

Computational Techniques for Stochastic Reachability

Dr Kendra Lesser

Department of Computer Science, University of Oxford

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Abstract:

The focus of this talk is on safety verification and controller synthesis for stochastic systems, which can be addressed in the framework of stochastic reachability analysis. There are, however, some serious limitations in the applicability of reachability analysis to higher dimensional systems and systems that are partially observable. To address these issues, I will first discuss some alternative methods for computing stochastic reachable sets that are better suited to higher dimensional systems. I will then show how stochastic reachable sets can be used to solve motion planning problems in the presence of hundreds of stochastically moving obstacles. The rest of the talk will be concerned with partially observable systems, in which controllers must be constructed to satisfy safety specifications using only a stochastic observation process. I will show how abstraction techniques from the verification community can be combined with approximation algorithms for optimal control of partially observable Markov decision processes (POMDPs) to generate control laws that guarantee safety specifications are satisfied with maximum probability.