SAT-based Techniques for Reactive Synthesis

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ECEE 1B55
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3:00 p.m. to 4:00 p.m.

Two-player games are a useful formalism for the synthesis of reactive systems. The traditional approach to solving such games iteratively computes the set of winning states for one of the players. This requires keeping track of all discovered winning states and can lead to space explosion even when using efficient symbolic representations. I will present a new game solving method that works by exploring a subset of all possible concrete runs of the game and proving that these runs can be generalised into a winning strategy on behalf of one of the players. We use counterexample-guided backtracking search, inspired by the RaReQs QBF solver, to identify a subset of runs that are sufficient to consider to solve the game. Our search procedure performs learning from both players' failures, gradually shrinking winning regions for both players. In addition, it allows extracting compact winning/spoiling strategies using interpolation procedures. We evaluate our algorithm on several families of benchmarks derived from real-world device driver synthesis problems. Our approach outperforms state-of-the-art BDD solvers on some families of benchmarks. We demonstrated that our strategy extraction procedure is efficient and introduces low overhead on top of the main solver.

Nina Narodytska is a visiting researcher in the Carnegie Mellon University School of Computer Science. She received her PhD from the University of New South Wales in 2011. Nina works on developing efficient algorithms for decision and optimization problems. She was named one of "AI's 10 to Watch" young researches in the field of AI. She also received an Outstanding Paper Award at AAAI 2011 and an outstanding program committee member award at the Australasian Joint Conference on Artificial Intelligence 2012. Her EvaMaxSAT Solver is a winner of the Ninth Evaluation of Max-SAT Solvers in 2014.
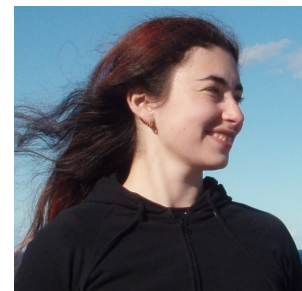
Hosted by Pavol Cerny (pavol.cerny@colorado.edu).

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