Doctoral Thesis Defense Announcement:

Online Trajectory Planning Algorithms for Robotic Systems under Uncertainty in Interactive Environments

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Thursday, July 22nd, 2021 at 10:00AM (PDT)

Zoom link: https://stanford.zoom.us/j/98937906287?pwd=ZEpGdnh3VkRTWXBFWTRNRkp6eUxFUT09

Meeting ID: 989 3790 6287, Passcode: 699988

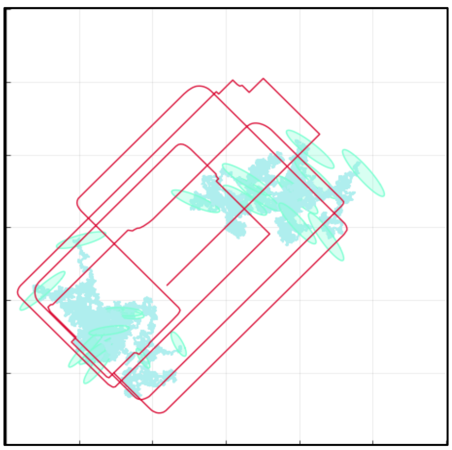

Figure 1 (Left) A robot's trajectory generated by our active sensing method to autonomously survey a simulated open field in 2D and reduce environmental uncertainty. (Right) A ground robot autonomously navigating alongside human pedestrians while evaluating and minimizing the risk of collisions in real time.

Recent advances in perception, planning, and control have enabled mobile robots to perform complex human-level tasks in many industrial domains. However, most of the robots still lack the capability to consider and address *uncertainty*, which demands that they be caged or confined to a dedicated, structured workspace. To enable reliable autonomy for "cage-free" robotic operations, this thesis will present computationally efficient algorithms for trajectory planning that can collectively overcome environmental and dynamic uncertainties existing in open, interactive environments. Our approach leverages probability theory and optionally machine learning to quantify the amount of present and future uncertainty. Based on the quantification, we develop online methods for model-based planning and control that either mitigate, avoid the risk of, or are robust against uncertainty to successfully accomplish a given task. Relevant tasks include active perception, Bayesian reinforcement learning for mobile manipulation, and safe autonomous navigation in human crowds. The methods presented in this thesis will ultimately allow intelligent mobile robots to operate in considerably more uncertain and dynamic workspaces than the current industrial standard. This will open up possibilities for various practical applications, including autonomous field robots for persistent environmental monitoring, fully automated driving on urban roads, and autonomous drone flights in densely populated areas for logistics services.