

**Lantao Liu**

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Geology GY S-201

## From Single-Robot Planning to Multi-Robot Collective Decision-Making

**Abstract:** Effectively understanding the surrounding environment and efficiently interacting with it are important functions for autonomous systems, where in a broad sense the unstructured environment consists of not only static objects but also dynamic things such as winds, water flows, and other robot teammates. The non-static environment also indicates that the underlying environmental model can be time-variant, with possibly high uncertainty in both spatial and temporal dimensions. In this talk, I will first introduce a decision-making framework called time-varying Markov Decision Process, which can be used to cope with robot's time-varying action uncertainty caused by dynamic disturbances (e.g., turbulences in water, air). Then I am going to describe a data-driven planning and learning method for long-term environment sensing and monitoring, where I use techniques of Gaussian Processes, information theory and Bayesian inference to navigate the robot to explore unknown habitats and collect data with maximal information. After that, I will discuss a cooperative stochastic planning framework for multi-robot systems. This coordination method takes advantage of a classic optimal assignment problem, and re-interprets the underlying matching mechanism so that it is used to decouple and approximate the original computational prohibitive stochastic problem. Experimental and simulation results on both underwater and aerial vehicles will be included in this talk.

**Biography:** Dr. Lantao Liu is a Postdoctoral Scholar - Research Associate in the Department of Computer Science at the University of Southern California. Before his research experience at USC, Dr. Liu worked as a Postdoctoral Fellow in the Robotics Institute at Carnegie Mellon University. He received a Ph.D. from the Department of Computer Science and Engineering at Texas A&M University in 2013, and a Bachelor degree from the Department of Automatic Control at Beijing Institute of Technology in 2007. Dr. Liu's research interests include planning, decision-making, and applied machine learning methods for autonomous robotic systems, as well as distributed or decentralized coordination approaches for multi-robot or swarm systems.

