Continuous Task Execution for a Heterogeneous Multi-Robot Team

Robotics research has progressed over the years, in areas such as mechanical design, controls, manipulation, and perception. Robots are also increasingly used in many domains, for example in manufacturing, mining and farming. However, many robots are tele-operated or semi-autonomous, i.e., there is a human controlling the robot’s actions to some extent. Such an approach is not scalable – in large, complex tasks, a one-to-one ratio of robots to humans will require a large team of human controllers and engineers.

One approach is to use teams of autonomous robots. Multi-robot teams offer many advantages over a single-robot system, such as robustness, autonomous coordination, and distributed perception and manipulation on the environment. If one of the robots fails (e.g., the hardware malfunctions), the other robots can adapt and continue performing the task. A multi-robot team is capable of autonomously coordinating to perform a complex task, and as sub-tasks are completed or new objectives are given, the multi-robot team autonomously reallocates the sub-tasks without human intervention. A multi-robot team can be spatially distributed – robots are at different physical locations at any point in time. As such, multiple perspectives of the environment are possible, and the robots can manipulate multiple objects located at different places at the same time.

This research investigates how complex tasks are autonomously distributed and executed among a heterogeneous multi-robot team, leveraging on synergy between the different robots (i.e., their sensors and actuators). Aspects to be considered include:

1. Ensuring the task is continuously executed, even as some robots are recharging or undergoing maintenance;
2. Minimizing the overall energy usage of the multi-robot team;
3. Learning and exploiting the synergy of the heterogeneous robots.

Relevant Publications

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