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PRESENTS

Search-based Planning for High-dimensional Robotic Systems

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Abstract: Search-based Planning refers to planning by constructing a graph from systematic discretization of the state- and action-space of a robot and then employing a heuristic search to find an optimal path from the start to the goal vertex in this graph. This paradigm works well for low-dimensional robotic systems such as mobile robots and provides rigorous guarantees on solution quality. However, when it comes to planning for higher-dimensional robotic systems such as mobile manipulators, humanoids and vehicles driving at high-speed, Search-based Planning has been typically thought of as infeasible. In this talk, I will describe the research that my group has done into changing this thinking. In particular, I will describe how Search-based Planning can work for high-dimensional robotic systems based on two main principles: (a) finding a solution of bounded sub-optimality is dramatically more scalable than finding a provably optimal solution, and (b) planning for complex high-dimensional robotic systems can often be decomposed into several lower-dimensional planning problems, solutions to which can effectively guide the overall planning process. I will present several algorithms that utilize these principles and their applications to a range of physical high-dimensional robotic systems.

Bio: Maxim Likhachev is an Associate Professor at Carnegie Mellon University, directing Search-based Planning Laboratory (SBPL). His group researches heuristic search, decision-making and planning algorithms, all with applications to the control of robotic systems including unmanned ground and aerial vehicles, mobile manipulation platforms, humanoids and multi-robot systems. Maxim obtained his Ph.D. in Computer Science from Carnegie Mellon University with a thesis called “Search-based Planning for Large Dynamic Environments.” Maxim has over 120 publications in top journals and conferences on AI and Robotics and numerous awards. His work on Anytime D* algorithm, an anytime planning algorithm for dynamic environments, has been awarded the title of Influential 10-year Paper at International Conference on Automated Planning and Scheduling (ICAPS) 2017, the top venue for research on planning and scheduling. Other awards include selection for 2010 DARPA Computer Science Study Panel that recognizes promising faculty in Computer Science, Best RSS paper award, being on a team that won 2007 DARPA Urban Challenge and on a team that won the Gold Edison award in 2013, and a number of other awards.

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