Path Planning Analysis

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Abstract

Probabilistic Roadmaps (PRM) [1] is an algorithm for finding a collision-free path in a known environment. It works by sampling possible configurations q_i of the robot in the configuration space, C, and making connections between "near" configurations with a local planner (i.e. straight lines of bounded length). A recent result by Ladd and Kavraki [2] shows that this process finds a path with high probability (which was already known) but does so with no assumptions about metrics in the space, and the bound only depends on the probability distribution and not the dimensionality of the space. This work simplifies and improves several previous confusing results.

The algorithm and idea of the analysis are simple and easy to understand. However, the generality for which the analysis is done, makes this algorithm and its analysis applicable to a much wider array of geometric and topological problems. Thus, I will present first the algorithm and the idea of its analysis. I will then present some of the formalism behind the analysis, hopefully give additional insight into its broader applications.

References

[1] L. E. Kavraki, P. Svestka, J.-C. Latombe, and M. Overmars. Probabilistic Roadmaps for Path Planning in High Dimensional Configuration Spaces. *IEEE International Transactions on Robotics and Automation*, 12(4):566–580, June 1996.

[2] Andrew M. Ladd and Lydia E. Kavraki. Analysis of Probabilistic Roadmap Methods for Path Planning. *Transactions of Robotics and Automation*, 20(2):229–242, April 2004.