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ABSTRACTS

Susie Bayarri, University of Valencia

Managing uncertainties in traffic networks

CORSIMS is a frequently used stochastic microsimulator of highway and street traffic. It simulates de behavior of each single vehicle (agent) and its interactions with other vehicles as it travels through the network. It has a number of uncertain inputs which are usually replaced by fixed values (estimates, tuned, guesses, default values, etc.) and hence uncertainty is not taken into account. A Bayesian solution consists of feeding CORSIMS with simulated values from the (joint) posterior distribution of the inputs thus producing distributions on the outputs reflecting the inherent uncertainty in the problem. Moreover, the Bayesian model can also handle in a natural way the substantial error in the observations as well as missing counts. CORSIMS runs time precludes direct MCMC computations. We use a stochastic network that mimics the probability structure of key inputs to carry out the required MCMC runs.

This is joint work with Jim Berger and German Molina.

Georgiy Bobashev, RTI International

A Hybrid Epidemic Model: Combining the Advantages of Agent-based and Equation-based Approaches

Agent-based models (ABMs) are powerful in describing structured epidemiological processes involving human behavior and local interaction. The joint behavior of the agents can be very complex and tracking the behavior requires a disciplined approach. At the same time, equation-based models (EBMs) can be more tractable and allow for at least partial analytical insight. EBMs however, can inadequately represent the details of the population structure. Lack of such details can lead to spurious results. I propose a novel approach that combines the two modeling paradigms and introduces a hybrid model that starts as agent-based and switches to equation-based after the conditions for the large number approximation are met. This hybrid model can dramatically save computational times and, more fundamentally, allows for the mathematical analysis of emerging structures generated by the ABM. I also present the conditions under which an ABM could be collapsed into an equivalent EBM, and discuss the role of the population size, law of large numbers and number of replications necessary for obtaining average values.

Elizabeth Groff, Temple University

Agent-based Models in Criminology and Criminal Justice

The use of agent-based models (ABM) in criminology and criminal justice is growing rapidly. This growth is due to the important role that ABMs can play in elaborating on theory and exploring the mechanisms underlying crime patterns. However, there are significant challenges and obstacles to using ABM and those are discussed.

Thomas Lucas, Naval Postgraduate School

Agent-based Models in the Department of Defense: Motivation, History, and Applications

The United States Department of Defense (DoD) extensively uses models to help decision makers determine how best to equip, organize, train, and employ forces. One class of models that has been gaining increased usage is agent-based simulation (ABS). However, their use remains quite controversial. This talk discusses the origins of DoD's interest in ABS and some of the issues being debated about their utility. We also review some of the applications, modeling environments, and design of experiments research done within the Simulation Experiments and Efficient Designs(SEED) Center for Data Farming at the Naval Postgraduate School with ABS.
(see: http://harvest.nps.edu)

James Moody, Duke University

Simulating Social Networks: Agent based models in Sociology

Abstract: This presentation provides a brief overview of recent work using Agent based models in sociology. The talk then turns to the challenges (and rewards!) of using ABMs to analyze dynamic social networks.

David Wagner, University of Waterloo

Agent-based models and interacting particle systems

Interacting particle systems are a class of models of phenomena in non-equilibrium statistical mechanics. They are agent-based models with some additional restrictions, but they are quite general and not very well-understood. I'll sketch some of their theory, with emphasis on issues relevant to the quantitative analysis of agent-based simulations, especially the identification of dynamical phase transitions.