Jan 2017 Complexity Community Sharing Session

11 Jan 2017 (Wed) 11:00am-01:00pm

Seminar Room 102

(opposite Learning Hub), Blk 1 Innovation Centre, Level 1
16 Nanyang Drive, Singapore 637722

Dr. Mikhail FILIPPOV

Brain strategies for the visual image construction

Although we are removed by over a century of work from early theories of how the visual brain is organized, these early theories nevertheless linger on, sometimes forcefully, in our present day theorising about the visual brain. Results from a variety of sources, some many years old, lead us ineluctably to a fundamental re-appraisal and re-assessment of the strategies used by the brain to construct an image of the visual world. Fundamental to that re-appraisal are the twin strategies of hierarchical and parallel processing, which together have dominated thinking about the visual brain. Contrary to common supposition, there is not one but three anatomical hierarchies that reach both the primary visual cortex and the specialized visual areas outside it, in parallel. These anatomical hierarchies do not conform to the temporal hierarchies with which visual signals reach primary visual cortex and the specialized areas. Furthermore, neither the anatomical hierarchies nor the temporal hierarchy predict the perceptual hierarchy. The latter shows that we see (and become aware of) di□erent visual attributes at di□erent times, with colour leading form (orientation) and visual motion, even though it is signals from fast moving stimuli that are the earliest to reach the cortex.

Biography: *Mikhail Filippov is a research fellow at the Division of Physics and Applied Physics, Nanyang Technological University. He is concurrently an Honorary Research Fellow at the University College London. Mikhail graduated with Ph.D. in Physics from NTU and M.Sc. in Applied Mathematics from Moscow Institute of Physics and Technology. He is interested in understanding the dynamics of complex systems with very many degrees of freedom, such as atmospheric and hydrodynamics, molecular biology, brain and history.*

Prof. Cai Wentong

Data-driven Agent Behaviour Modelling for Crowd Simulation

Over the past few years, crowd simulation has been an active research field with an increasing attention from different research areas such as virtual environment, object tracking, computer animation and civil planning. These applications require the synthesized pedestrians to move in a realistic and believable manner, in order to have an excellent user experience or to draw some reliable conclusions based on the simulation results. In this talk, I will summarize the research work we have done on crowd modeling and simulation for the past few years. Specifically, two pieces of our recent work on data-driven agent behavior generation for crowd simulation will be discussed in details.

In the first approach, the problem of modeling crowd behaviors is formulated as a symbolic regression problem and the self-learning gene expression programming is utilized to solve the problem and automatically obtain behavioral rules that match the data. In the second approach, examples are extracted from videos to describe how pedestrians avoid collisions, which are clustered using hierarchical clustering algorithm with a novel distance function to find similar patterns. During the simulation, the perceived state of each agent is classified into one cluster using a neural network trained before the simulation. A sequence of velocity vectors, representing the agent's future motion, is then selected among the examples corresponding to the chosen cluster. Both approaches been tested on several real-world scenarios and compared with real-world pedestrian motion data both qualitatively and quantitatively.

Biography: *Wentong CAI is a Professor in the School of Computer Science and Engineering at Nanyang Technological University, Singapore. He received his Ph.D. in Computer Science from University of Exeter (UK) in 1991. His expertise is mainly in the areas of Modeling and Simulation (particularly, modeling and simulation of large-scale complex systems, and system support for distributed simulation and virtual environments) and Parallel and Distributed Computing (particularly, Cloud, Grid and Cluster computing). He has published extensively in these areas and has received a number of best paper awards at the international conferences for his research in distributed simulation. He is an associate editor of the ACM Transactions on Modelling and Computer Simulation (TOMACS), the Journal of Simulation (JOS), and an editor of the Future Generation Computer Systems (FGCS). He has chaired a number of international conferences. Most recent ones include: 2017 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation (SIGSIM PADS 2017), 2016 International ICST Conference on Simulation Tools and Techniques (SIMUTools 2016), 2015 IEEE/ACM Symposium on Distributed Simulation and Real Time Applications (DS-RT 2015), and 2014 IEEE International Conference on Cloud Computing Technology and Science (CloudCom 2014). His recent research is concerned with using Agent-based Modeling and Simulation to understand the effect of individual behavior on system-level dynamics and to develop decision support systems for planning and tactical operations.*

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