Balancing Exploration and Exploitation in Sampling-Based Motion Planning

Abstract:
We present the exploring/exploiting tree (EET) algorithm for motion planning. The EET planner deliberately trades probabilistic completeness for computational efficiency. This tradeoff enables the EET planner to outperform state-of-the-art sampling-based planners by up to three orders of magnitude. We show that these considerable speedups apply for a variety of challenging real-world motion planning problems. The performance improvements are achieved by leveraging work space information to continuously adjust the sampling behavior of the planner. When the available information captures the planning problem's inherent structure, the planner's sampler becomes increasingly exploitative. When the available information is less accurate, the planner automatically compensates by increasing local configuration space exploration. We show that active balancing of exploration and exploitation based on workspace information can be a key ingredient to enabling highly efficient motion planning in practical scenarios.