NERCCS 2020

Keynote Speakers

Keynote speaker 1: 9:45am, Thursday April 2, room 1220

Kerstin Dautenhahn
Canada 150 Research Chair in Intelligent Robots
Departments of Electrical and Computer Engineering
and Systems Design Engineering
University of Waterloo

Social Robots - Past, Present and Future

Social robotics and human-robot interaction are related research fields that focus on robots that do not only provide useful tasks but behave socially. In many application areas social interaction with people can be essential to how users, and society at large, much or might not accept such technology. Application areas of social robots include co-workers in industrial settings, robot companions and assistants in care homes or hospitals, robots being used as tutors in schools, or robots being used as tools in therapy and education. In these contexts, success is measured in terms of human-robot task performance but importantly, measured in terms of trust towards and acceptance of robots. I will survey some research that I have been involved in over the past few years, and outline some challenges for future work.

Keynote speaker 2: 2pm, Thursday April 2, room 1220

Marianthi Markatou
Associate Chair of Research and Healthcare Informatics
Department of Biostatistics, School of Public Health &
Health Professions; and CDSE Program
University at Buffalo, SUNY

Evidence and Uncertainty for Complex Health Interventions in Complex Health Systems

The 2030 United Nations (UN) Agenda for Sustainable Development recognizes that the concept of optimal health goes beyond survival, to include human rights, equity and empowerment of vulnerable populations. The UN agenda demands strategies to address underlying causes of ill health and in- equality to achieve sustained improvements in health.

Current processes for developing evidence in healthcare encompass methods for its generation, retrieval, synthesis and appraisal, offering answers to questions related to efficacy and safety of medical and public health interventions, as well as their effectiveness. However, to address questions relevant to optimal ways of healthcare delivery, investigators use ill-adapted methods to formulating recommendations. These methods were originally developed to address comparative eff effectiveness of interventions, and do not give adequate consideration to relevant aspects of complexity.

In this talk, we will discuss the key ideas of evidence and associated un- certainty in evidence generation in the healthcare context. What is complexity and at what levels is relevant in healthcare? What is the impact of complexity and uncertainty on the generation, quality and reproducibility of evidence? We attempt to answer these questions and further, we discuss the need to move from association to causality using case studies from the study of the liver and the microbiome.

Keynote speaker 3: 9:45am, Friday April 3, room 2220

Eugene Stanley
William Fairfield Warren Distinguished Professor
Departments of Physics, Chemistry, Biomedical Engineering, Boston University; Department of Physiology, Boston University School of Medicine

Using Statistical Physics Concepts to Offer Insights into Economic Questions

A physicist might view the economy as a collection of interacting units. This collection is very complex; everything depends on everything else. The interesting problem is: how does everything depend on everything else? Physicists are looking for laws that will help us to describe and to understand these complex interactions.

To a physicist, the most interesting thing about economics is that it is dominated by fluctuations in quantities of economic interest. Because big economic shocks affect the economy around the world, the possibility of an economic "meltdown" is one that we must take seriously. Big changes in big money affect not only people with large amounts of it, but also those who have very little of it—-those on the margins of society.

Finding ideas that serve to address economic problems can potentially help in making progress on unsolved physics problems. A good example is turbulence. If we take a bucket of water and disturb the surface, energy is added to the system on a big scale. This energy then dissipates over progressively smaller scales. This is an unsolved physics problem; many empirical facts can be stated, but there is incomplete understanding. The economy is analogous to this example of turbulence. One can add information on a big scale to an economic system—e.g., the news of who wins a presidential election—and that information is dissipated on smaller and smaller scales. The way that you handle the "turbulence" associated with this dissipation of information in a financial market may help us understand how to approach turbulence in our physics research.

Invited Speakers

Invited speaker 1: 9:15am, Thursday April 2, room 1220

Kenny Joseph
Assistant Professor
Department of Computer Science and Engineering
University at Buffalo, SUNY

The Complex Nature of Bias

Scholars have produced significant evidence regarding the dangers of biased and/or unfair algorithms. For example, biased algorithms have been shown to create racial disparities in the allocation of healthcare resources and rates of imprisonment during pre-trial arraignment. However, algorithms are only one part of a broader, complex sociotechnical system in which a multitude of biases are encoded, spread, and reified through action. Within this framework, significant open questions remain as to the importance of biases in algorithms relative to other institutionalized forms of bias, how different kinds of bias originate within these complex systems, and what, if anything, can be done to mitigate unwanted biases. In this talk, I will use specific examples from ongoing work in two very different contexts---racial homogomy in online dating, and how government-funded services are allocated to foster youth--- to illustrate these outstanding questions in the study of algorithmic bias, and to show progress we have made in addressing them.

Invited speaker 2: 1:30pm, Thursday April 2, room 1220

Sucheta Soundarajan
Assistant Professor
Department of Electrical Engineering and Computer Science
Syracuse University

The Fairness of Information Flow in Social Networks

Social networks play a vital role in the spread of information through a population, and individuals in networks make important life decisions on the basis of the information to which they have access. In many cases, it is important to evaluate whether information is spreading fairly to all groups in a network. For instance, are male and female students equally likely to hear about a new scholarship?

In this talk, I present the novel "information unfairness" criterion, which measures whether information spreads fairly to all groups in a network. I discuss the results of a case study on the DBLP computer science co-authorship network with respect to gender, with several surprising results.

Invited speaker 3: 9:15am, Friday April 3, room 2220

Saray Shai
Assistant Professor
Department of Mathematics and Computer Science
Wesleyan University

Percolation-based Network Algorithms for Destroying/Protecting Modular Networks

The flexibility of percolation theory combined with modern data analysis techniques has found many applications in the design of efficient network algorithms. Some examples include algorithms to protect/destroy network connectivity, immunize populations against a disease and identify influential spreaders. The percolation properties of a given network depend on its structure, and modular networks are of particular interest as many empirical networks naturally partition into relatively dense modules (or communities). We analyze various models of modular networks and their behavior under different node removal/addition algorithms such as random node removal and an attack on the interconnected nodes between the modules. We discuss the implications of modularity on network resilience both at a global (entire network) and meso- (each module) scale.

Invited speaker 4: 1:30pm, Friday April 3, room 2220

Winnie Chen
Assistant Professor
Department of Industrial and Systems Engineering
University at Buffalo, SUNY

Title
Abstract – TBD

Invited speaker 5: 2:00pm, Friday April 3, room 2220

Nishant Malik
Assistant Professor
Department of Mathematical Sciences
Rochester Institute of Technology

Uncovering Dynamical Transitions in Paleoclimate Time Series

The theory of dynamical systems is one of the chief mathematical techniques in climate modeling; however, it is not the most widely accepted technique in paleoclimate data analysis. The main hurdle has been the unique intricacies of the paleoclimate time series, as they are among the most challenging to analyze due to the shortness of the series, uneven sampling, presence of noise, and various levels of uncertainties in estimates. We present an approach that employs a nonlinear dynamics-based data analysis tool known as a recurrence plot, and we integrate it with manifold learning and fisher information metric. The resulting technique is very robust and can carry-out several different time series analysis tasks, even when the series is short and has high levels of noise and missing values present in it. Using several paradigmatic numerical examples, we illustrate the fitness of our approach in classifying distinct dynamical regimes in a paleoclimate time series, a significant problem in paleoclimate analysis. Specifically, we present our analysis of the paleoclimate series from South Asia covering the Holocene period and explore the role of climate change in the demise of the Indus Valley Civilization.

Invited speaker 6: 2:30pm, Friday April 3, room 2220

Irina Benedyk
Assistant Professor
Department of Civil, Structural and Environmental Engineering
University at Buffalo, SUNY

Cooperative Arrangements in Intermodal Transportation: Who pay for these decisions?

Competition or cooperation? Whatever area of human interaction is considered, the logical answer is the later, but observed behavior often is the former… This study uses a game theoretic framework that models competitive behaviors of two types of agents (maritime carriers and intermodal terminals), to understand how carriers and terminals can enhance their efficiency through four cooperative arrangements (incentives, alliances, change of scope, and collective actions). The analysis of agents' behavioral responses on cooperative arrangements, and how these behavior responses impact us, transportation service final users, will be discussed.