January 2019 Complexity Community Talks

Date: 29 Jan 2019 (Tue)
Time: 11:00 AM – 1:00 PM
Venue: Complexity Institute,
Nanyang Technological University

Talk 1 : Dynamics, Emergent Computation, and Evolution in Cellular Automata

Many systems in nature produce complicated patterns that emerge from local interactions of simple individual components that live in some spatially extended world, without the existence of a central control. Examples of emergent pattern formation in such decentralized spatially extended systems include spiral waves in aggregating amoebae, the foraging paths of social insects, and synchronized oscillations in the brain. Often, these emergent patterns give rise to some form of globally coordinated behaviour, or global information processing. For example, amoebae decide when and where to aggregate to reproduce, an ant colony decides what the shortest path is to some food source, and the brain classifies sensory inputs.

This global information processing in decentralized spatially extended systems, mediated by emergent pattern formation, is known as emergent computation. However, there is still little understanding of how the dynamics (i.e., the pattern forming behaviour) of these systems gives rise to emergent computation, or how such systems and their behaviors and (emergent) computational abilities have evolved.

In this talk, I will give an overview of the Evolving Cellular Automata (EvCA) project, which provides a framework for studying the relations among dynamics, emergent computation, and evolution in decentralized spatially extended systems. In the project, a genetic algorithm (a simple model of an evolutionary process) is used to evolve cellular automata (simple models of decentralized spatially extended systems) to perform certain computational tasks that require global information processing. The results of this research project provide significant insights into emergent computation and its evolution.

Speaker: Dr. Wim Hordijk
Independent & Interdisciplinary Scientist

Wim Hordijk is an independent and interdisciplinary scientist interested in the origin and evolution of life. After spending several formative years as a graduate fellow at the Santa Fe Institute and earning a PhD in computer science from the University of New Mexico, USA, he has worked on many research and computing projects at different universities and research institutes all over the world. A wandering scientist by choice, he has collaborated with biologists, physicists, mathematicians, computer scientists, chemists, and even an archaeologist. He recently held a research fellowship at the Institute for Advanced Studies, University of Amsterdam, Netherlands.

Wim is also an enthusiastic popular science writer with contributions to The Scientist, Plus magazine, TVOL etc. You can follow his research and writings on Twitter (@WanderingWim) or his personal website at www.WorldWideWanderings.net

Talk 2 : What Do We Know About Criticality on Social Systems?

In this talk, I will speak about the previous literature concerning the studies of criticality over social systems. The goal is to review the state of the art on this subject. Rigorously speaking, criticality occurs under specific conditions on phenomena on physics; then, the several definitions involved require being carefully handled. The idea is to revise definitions, physics-social counterparts, and previous models, among others. In general, the aim is to explore the extent of the frontiers of Physics in the border with social-related problems.

Speaker: Dr. Yerali Gandica
Scientific Collaborator
Center for Research in Finance and Management (CeReFiM), University of Namur

Yerali got her PhD in Physics from the Venezuelan Institute for Research (IVIC). With more than six years of experience in research among four Postdoctoral positions in Europe, she also has a second background on Sociology. She has broad experience working in computational social science, Big Data and network science among several interdisciplinary groups.

Yerali's main interest in research lies in the application of statistical and Critical Phenomena approaches to emergent social phenomena. More recently, she is working with high dimensionality reduction, and clustering methods, both of which are methodologies of unsupervised learning.

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(Lunch will be provided.)

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