

The mission of the HEATlab is to create new techniques for human-robot teaming—the flexible navigation and coordination of complex, inter-related activities in shared spaces. We focus on using ideas from AI to automate the scheduling and coordination of multiple agents, including humans, computational agents, and robots (embodied agents). We are particularly motivated by the challenge of coordinating the activities of human-robot teams in environments that require explicit cooperation to be successful. Our goal is to create human-robot teams exploit the relative strengths of humans and agents to accomplish what neither can achieve alone.



Learn more by reading the recent feature in PC Magazine about the lab: <https://tinyurl.com/HEATlab-PCMAG>

This summer we will pursue two exciting new research directions!

Creating more robust human-robot teams: When robots team up with humans, we want to give human teammates as many possibilities as we can for completing their activities. However, measuring the number and quality of the possibilities that exist is actually very difficult! In this project, we will:

- Build on geometric interpretations of temporal plans as n-dimensional polyhedra to further explore and gain insights into scheduling situations that involve uncertainty, preference, or choice (e.g., due to interactions with a human teammate);
- Extend or adapt existing temporal plan quality metrics to handle scheduling situations that involved uncertainty, preferences, or choice;
- Develop new algorithms that can optimize for our new geometry-inspired metrics of plan quality; and
- **Stretch goal:** Design new tools for visualizing probabilistic and disjunctive temporal plans.

Creating more intuitive robot teammates: How can we adapt existing temporal planning models and methods to be more amenable to the ways that humans actually execute tasks in teamwork settings? In this project, we will:

- Review existing literature in temporal reasoning for representing the preferences and tendencies of humans;
- Explore how explainable, predictable/transparent, and legible current scheduling methods are for human teammates;
- Augment existing or develop new problems representations that capture the novel ways that humans introduce uncertainty and contingency into scheduling scenarios;
- Develop new algorithms that are responsive to the novel sources of uncertainty for capturing the types of uncertainty that humans introduce to team activities; and
- **Stretch goal:** Evaluate our new and existing approaches for on multi-robot / human-robot close collaborative tasks.

Useful Skills/Interests: artificial intelligence, algorithm design, probability, geometry, cognitive science, info visualization.

Before applying, please check out our past papers:

- Publications: <https://heatlab.org/#publications>
- Working Drafts (papers from last summer's projects): <https://tinyurl.com/HEATlab-drafts>

Learn More: <http://www.heatlab.org/>

Apply at: <https://www.cs.hmc.edu/research/>

