

## Ph.D. Defense Announcement

# Towards Environment-aware Field Robotic Assistants: Adaptive Locomotion on Mud, and Cognitively-compatible Scientific Explorations

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**Date:** Monday, February 2nd, 2026

**Time:** 10:00 AM – 12:00 PM

**Location:** EEB 110

**Zoom Link:** <https://usc.zoom.us/j/96743401995?pwd=dyjAg0kQqfzXIH7gl3rFJDp9eEQHXQ.1>

**Committee:** Prof. Feifei Qian (Chair), Prof. Maja Mataric, Prof. Bhaskar Krishnamachari, Prof. Priyadarshini Panda, Prof. Erdem Biyik

**Abstract:** Robotic field exploration offers immense potential for scientific discovery, yet current systems struggle with reliable mobility on deformable terrains and lack cognitive alignment with human scientists. The goal of this thesis is to transform robots from passive sensor platforms into adaptive exploration teammates capable of both physical navigation and cognitive collaboration. This work develops physics-based models and proprioceptive sensing frameworks that enable legged robots to estimate terrain properties and adapt locomotion on deformable substrates, preventing entrapment and improving mobility. In addition, this thesis investigates human decision-making processes to create cognitively-compatible human-robot teaming frameworks. By encoding expert sampling strategies into multi-objective balancing algorithms, we enable robots to generate sampling suggestions that align with human scientific reasoning. These contributions are integrated into a heterogeneous multi-robot system, where legged scouts generate terrain-risk maps to guide wheeled rovers and science-reward maps to guide human scientists. Together, these advances in terrain-aware locomotion and human-robot teaming establish a comprehensive framework for safe, effective, and scientifically productive exploration in extreme environments.

### Biography:



**Shipeng Liu** received the Bachelor's degree in Electrical and Computer Engineering from Tongji University, China, in 2020 and the M.S. degree in Electrical and Computer Engineering from the University of Southern California, U.S., in 2025. He is currently pursuing a Ph.D. degree in the Ming Hsieh Department of Electrical and Computer Engineering at the University of Southern California, Los Angeles, CA, USA. His research interests focus on Machine Learning and Robotics, with a specific focus on enhancing sensing, locomotion, and navigation, as well as human-robot collaboration.