ASU Robotics Seminar Course: CSE 591 Coordination and Control of Multi-Robot Systems

Time/Location: M,W 10:30am-11:45am (tentative)

Instructor:
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O: TBD

Course Description and Expected Learning Outcomes: Multi-robot systems are becoming more pervasive; from future self-driving car teams, to fleets of delivery drones, to factory robots working together to build the cars we drive and the planes that we fly in. Multi-robot systems hold the potential to revolutionize transportation, services, and manufacturing across the globe. As a result, the question of how to control, coordinate, and secure these systems has been a growing topic in the robotics literature in recent years. In this seminar-style course we will do a deep dive into this topic by reviewing classic and recent results in multi-agent planning and control literature. We will cover a wide range of applications from control of groups of flying drones, to decision making in self-driving car networks, to space exploring CubeSats.

Students will develop skills in evaluating and critiquing research papers, will develop their technical presentation abilities, and will prepare a final project. They can also expect to have a broad understanding of the field of multi-robot systems coordination and control.

Course Structure: This course will be highly interactive where students will be assigned a number of papers to review before the start of each lecture (16 weeks total). The instructor will present theory from these papers (16 lectures), students will present an in-depth overview of at least one paper during the semester (12 lectures) and will present their final project during the last two weeks of the class (4 lectures). For the final project each student will be expected to conduct a rigorous survey of the literature on a pre-determined topic area of interest and will be asked to write the results of this survey as well as their ideas of promising areas for future work, in the format of an IEEE conference paper. Topic areas for the final papers will be posted at the beginning of the semester. This will give students the opportunity to develop critical literary review skills and learn to identify gaps in the existing literature and high impact areas for future work.

Topics: This class will cover many topics such as multi-agent problems in (tentative):

- Consensus
- Formation control
• Coverage
• Sensor deployment
• Collision avoidance
• Cooperative mapping
• Security and adversarial agents
• Asynchronous versus synchronous parallel computation
• Coordination for CubeSats in space

**Prerequisites:** This course is a graduate-level seminar course. Undergraduates may be permitted with instructor permission. It will be assumed that students have a strong command of calculus and basic probability theory. An understanding of mathematical optimization methods is preferable.

**Grading:**

- Homework: 20%
- Pop quizzes: 10%
- In-class presentations: 30%
- Final project: 35%
- Participation: 5%

**Readings and Assignments:** Students will be expected to have read assigned conference and journal papers before the start of every class meeting. Homework assignments and pop-quizzes will test student's knowledge of the topic area before the start of class.

**Disclaimer:** The information above is tentative and subject to change.