Keynote Forum
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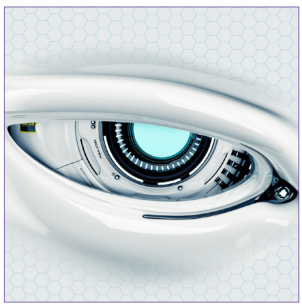
Robotics 2019



2nd International Conference on

Robotics and Artificial Intelligence

May 23-24, 2019 | Vienna, Austria

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Philip R Buskohl

Richard Vaia, Ben Treml and **Andrew Gillman**

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Local mechanologic operators for enhanced autonomy

Autonomous robotics and unmanned vehicles continue to revolutionize the operational model of various industries, ranging from transportation and manufacturing to defense. Autonomy however requires a platform with both local and global situational awareness. The associated control system, including sensors, actuators, computation, information transfer, and data storage, increases the complexity of the platform exponentially. A key challenge to this vision is disaggregating centralized control methodologies into a hierarchical network where some autonomy (spatial and temporal) is local, much like the autonomic versus the somatic nervous system. While much of the effort to address this challenge has focused on enhanced algorithms for synthesis of global sensor data, an alternative approach to local autonomy is to reframe how we consider engineering a material to behave in an environment. In this study, structure deformation and material responsiveness is re-interpreted into the language of logical operators, raising the level of decision functionality at the material/structure level. Thus, a desired response function based on environmental sensing, information processing, and deformation memory emerges from the synergism between the structure and material, which we will demonstrate in a humidity-responsive, origami structure. This paradigm shift provides a significant opportunity to rethink how autonomous functionality can be distributed across a robotics system to share and decentralize the information processing.

Speaker Biography

Philip R Buskohl is a Research Mechanical Engineer in the Functional Materials Division at the U.S. Air Force Research Laboratory (AFRL). The Division delivers materials and processing solutions to revolutionize AF capabilities in Survivability, Directed Energy, Reconnaissance, Integrated Energy and Human Performance. He has authored over 23 peer-reviewed papers ranging from the mechanical properties of embryonic heart value development, the chemical-mechanical feedback of self-oscillating gels, stimuli responsive polymers, and origami design. He is currently a member of the Flexible Electronics research team at AFRL, where he provides mechanical analysis and design concepts for conformal and deformable electronics packaging. He received his PhD degree in theoretical and applied mechanics from Cornell University in 2012.

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Eleni Efthimiou

Institute for Language and Speech Processing, Greece

Increasing user acceptance by augmented robot intelligence: The lesson we got from the semantics of human communication

Research on assistive robots has received special focus within the domain of robotics and is continuously gaining ground, also boosted by demographic data and related AAL supportive policies worldwide. Having in mind devices which need to address real user needs and be capable of interacting with users in some sort of "human" like manner, it has become mandatory to find robust ways for augmenting robot intelligence in order to enable devices overcome basic interaction shortages which are easily spotted during validation by end user populations.

One predominant parameter for user acceptance is proven to be satisfaction of the human need for communication with an "intelligent" companion or assistant, if a device has to gain user trust and be systematically used within a specific mid- to long-term time frame. In this context, we exploit the paradigm of exposure of assistive devices in real use conditions, to discuss the degree of user acceptance and the need to augment robot intelligence in the context of multimodal HRI. Focus is placed on those NLP tools and resources which may increase the span of human-robot communication by engaging standard NLP approaches in combination with signals of human embodied expression which can lead to enhanced performance of robotic devices when they interact with humans.

Speaker Biography

Eleni Efthimiou is Research Director at the Institute for Language and Speech Processing /ATHENA RC, where she heads the Embodied Interaction and Robotics Group, focusing on multimodal human communication, assistive interfaces and multimodal Human-Robot Interaction. In 1986, she received her Ph.D. degree in Generative Linguistics from the University of Salzburg. Her main research interests focus on natural language processing, sign language (SL) technologies and optimization of HCI/HRI. From 1995 to date, she has designed and developed various interaction environments with emphasis on SL based interfaces, while she has also developed methodologies for human multimodal data collection. In 2005, she founded the Sign Language Technologies Team at ILSP, a group of excellence activating in wide scale SL resources and technologies with emphasis on synthetic signing, machine translation and information retrieval from SL video. She is an editorial board member of Universal Access in the Information Society (UAIS) Journal.

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Christian Huyck

Middlesex University, UK

Cell Assemblies and Robots

Cell Assemblies (CAs) are crucial to human and mammalian cognition and behaviour. A CA is a group of neurons that can maintain firing without external stimulation. Our symbolic concepts, like dog, are represented by CAs. Many non-human mammals do not have symbols, but they do have concepts. So, a rat will probably have a generic CA for cat, which will fire when a cat is present.

There is an enormous gap in the academic community's understanding of CAs, how they affect motor control, and how they regulate sensing. Theoretically, my CA for walk to the door is firing when I am walking to the door, but it is not clear how that interacts with central pattern generators (CPGs), or even if those neurons that execute the CPG are part of the CA. Similarly, it is clear that, for instance, neurons in the primary visual cortex are involved when a human view a dog, but it is not entirely clear how they lead to the ignition of the dog CA, or which neurons are in the dog CA.

As there's a gap, I, and my collaborators, are trying to fill the gap. I am a computer scientist, so I am trying to develop programs based on CAs. In particular, we think embodiment is important, and that working from simulated neurons is important. So, we work with robots, virtual and physical. We work with spiking neurons, typically point models. We have been developing neural topologies that can be used for virtual agents. We are now working as part of the Human Brain Project, developing topologies that can be reused by others to implement agents. We have done a fair bit of work on developing "higher" function such as neuro-cognitive models of natural language parsing and learning a two-choice task.

We have also done some work with physical robots. We developed the neural software for a simple Braitenberg robot that followed lines using vision; this was based on our CA work. We are currently developing CA based neural models for grasping control that are also neuro-cognitive models of a stop task. More recently, we have been working on the forward model for a fast walking robot. This work does not use currently make use of CAs. Instead, it approximates standard analytical models (like a cart and pole) with point neurons; neurons are turing complete. The plan is to continue on with this work. We can explore the use of CAs in virtual robots. It is my contention that following this approach, mimicking the human model as closely as possible, physically, neurally, and psychologically is the best way to get to Turing test passing AI. It also has the benefits of furthering our understanding of human neural and psychological processing and developing systems that are useful. These more useful systems include robots.

Speaker Biography

Christian Huyck completed his PhD in 1994 from the University of Michigan. He is the professor of Artificial Intelligence at Middlesex University and has over 100 publications. He has been head of the AI research group at Middlesex for over 20 years. His two main areas of research are natural language processing and processing with simulated neurons.

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Kohei Ogawa

Osaka University, Japan

Understanding humans by creating Androids

Why do we feel another person's presence? How can this presence be captured, revived, and transmitted? To tackle these mysteries, we have developed a new artificial being, "Geminoid" and "Telenoid". The Geminoid is an android robot based on an existing person and it can act as an avatar of the original person. The Telenoid is another android robot which is characterized by implementing a minimal feel as if a spatially distant acquaintance is close-by. We explorer the mystery of human nature by using the polarity concept of these android robots.

Speaker Biography

Kohei Ogawa received the Ph.D. degree in system information science from Future University Hakodate, Japan, in 2010. From 2008, he was a Researcher at Intelligent Robotics and Communication Laboratories, Advanced Telecommunications Research Institute International. From 2012, he has been an assistant professor in the Graduate School of Engineering Science, Osaka University. From 2016, he has been a Special Appointed Associate Professor of JST ERATO, Ishiguro Symbiotic Human-Robot Interaction Project.

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Junichi Takeno

Meiji University, Japan

Research on a conscious system and experiments using a Robot

My research group and I have invented a consciousness module called a MoNAD that is constructed of a few recursive neural networks, and we have developed a conscious system using these modules. The module is only comprised of simple combined neural networks, but it can be used to explain a part of the phenomena of human consciousness. We also include an explanation about the module's self-reference function, that is, a MoNAD is able to represent itself. The module also includes the famous mirror neuron capability in which the central neurons of the module are related to cognition and behavior. The module can also be used to explain how a machine feels by means of neural networks. We think this is a very important explanation for robots of the future because it can learn unknown concepts autonomously. We conducted several experiments using this conscious system with a small robot. We will provide details on these experiments in the lecture, and speak on the capabilities of consciousness in color perception, the principles of pleasant and unpleasant feelings, modeling and simulation experiments on the Rubin's vase phenomenon, and the ego (the self) as a program. And finally we will touch on the modeling of advanced traumatic brain injuries using this conscious system.

Speaker Biography

Junichi Takeno is a Professor at Meiji University and President of Heuristics Science Research Institute. He has also been the Associative editor of the ELSEVIER. He served as General Chair of ICAM94 (International Conference of Advanced Mechatronics, Japan Society of Mechanical Engineers). He was a guest lecturer at Karlsruhe University, Germany, 1994 Trusty of the RSJ, 1998–2000 Aide for the President of Meiji University (2004-2011).

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