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Automated Analysis and Verification of Probabilistic Recursive Models

Recursive Markov Chains (RMCs), Recursive Markov Decision Processes (RMDPs), and Recursive Stochastic Games (RSGs), are finitely presented countable-state stochastic models that combine probabilistic and controlled/game behavior with recursion. They are natural abstract models of probabilistic procedural programs and other systems, and a number of well-studied infinite-state stochastic models are in a precise sense subsumed by them.

I will describe these models, survey algorithms for their analysis and model checking problems, and describe what we currently know about the computational complexity of key problems. Key algorithmic problems associated with these models boil down to computing least fixed point solution values for monotone systems of nonlinear (min-max) algebraic equations. These values can be irrational, and many numerical and symbolic techniques come into play for computing/approximating them efficiently. Several numerical algorithms have been implemented in a tool called PReMo, and show promising results, but many intriguing questions remain.

This talk describes joint work with Mihalis Yannakakis (Columbia University), and Dominik Wojtczak (University of Edinburgh).

Andrew Ireland

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Automated Software Verification - A Renaissance

The goal of developing software that can be formally verified as correct with respect to its intended behaviour has a long and distinguished history, dating back over fifty years. Much has been achieved, but what has remained elusive are scalable verification tools that can deal with the complexities of software systems. However, times are changing, as reflected in what could be called a renaissance within the formal software verification community. My talk will focus on automated reasoning aspects of software verification. In particular, I will argue for the benefits that can be achieved if complementary reasoning techniques are combined cooperatively. As evidence for my argument I will draw upon a past industrial oriented project. Some new research projects will also be highlighted together with research challenges.