

The 2nd International Symposium on Symbiotic Intelligent Systems

Umeda Sky Building, Osaka, Japan

31th January – 1st February 2020

Abstracts

Session 1: “Cognitive Robotics”

‘Developing Familiarity with Assistive Robots’

Giulio Sandini (Italian Institute of Technology)

In spite of the very fast advancements of robot technology and the general impression that personal robots will soon enter our everyday life to support activities of daily living, the social impact of assistive robots is still very limited and the interaction between humans and robots still very much relies on technology-based unidirectional communication and reactive robot behavior.

As a result, the performance of personal robots designed to interact and assist humans is still far from meeting users’ expectations and to create a society-supportive and commercially profitable market. Personal robot, even if advanced technological devices and bold commercial adventures, are still not able to sustain human interest beyond the initial curiosity and stimulate their use beyond limited conventional use.

What do robots (and machines in general) miss to establish a long-term, personalized relationship with a human based on mutual understanding and anticipatory behaviours (fundamental requirements to assist a partner during even simple collaborative tasks)? What are the functions a robot needs in order to adapt its actions to the skills, pace, fatigue, knowledge (including shared memories) of the assisted individual and not to be driven like a general-purpose machine?

During the talk I will discuss what I consider are some of the ingredients needed to endow the robot (as an embodied agent) with the ability to build a personalized long-term relationship with humans and to develop the kind of positive familiarity necessary to establish a mutually predictive assistance tailored to individual situations and users.

‘Understanding the Development of Embodied Cognition with Brain-inspired Models and Robots’

Alex Pitti (CNRS / University of Cergy-Pontoise)

Despite the great successes currently made in artificial intelligence, their capabilities are still very far from those of children. Babies are very fast to learn strategies for moving in space and to interact with objects and persons. I will present some neurobotic models to explain how the child's brain enables the learning of its own body, its action in space, and the emergence of language and symbolic representation.

Session 3: “Technology, Ethics, and Culture”

‘Artificial Moral Agents with Artificial Pain’

Minoru Asada (Osaka University)

Pain and nociception is one of the most important sensations and perception for biological systems to survive in their environment, and could be one of the sources for the emergence of ethics. In this talk, I discuss any possibility of the emergence of ethics in artificial systems from artificial pain. The working hypothesis is introduced with an assumption of mirror neuron system, and developing process for artificial moral agents is given as a thought experiment. Finally, the design of artificial pain is argued as an ethical issue.

‘Meaningful Human Control and Moral Responsibility for Robots’

Filippo Santoni de Sio (Delft University of Technology)

In this talk I will explain what is meaningful human control over robots (and automated systems more generally), and why it matters.

‘Operationalising Meaningful Human Control into Technical and Institutional Design Requirements’

Giulio Mecacci (Delft University of Technology)

In order to be usable by a wide range of stakeholders, the normative requirements for Meaningful Human Control should be translatable into technical and institutional design solutions. A proper operationalization will grant clearer human accountability and more safety in socio-technical systems where artificially intelligent systems operate in circumstances where human life is at stake.

‘Technologies for Glocal Solutions’

Fiorenzo Marco Galli (National Museum of Science and Technology Leonardo da Vinci)

In contemporary society, the concepts of space and time are changing. Global issues must be faced connecting local and global perspectives that integrate technologies for competitiveness and sustainability.

Session 4: “Action and Embodiment”

‘How Embodiment Affects Learning’

Helge Ritter (Bielefeld University)

Deep learning has allowed to solve an unexpected row of challenges that in former years were only solvable for humans or highly sophisticated, handcrafted algorithms. This was enabled through huge advances in computing power in combination with massive training data while the core algorithms had been known already decades ago. While the achieved break-throughs are impressive, they are largely focused on tasks for which physical embodiment is either absent, weak or can be circumvented, e.g. through simulation. Only very recently deep learning has solved difficult interaction tasks, such as manipulating an object - however at the expense of simulating the equivalent of millenia of interaction years. This is beyond what a real embodied agent would be able to do and raises the question of how the constraint of embodiment - along with its strengths - could direct us towards different, more parsimonious learning approaches. We argue that such approaches would need to exploit properties of physical interaction, in particular touch and contact, cope with and exploit elasticity, and utilize strong priors, for instance in the form of situation models that link perception, memory and action in generic and structured ways, capturing regularities in the world, such as physics and topology. We present some examples in the context of robotics and take a look at possible avenues of progress for making learning more data- and interaction-parsimonious.

‘Building Blocks for Intelligent Systems in Memory and Brain’

Thomas Schack (Bielefeld University)

Neurocognitive approaches of manual intelligence seek to understand the relationship between neuronal processing and cognitive structures in the service of action control. The talk will present related research and provide first insights into the implementation of neuro-motor research into intelligent systems.

Session 5: “Human-Robot Collaboration”

‘Towards a Robot-Enabled Society: The Role of Human Adaptation to Robot Control’

Erhan Oztop (Osaka University)

Robot programming via human-in-the-loop robot (shared) control, is an effective means for realizing a robot-enabled society that can foster symbiotic co-existence of humans and intelligent machines. In the human-in-the-loop robot control, as in human-human collaboration, both the robot and the human can learn and adapt their control policies based on each other’s behavior. If managed properly, this co-evolving shared control framework may lead to higher task performance and effective robot behavior synthesis. However, care must be taken to ensure that the required human effort for high task performance is not prohibitively high. Currently, there is no general rule to ensure that these goals are met for a given task learning scenario. Therefore, in addition to the robot learning, the human learning that takes place during shared control framework needs to be studied in detail, for paving the road for a symbiotic robot populated society.

“Characterizing Neuro-Developmental Deficits through Socially Assistive Agents”

Salvatore Anzalone (Université Paris 8)

In this presentation, we will show how it is possible to use social robots and virtual agents for the characterization of behaviors of children with Neuro-Developmental Deficits. We will focus, in particular, on joint attention, imitation and perspective taking, a set of basic socio-cognitive skills that are impaired in presence of such disorders.

Session 6: “Interaction Systems”

‘Language as the Vector for Symbiotic Intelligence’

Peter Ford Dominey (CNRS / INSERM)

The cultures into which we are born define our perception and conception, and mold us into members of our culture. Language is the principle vector for this symbiotic enculturation. If we are to engage intelligent systems in symbiotic relations, then we must develop their language capabilities as a principle vector for interaction.

‘Exploring Neurobehavioral Dynamics from Human-Human to Human-Machine Social Interaction’

Guillaume Dumas (Institut Pasteur / CNRS)

How are neural, behavioral and social scales coordinated in real time to allow the emergence of social cognition? We will discuss how the combination of human-human and human-machine interactions presents new approaches to study the neurobiological mechanisms of social interactions.