

MSc. Project Proposal

Title: Human-swarm interaction and control

Brief description: How can a person control a large team of robots to efficiently and intuitively perform a complex task? This is a dimensionality reduction problem. The goal of this project is to develop control algorithms with dimensionality reduction that automatically transform high level commands from the operator into individual motion or tasks for each robot. The method should be able to reduce the cognitive load of the operator when performing a task with a large team of robots. A tangible result of this project could be an interactive volumetric display formed by several drones.

Related video from past work: <https://youtu.be/ZOmwXJFCTwY>

Collaboration: For outstanding students there is the possibility of an internship at Disney Research Zurich during summer 2017. The Advanced Interaction Technologies lab of ETH Zurich will be a partner.

Desired qualities:

- Motivated and independent
- Good problem solving skills
- Experience/interest in motion planning, model predictive control and/or formal methods
- Experience in C++ programming and Robot Operating System (ROS)
- Experience with aerial vehicles (drones)

To apply please send me an email with:

- Why are you interested in this project? What would you like to achieve?
- What is your experience relevant to this project? This could be past projects, past courses; theoretical knowledge or practical experience, related to constrained optimization, planning and/or robotics.
- When would you like to start and which courses will you have left by then?
- Is your motivation to do algorithmic work or applied research?
- Your transcript of record with past courses.
- Available day/times to meet within one/two weeks.

References:

- [1] J. Alonso-Mora, M. Schoch, A. Breitenmoser, R. Siegwart, and P. Beardsley, "Object and animation display with multiple aerial vehicles," presented at the Intelligent Robots and Systems (IROS), 2012 IEEE/RSJ International Conference on, 2012, pp. 1078–1083.
- [2] J. Alonso-Mora, S. Haegeli Lohaus, P. Leemann, R. Siegwart, and P. Beardsley, "Gesture Based Human - Multi-Robot Swarm Interaction and its Application to an Interactive Display," *IEEE Int. Conf. Robotics and Automation*, pp. 1–6, May 2015.
- [3] J. Alonso-Mora, E. Montijano, M. Schwager, and D. Rus, "Distributed Multi-Robot Navigation in Formation among Obstacles: A Geometric and Optimization Approach with Consensus," *IEEE International Conference on Robotics and Automation (ICRA)*, 2016.

You may also propose your own project.