

MEAN FIELD APPROXIMATION MEETS STOCHASTIC MODEL CHECKING

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Mean field approximation techniques are well established approaches to analyse large-scale stochastic processes, especially population Markov models. Some years ago, they have entered the arena of quantitative formal methods, and they provided a consistent way to define fluid semantics for stochastic process algebras (formal languages that can be used to describe population Markov models, and more generally continuous time Markov chains, in terms of interacting agents, and reason algebraically about them).

Here, we will discuss how mean field approximation can play a role in another successful area of quantitative formal methods, namely stochastic model checking. In particular, we will focus on a subclass of Continuous Stochastic Logic (CSL), considering formulae that expresses properties of single agents in a population model, and we will present an approximate model checking algorithm based on mean field approximation. We will also discuss model checking CSL formulae against time-inhomogeneous CTMC models, as this turns out to be the core procedure needed for fluid approximation. Finally, we will consider a class of global properties that can be analysed by linear noise approximation, a higher order fluid approximation.