EECS 598: Motion Planning
Winter 2021 Syllabus

Instructor:

Dmitry Berenson
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Office Hours: By appointment
Email: dmitryb [at] umich.edu

Time: Mon, Weds 3:00pm - 4:30pm

Location: Zoom

Course Website:
http://web.eecs.umich.edu/~dmitryb/courses/winter2021motionplanning/index.html

The instructor reserves the right to modify the course outline and policies mentioned in this syllabus at any time during the term.

Overview: Motion planning is the study of algorithms that reason about the movement of physical or virtual entities. These algorithms can be used to generate sequences of motions for many kinds of robots, robot teams, animated characters, and even molecules. This course will cover the major topics of motion planning including (but not limited to) planning for manipulation with robot arms and hands, mobile robot path planning with non-holonomic constraints, multi-robot path planning, high-dimensional sampling-based planning, and planning on constraint manifolds. Students will implement motion planning algorithms in open-source frameworks, read recent literature in the field, and complete a project that draws on the course material.

Prerequisites: Undergraduate Linear Algebra and significant programming experience.

Course Layout: This course will consist of reading, presenting, critiquing, and discussing papers, and implementing and presenting a final project employing the ideas covered in the class. Students will read a combination of chapters from textbooks and research papers. Students will take turns presenting and discussing the readings. Students will complete homeworks, paper reviews, a final project proposal, final project writeup, and final project presentation.

Lectures: Students are expected to attend all classes. It is essential that you carefully review any required reading before each class and be prepared to share your perspective. Class participation is essential.

Homework: Homework will be assigned throughout the semester. All homework will have a due date and no late homework will be accepted. **All homeworks must be done individually**.

Projects: The principles learned in class will be applied in final projects, involving either physical robots or simulation. Projects are open-ended but must involve a robot performing motion planning to accomplish a desired task. Students are encouraged to find an aspect of their research that involves motion planning and use that as the final project. The instructor will also provide final project ideas that students can choose from upon request. Individual projects are encouraged (to tailor to the individual's research) but group projects in teams of 2 or 3 are also allowed.

Presentations: Students will read and present research papers throughout the semester. The allocated time for presentations and the number of presentations will depend on the number of students in the class and will be decided during the course.

Course Schedule: The course schedule is available on the course website.

Grading:

In-Class **Participation***	10%
Research Paper Reviews	5%
Research Paper Presentations	10%
Homeworks	25%
Final Project Proposal	10%
Final Project Presentation	10%
Final Project Writeup	30%

*Attendance does NOT count toward participation credit. Participation is defined as asking/answering questions or making non-trivial comments in class during lecture, after presentations, and during paper discussion. Meaningful questions and answers on Piazza will also be counted toward participation credit.

Academic Integrity: All work submitted for credit must be your own. Plagiarism is cheating and will be dealt with accordingly. Review the college of Engineering's Honor Code here:
http://www.engin.umich.edu/college/academics/bulletin/rules

Student Disability Services: If you need course adaptations or accommodations because of a disability, or if you have medical information to share with the instructor, please make an appointment with your instructor within the first week of classes.

References:

- Steven M. LaValle, *Planning Algorithms*, Cambridge University Press, 2006.
- Jean-Claude Latombe, *Robot motion planning*. Springer, 1990.
- Choset, H., Lynch, K. M., Hutchinson, S., Kantor, G., Burgard, W., Kavraki, L. E., & Thrun, S. (2005). *Principles of robot motion: theory, algorithms, and implementations*. MIT press.
- B. Siciliano, L. Sciavicco, L., Villani, G. Oriolo, *Robotics: Modeling, Planning and Control*, Springer, 2009.