Plenary speakers:

PT1 : Modular Playware Technology

Prof. Henrik Hautop Lund

Professor, Center for Playware, Technical University of Denmark, Denmark

Abstract:

Playware is intelligent hardware and software that creates play and playful experiences for users of all ages. Such playware aim at providing play forces to bring the user into play dynamics, and in this way motivate the user to perform desired behaviors, e.g. for play, education, sports training, and health improvements. However, designing playware technology that results in specific behaviors of the user in not a trivial task, and it demands an array of background knowledge in a number of scientific fields. Indeed, definition of desired interactions and behaviors should arise from deep knowledge of the field of application (e.g. play of a specific user group, clinical knowledge of therapy of a specific patient group, professional music knowledge, and professional sport knowledge). In order to meet a practice, where several disciplines can join to develop such playware, we conceptualized the approach of modular playware in the form of building blocks. Building blocks should allow easy and fast expert-driven or user-driven development of playware applications for a given application field. The development of such modular playware technology takes its inspiration from modular robotics, human-robot interaction and embodied artificial intelligence. In this talk, I will present the design principles for creating such modular playware technology with focus on the play principles and educational principles that forms the foundation for the design principles of modular playware technology. I will exemplify the design principles with practical applications from the fields of play, education, sports, music, performance art, and health.

Biography:

Henrik Hautop Lund is head of the Center for Playware at Technical University of Denmark (DTU Elektro). Prof. Lund is known world-wide for his work in bringing robotics to use in novel ways. His approach is to combine modular robotics and modern artificial intelligence to create novel solutions to problems that occupy the citizens of the World, e.g. obesity, rehabilitation, and 3rd World development. He has recently founded the Center for Playware to focus even further on how playful aspects of robotics may provide motivation for any citizen to perform different kinds of interaction with the robots of our future daily life. He chaired the Robots at Play festivals in the open city areas where researchers, artists, entertainers, and citizens meet through playful hands-on experience with robotics in the daily life of the citizens. In all cases, Prof. Lund has shown how the combination of a modern artificial intelligence, modular robotics and entertainment may provide novel opportunities in play, rehabilitation, sport, music, teaching, third World development, etc., by trying to allow non-expert users easy access to the technology in a playful and motivating way.

Prof. Lund has published 150 scientific articles in the field of robotics, he has been a member of the Danish Research Council, and he has been invited to present his robotic work in numerous occasions, for instance for the Emperor of Japan at Akasaka Palace in Tokyo. He founded and headed the LEGO Lab in 1997-2000. He invented the RoboCup Junior robot football game for children, and his Adaptronics group won the RoboCup Humanoids Free Style World Championship 2002 in front of 120.000 spectators. Further, he developed the RoboMusic in collaboration with World Music Award winner, remix musician Funkstar De Luxe. Prof. Lund's work has received world-wide interest from news media, and he was nominated for the award for the best entertainment robots and systems research over the last 20 years at the IEEE International Conference on Intelligent Robots and Systems (IROS).

Prof. Lund is director of the spin-off company Entertainment Robotics.

PT2 : Fundamentals of Neurodynamics: Statistical neurodynamics and Neural Field Theory

Prof. Shun-ichi Amari

Senior Advisor, RIKEN Brain Science Institute, Japan

Abstract:

The brain consists of a vast number of neurons and processes information through their dynamical interactions. Peculiar characteristics neural networks would be useful for designing algorithms for artificial life and applying them to robot navigation. The present talk will focus on two types of neurodynamics, one is generalized majority decision dynamics and the other dynamics of excitation patterns in a neural field.

A neural network is a generalized majority decision system, in which each element calculates a weighted sum of the outputs of the other elements and decides its own output. Such a system is common in many biological systems such as a gene expression network, social communication network etc. We consider randomly connected binary elements and compare its dynamical behavior with that of a random Boolean logic network. We prove that a generalized majority decision system can make very quick decision (short transient time) compared with a random Boolean net. We also show that its state transition graph has a scale-free property so that a small number of states monopolize the incoming branches.

Neurons are arranged in a two-dimensional sheet in the cortex, where neighboring neurons are connected. Excitations in a neural field propagate and interact. We show an interesting phenomenon of traveling local excitations and their collision. Such phenomena will be applied to information processing having topology of the outer environment. This will be applied to the problem of robot navigation.

Biography:

Shun-ichi Amari was born in Tokyo, Japan, on January 3, 1936. He graduated from the Graduate School of the University of Tokyo in 1963 majoring in mathematical engineering and received Dr. Eng. Degree.

He worked as an Associate Professor at Kyushu University and the University of Tokyo, and then a Full professor at the University of Tokyo, and is now Professor-Emeritus. He served as Director of RIKEN Brain Science Institute for five years, and is now its senior advisor. He has been engaged in research in wide areas of mathematical engineering, in particular, mathematical foundations of neural networks, including statistical neurodynamics, dynamical theory of neural fields, associative memory, self-organization, and general learning theory. Another main subject of his research is information geometry initiated by himself, which provides a new powerful method to information sciences and neural networks.

Dr. Amari served as President of Institute of Electronics, Information and Communication Engineers, Japan and President of International Neural Networks Society. He received Emanuel A. Piore Award and Neural Networks Pioneer Award from IEEE, the Japan Academy Award, Gabor Award from INNS, Caianiello Award, and C&C award, among many others.