

Keynote presentation

From Raw Data to Abstract Concepts

Harri Valpola

Abstract: Our brain can learn abstracts concepts and give meaning to the raw data provided by the senses. Vision, for instance, is not really about building a 3D model of the external world but rather about understanding the meaning of what is out there. It has been very difficult to match this ability with machines, but we are getting closer. We are beginning to understand the brain mechanisms in play and are making steady progress in replicating them in machines.

In this talk I will discuss the structure and function of the cerebral cortex which is responsible for giving abstract meanings to sensory stimuli. The main ingredients are

- a distributed hierarchy of increasingly abstract representations,
- distributed selection of useful information, and
- a suitable nonlinear mapping between the levels of hierarchy.

Bio: Harri Valpola received his M.Sc. degree in technical physics in 1996 and the D.Sc. degree in computer science in 2000 from the Helsinki University of Technology, Finland. The topic of his M.Sc. and Ph.D. research were brain inspired sparse coding and developing variational Bayesian techniques for unsupervised learning of hierarchical nonlinear models, respectively. He is currently an Academy Research Fellow heading a computational neuroscience group at the Department of Biomedical Engineering and Computational Science, Helsinki University of Technology. The research of the group focuses on building a neural cognitive architecture and research interests include development of representations, attention, reinforcement learning and motor control. He has previously been a researcher at the Laboratory of Computer and Information Science, Helsinki University of Technology, and a post-doctoral researcher at the Artificial Intelligence Laboratory, University of Zurich, Switzerland. He is currently also the CEO of Zendroid Ltd., which commercialises the research of the group.