MINI SYMPOSIUM

Brain Science Institute
RIKEN

3rd mini-symposium on Computations, Brains and Machines

Mar 17 (Thursday), 2016
13:30 – 17:00
1F Seminar Room, BSI Central Building

13:30-13:35   Opening

13:35-14:20
Recent Advances in Natural Language Processing and Game AI
Dr. Yoshimasa Tsuruoka
The University of Tokyo

14:20-15:05
Statistical Analysis on Order Structures
Dr. Mahito Sugiyama
Osaka University

15:15-15:30   Break

15:30-16:15
Market Design: Designing Social System by Game Theory
Dr. Makoto Yokoo
Kyushu University

16:15-17:00
Deep Neural Models for Multimodal Integration in Robot System
Dr. Tetsuya Ogata
Waseda University

17:00-17:45   Informal discussion (at Nakahara Lab/N201)

Host:
Hiro Nakahara   Lab for Integrated Theoretical Neuroscience

Recent Advances in Natural Language Processing and Game AI

Dr. Yoshimasa Tsuruoka
The University of Tokyo

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This talk will cover, together with our recent research efforts, latest research topics in the fields of natural language processing and game AI. The use of (deep) neural networks is increasingly common and is bringing drastic changes in the design of various algorithms in both fields. In natural language processing, words are now represented with real-valued vectors and traditional feature engineering efforts are being replaced by general learning frameworks such as convolutional neural networks. Even complex language processing tasks like machine translation can be performed by a simple combination of recurrent neural networks. The field of Game AI is experiencing similar changes, and accurate models for move prediction and position evaluation are built by using deep neural networks, which has lead to recent breakthroughs in computer Go and video-game playing programs. Another important breakthrough has been achieved in solving imperfect information games--an approximate Nash equilibrium (i.e. optimal) strategy has been computed for a popular variant of Poker, using a self play-based algorithm called counterfactual regret minimization.

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Statistical Analysis on Order Structures

Dr. Mahito Sugiyama
Osaka University

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Orders are a fundamental structure in mathematics and computer science, for example, the relations on set inclusion, sequence prefixes, subgraphs, and reachability in directed acyclic graphs. In this talk, I will introduce information geometry for order structured variables and show orthogonal decomposition of information theoretic quantities such as the KL divergence and entropy. This technique allows us to analyze higher order statistical interactions of variables and can be used to reveal unknown associations in a wide variety of applications, such as firing patterns of neurons in neuroscience and gene interactions in biology. The key to the efficiency of decomposition algorithms is a previously unexplored link between order theory and information geometry: Principal lower ideals and principal upper filters of a partially ordered set (poset) generate dual coordinates of the exponential family. Moreover, I will discuss statistical significance on a poset with highlighting the task of significant pattern mining, finding statistically significant combinatorial patterns with controlling the false positive rate, which is understood to be an upward analysis on a poset.

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Market Design: Designing Social System by Game Theory

Dr. Makoto Yokoo
Kyushu University

Mar 17 (Thursday), 2016
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"Market Design" is a research field that examines how to design a new market or improve an existing market such that a certain design goal is satisfied. This research field is influenced by micro economics, in particular, game theory. Here, the meaning of a "market" is very broad; it includes a spectrum auction, in which a government allocates the licenses to use specific spectrum bandwidth to companies, or a market without monetary transfer, such as a kidney exchange program, or a school choice program, in which children/parents can choose public schools they want to attend. Now, market design has become a interdisciplinary research topic that is relevant to computer science and information systems. In this talk, I will describe two representative application domains of market design: auction mechanisms (e.g., spectrum auctions, sponsored search) and two-side matching mechanisms (e.g., medical resident matching programs, school choice programs).

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Deep Neural Models for Multimodal Integration in Robot System

Dr. Tetsuya Ogata
Waseda University

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In this talk, I will present two topics of our research on neuro-dynamical models, which enable robot systems to recognize the environment and to interact with human beings. The first topic is a multi-modal integration model of humanoid robot using time-delay deep auto-encoders. The proposed mechanism enables the humanoid to handle different objects by integrating the raw camera images, raw sound spectrums and motor joint angles without any dedicated feature extraction mechanism. By retrieving temporal sequences over the learnt different modalities, the robot can generate and predict the object manipulation behaviors or camera images from the current sensory-motor states. The other topic is a linguistic communication model of the robot following a sequence-to-sequence manner with a recurrent neural model. In the proposed neural model after the network receives a verbal input, its internal state changes according to the first half of the attractors with branch structures corresponding to semantics. Then, the internal state shifts to the second half of the attractors for generating the appropriate behavior. The model achieves immediate and repeatable response to linguistic directions. The future problems for the robot application will be discussed in the end of this talk.

Host:

Hiro Nakahara   Lab for Integrated Theoretical Neuroscience