

Probabilistic Verification of Concurrent Autonomous Systems

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Modern computing systems increasingly involve autonomous agents acting concurrently, which may either compete or collaborate to achieve their own objectives. Designing these systems is a challenge, particularly when they need to operate in uncertain or adversarial environments. Probabilistic model checking is a technique for formal modelling and analysis of such systems. Given a quantitative correctness specification expressed in temporal logic, it can either verify that the system behaves as intended, or synthesise a controller which guarantees that this will be the case.

This tutorial explains some of the recent advances in this area, with a particular focus on the use of stochastic games to verify multi-agent systems. This includes concurrent stochastic games, for more realistic modelling of agents acting concurrently, and Nash equilibria, for more expressive specification of agents with differing objectives. We summarise the key underlying theory and algorithms, and illustrate the applicability of the techniques with examples from a range of applications.