. I will demonstrate throughout the talk how robots of different sophistication can benefit from natural language instructions and not only quickly acquire new knowledge, but also use it right away during task performance. I will then argue that this way of learning not only mirrors human abilities and can thus also be used to model human instruction-based learning, but moreover allows for unprecedented knowledge acquisition for future robots that can outperform standard statistical approaches.

BIO
Matthias Scheutz is a Professor in Cognitive and Computer Science in the Department of Computer Science at Tufts University. He earned a Ph.D. in Philosophy from the University of Vienna in 1995 and a Joint Ph.D. in Cognitive Science and Computer Science from Indiana University Bloomington in 1999. He has more than 250 peer-reviewed publications in artificial intelligence, natural language processing, cognitive modeling, robotics, and human-robot interaction. His current research focuses on complex cognitive robots with natural language capabilities.

Robot Intelligence vs Biological Intelligence
Aaron Sloman
Honorary Professor, Artificial Intelligence and Cognitive Science
University of Birmingham

ABSTRACT
Alan Turing died in 1954. The Meta-Morphogenesis project is a conjectured answer to the question: what might Alan Turing have worked on if he had continued several decades after publication of his 1952 paper The Chemical Basis of Morphogenesis, instead of dying two years later? The project has many strands, including identifying what needs to be explained -- e.g. how could evolution have produced the brains of mathematicians like Pythagoras, Archimedes and Euclid?; or the brains of human toddlers who seem to make and use topological discoveries before they can talk? Or the brains of intelligent non-humans, like squirrels, weaver birds, elephants and dolphins? How did those ancient human brains make their amazing, deep discoveries over two millennia ago -- long before the development of modern logic or proof-theory? What features of the “fundamental construction kit” (FCK) provided by physics and chemistry made that possible? What sorts of "derived construction kits” (DCKs) were required at various stages of evolution of increasingly complex and varied types of biological information processing? Were some currently unrecognized forms of information processing required that will be needed by future Archimedes-like robots -- e.g. in order to be able to discover that extending Euclidean geometry with the neusis construction allows arbitrary angles to be trisected? A major task of the project is collection and analysis of examples of natural intelligence that current AI cannot match, and current neuroscience cannot explain, to help steer research towards new subgoals. One of my goals is to explain why Immanuel Kant was right about the nature of mathematical discovery in 1781 even if he missed some important details. The presentation will be a revised version of my IJCAI 2016 tutorial. An introduction and some messy notes are here: http://www.cs.bham.ac.uk/research/projects/cogaff/misc/sloman-tut-ijcai-2016.html [Still being revised and extended.]

BIO
Aaron Sloman
Honorary Professor of Artificial Intelligence and Cognitive Science
(Retired since 2002, but still doing research full time)
School of Computer Science, The University of Birmingham, UK
Born 1936 Southern Rhodesia (now Zimbabwe).
BSc Mathematics and Physics CapeTown, 1956.
Was seduced from mathematics to philosophy while a graduate student in Oxford, because the philosophers there mis-described mathematics.
Learned about AI in 1969 from Max Clowes (pioneering vision researcher) at Sussex University. Presented a challenge to AI at IJCAI 1971. Was invited to Edinburgh University to work with AI people on the challenge for a year 1972-3. Spent several more decades working on those problems first at Sussex then Birmingham, linking AI, Philosophy, Cognitive Science, and Biology -- trying to formulate and answer questions ignored by most AI researchers. Found progress very slow, very difficult (and often lonely).
Was inspired by the Turing centenary 2012 to reflect on how Turing might have addressed the problem. This led to the Meta-Morphogenesis project (see my abstract). This has produced a steady flow of (still incomplete) interconnected, freely available, online papers with this root: http://www.cs.bham.ac.uk/research/projects/cogaff/misc/meta-morphogenesis.html
Natural and Artificial Intelligence: Towards Neuromorphic Computational Systems

Klaus Mainzer
Professor Emeritus, Philosophy and Philosophy of Science
Technische Universität München

**ABSTRACT**

In the past, artificial intelligence followed the digital paradigm of computability and the Turing test. But, in natural systems, perception, action and cognition are based on analog abilities which cannot be completely reduced to the digital paradigm. In evolution, natural intelligence has emerged in brains with analog and digital principles. Increase of natural intelligence was realized by increase of the density of more and more neurons in brains with slow synapses, analog weights, and sensible “wetware” (cellular tissue + neurochemistry), but saving energy. In technology, increase of artificial intelligence was realized by increase of computational velocity and storage of digital computers with “robust hardware” (e.g. silicon + semiconductor technology), but at the cost of high energy. Mathematically, it can be proven that neural nets (“brains”) and appropriate automata and machines (“computers”) are equivalent – from simple automata and networks up to analog networks with real computing. The lecture considers the computational foundations of analog systems with respect to applications to perception, action and cognition. The target of research should be the convergence of evolutionary (“analog”) and technical (“digital”) strategies in neuromorphic systems which combine technical efficiency with evolutionary advantages (e.g. saving energy).

**References**


**BIO**

Prof. Dr. Klaus Mainzer studied mathematics, physics, and philosophy (1968-1972), Ph.D. (1973) and habilitation (1979) at the university of Münster; Heisenberg-scholarship (1980); 1981-1988 professor for foundations of exact sciences at the University of Constance, vice-president of the university of Constance; 1988-2008 chair for philosophy of science, dean, director of the Institute of Philosophy (1989-2008) and founding director of the Institute of Interdisciplinary Informatics (1998-2008) at the University of Augsburg; since 2008 chair for philosophy of science and technology, director of the Carl von Linde-Academy (2008-2015) and 2012-2014 founding director of the Munich Center for Technology in Society (MCTS) at the Technical University of Munich (TUM); since 2016 TUM Emeritus of Excellence; member of several academies and interdisciplinary organizations (e.g., The Academy of Europe/Academia Europaea in London, European Academy of Sciences and Arts in Salzburg, National Academy of Science and Engineering (acatech) in Berlin) and guest-professor in Brazil, China, Japan, South-Korea, Russia, and USA.

Research interest are mathematization and computer modelling, complex dynamical systems, self-organizing and autonomous systems, complexity and computability, artificial intelligence (AI), computational brain, embodied robotics, and big data technology.


Digital Companions for Seamless Co-Creation

Andreas Dengel
Scientific Director, Knowledge Management Department
German Research Center for Artificial Intelligence (DFKI)

**ABSTRACT**

The momentum of the modern world increasingly requires a rapid and situational learning of new skills. Due to the growing information intensity, the trend towards shorter innovation cycles and the reduction of knowledge half-live time degrades the importance of factual knowledge. In order to enhance performance and productivity, computers are increasingly taking over the role of an amplifying partner supporting our individual handling of diverse information sources and exploring synergies between large communities. In such an evolutionary cyber-social environment, new potentials for digital companions are emerging, assisting users in understanding, learning, decision-making, and memorizing. This talk discusses the various factors of digitalization and presents examples of current research and development that will affect our way of cognitive co-creation in the near future. It is trying to give some answers to questions, such as: What is expertise and what is the prerequisite for it? What factors influence the creation of competence today? How can technology be employed to act as associative memories for supporting knowledge work in cyber-social settings? How to support knowledge sharing? Can you measure and anticipate information needs? How to employ interactive learning aids for co-creation?

**BIO**

Professor Andreas Dengel is a member of the Management Board as well as Scientific Director at the German Research Center for Artificial Intelligence (DFKI) in Kaiserslautern where he is leading the Knowledge Management Research Department. In 1993 he became a Professor at the Computer Science Department of the University of. Since 2009 he also holds a Honorary Professorship at the Dept. of Computer Science and Intelligent Systems, Graduate School of Engineering of the Osaka Prefecture University. From 1980 to 1986 Andreas studied Computer Science and Economics at the University of Kaiserslautern. He subsequently worked at the Siemens research lab in Munich and at the University of Stuttgart where he completed his doctoral thesis in 1989. In 1991 he worked as a guest researcher at Xerox Parc in Palo Alto. Andreas is a member of various advisory boards, such as for the Cyber-Physical Systems (CPS) IIP Programm of MEXT in Japan, the Computer Vision Center (CVC) at the University of Barcelona, Spain, the Center for Co-Evolutionary Social Systems at Kyushu University, Japan the Center of Excellence on Semantic Technologies at MIMOS in Kuala Lumpur, Malaysia, and the Int’l Conference on Document Analysis and Recognition (ICDAR). He further is an active reviewer for many organizations, such as the German Council of Science and Humanities, the Research Council of Norway, the Dutch, the Swiss, Luxembourg, and the Austrian Science Foundation. Formerly, he acted e.g. as a member of the IT-Summit Working Group on “Service and Consumer-Oriented Information Technology" consulting the German government on questions of future IT strategies. He also was the German representative in the IST Prize Executive Jury of the European Council of Applied Science (Euro-CASE), a lecturer of the Joint Executive MBA course at the Johannes Gutenberg University at Mainz, the University of Texas at Austin, and the Dongbei University of Finance and Economics at Dalian, China, as well as a member of the METTREC Planning Committee (Metadata/Text Retrieval Conference Committee) of the National Institute for Standards and Technology (NIST) in the United States. Moreover, he is founder or initiator of several successful start-up companies. In 2005 he received a “Pioneer Spirit Award” for one of his start-up concepts and at CeBIT 2015 his recent start-up digipen technologies has received the CeBIT Innovation Award. In Cambridge, UK, in 2004, Andreas Dengel has been elected a Fellow of the International Association for Pattern Recognition (IAPR). His scientific contributions have been honored several times by international scientific prizes. His main scientific emphasis is in the areas of Smart Data, Deep Learning, Document Understanding, Semantic Technologies, Information Retrieval, Multimedia Mining, and Social Media.
A Bayesian Perspective of Intelligence

Hideki Asoh
Senior Research Scientist, Artificial Intelligence Research Center (AIRC), AIST, Japan

ABSTRACT

Intelligence has been developed for surviving and behaving well in the changing real world. Observation of the world is inevitably partial, and simulations based on the fundamental principles can’t cover various phenomena in the world. In order to cope with the situation, intelligence seems to use statistical models which are based on probability theory. Using the models, various kinds of information processing such as prediction, simulation, and planning of actions can be done for behaving better in the uncertain real world. Bayesian inference with probabilistic models is a powerful and mathematically sound tool to treat the uncertainty and have been exploited to construct various intelligent systems such as pattern recognition systems, anomaly detection systems, and so on. There are several evidences supporting that our brain also utilizes Bayesian inference.

In my talk, first I would like to give an introduction of Bayesian inference with probabilistic models. In the talk I’ll try to show a unified framework in which various concepts in machine learning and probabilistic inference e.g. generative models, discriminative models, predictive coding, deep learning, and so on are related to construct intelligence.

Then, in the latter half of the talk, I would like to introduce the artificial intelligence research center of AIST and show some research activities regarding Bayesian modeling and inference in the context of intelligence embedded in the real world.

BIO

Hideki Asoh received B.Eng. in mathematical engineering and M.Eng. in information engineering from the University of Tokyo, in 1981 and 1983 respectively. In April 1983, he joined in Electrotechnical Laboratory as a researcher. From 1993 to 1994 he stayed at German National Research Center for Information Technology (GMD) as a visiting research scientist. He is currently a deputy director of Artificial Intelligence Research Center (AIRC) in National Institute of Advanced Industrial Science and Technology (AIST). His research interests are in constructing intelligent systems which can learn through interactions with the real world.
21  Data Curation Layer for Wellness Platforms  
   Haifiz Syed Muhammad Bilal and Sungyoung Lee(Kyung Hee University)
22  Smartphone User Authentication Based on Rotation Touch Behavior Biometrics  
   M.H. Mohd Zain, Toshiyuki Kinoshita(Tokyo University Technology) and M.Z. Ismail(University Kuala Lumpur-BMI)
23  Local and Global map interface design for flying drone  
   Sanghyeong Yu, Jongwoo Jeon and Kwangsu Cho(Yonsei University)
24  Mining Minds, an opensource initiative towards health and wellness platforms  
   Muhammad Bilal Amin and Sungyoung Lee(Kyung Hee University)
25  SaKEM: A Semi-automatic Knowledge Engineering Methodology for Building Rule-based Knowledgebase  
   Maqbool Ali, Maqbool Hussain, Sungyoung Lee(Kyung Hee University) and Byeong Ho Kang(University of Tasmania)
26  X-UDeKAM: An Intelligent Method for Acquiring Declarative Structured Knowledge using Chatterbot  
   Maqbool Ali, Jamil Hussain, Sungyoung Lee(Kyung Hee University) and Byeong Ho Kang(University of Tasmania)
27  Aupair: A Home Robot for Personal Care  
   Beom-Jin Lee and Byoung-Tak Zhang(Seoul National University)
28  Schedulebot: A Home Robot Learning and Acting Schedule Adaptively via Dynamic Environments  
   Chung-Yeon Lee, Sang-Woo Lee(Seoul National University), Chaeueun Lee(University of Minnesota) and Byoung-Tak Zhang(Seoul National University)
29  Evaluation of User Interface Design using Psychophysiological Measures  
   Bonseung Koo, Nahye Kim and Kwangsu Cho(Yonsei University)
30  Cambot: A Visual Conversation Robot for Interactive Engagement  
   Kiboeun Kim, Jin-Hwa Kim and Byoung-Tak Zhang(Seoul National University)
31  Glassbot: Personalized Wearable Agents Learning from Everyday Human Behaviors  
   Sung-Woo Lee, Chung-Yeon Lee, Dong-Hyun Kwak and Byoung-Tak Zhang(Seoul National University)
32  Jibobot: A Personal Assistant Robot with Social Motions  
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33  Pandabot: Multimodal Story Learning with Dynamic Memory Construction  
   Yu-Jung Heo, Eun-Sol Kim, Kyoung-Woon On and Byoung-Tak Zhang(Seoul National University)
34  Knowledgebot: Neuroknowledge based complimentary Learning Model for Question Answering Systems  
   Kyoung-Woon On, Eun-Sol Kim and Byoung-Tak Zhang(Seoul National University)
35  Cafebot - A Conversational Cashier Robot in Cafes  
   Cheolho Han, Kyoung-Woon On, Eun-Sol Kim and Byoung-Tak Zhang(Seoul National University)
36  Pororobot: Child Tutoring Robot for English Education  
   Kyungmin Kim, Changjin Nan, Min-Oh Heo and Byoung-Tak Zhang(Seoul National University)
37  Storybot: Story Learning from Cartoon Videos via Consecutive Event Embedding  
   Min-Oh Heo and Byoung-Tak Zhang(Seoul National University)
38  Anomaly Pattern for Fraud Detection and Clustering on Large-scale On-line Enterprise Market  
   Eunji Jang and Taikyeong Jeong(Seoul Women’s University)
39  Childbot: A Conversational Assistant for Child Care  
   Hwiyeol Jo, Woo-Young Kang, Dong-Sig Han and Byoung-Tak Zhang(Seoul National University)
40  Human-machine Interactive Knowledge Discovery  
   - integrating IBM Watson Concept Insight in HCl and future research methodology  
   Hyunjeong Lee and Joongseek Lee(Seoul National University)
REGISTRATION

Early Registration Deadline: October 25, 2016

Registration Fee

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On-line Registration:
http://www.kiise.or.kr/pacs/2016/

Contact:
Heesoo Choi, +82-2-588-9246 / hschoi@kiise.or.kr

IMPORTANT DATES

- Online Poster Submission Open: September 5, 2016
- Submission Deadline: October 14, 2016
- Notification of Acceptance: October 18, 2016
- Early Bird Registration: October 25, 2016

VENUE

aT Center, Seoul
Gangnam-daero 27, Seocho-gu, Seoul, Korea
Subway Station: Yangjae Citizen’s Forest(Maeheon), Shinbundang-Line