

ELLIIT Ph.D. Course:
Advanced Motion Planning and Control
—Introduction to Final Projects

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Projects

- ▶ The final part of the course will be devoted to projects (performed individually or in pairs).
- ▶ Extended theoretical and simulation-based study of selected algorithm(s) or implementation of a method on a suitable hardware platform.
- ▶ Experiments can, e.g., be performed using the Robot Operating System (ROS), the PythonRobotics Toolbox, or the Open Motion Planning Library (OMPL).
- ▶ Preferably related to your own research (possible conference paper).

Suggestions for Projects (1/3)

- ▶ Extend one of the implementation assignments from the course (e.g., lattice-based planner for more complex scenarios or integrate planning method with feedback control).
- ▶ Implement a complete motion-planning algorithm from the course on an appropriate hardware platform (e.g., ground vehicle or aerial vehicle), either with stationary or time-varying obstacles.
- ▶ Explore how motion planning and control could be combined with learning (for example, trade-off between exploration and utilization of already acquired information in reinforcement learning). Study articles and do evaluations in simulation or experiments.

Suggestions for Projects (2/3)

- ▶ Study motion planning under uncertainty and sensor-based inputs (see Part III in the book by LaValle). Evaluate a few algorithms in simulation.
- ▶ Explore methods for structured and efficient decomposition of, and subsequent search, in the free configuration space (see Chapter 6 in the book by LaValle on combinatorial methods).

Suggestions for Projects (3/3)

- ▶ Select a certain class of motion-planning algorithms and study the latest articles within the field to define state-of-the-art. Implement and evaluate some of the algorithms in simulation or experiments.
- ▶ Perform a project as a pre-study to the WASP project course this fall (e.g., planning and control for docking of surface vehicles under wind disturbances).
- ▶ Your own project ideas.
- ▶ Project idea from your own research.

Organization of Projects

- ▶ You are welcome to discuss project proposals with the course organizers.
- ▶ For projects related to your own research, discuss also with your supervisor.
- ▶ Submit a short project description including goals (1/3–1/2 page) to `bjorn.olofsson@liu.se` by April 30, 2021.
- ▶ The project should correspond to approximately 2 hp.
- ▶ All projects are presented orally at a seminar on May 28, 2021 at 13:15–15:30 in Zoom (approx. 15–20 minutes per project, including questions).
- ▶ A short written report from the project should be submitted by June 4, 2021 (could be written as a conference paper draft).

Examination

In order to receive course credits, the participant is required to:

- ▶ Attend the weekly meetings and actively take part in the discussions.
- ▶ Submit the hand-in assignments prior to each meeting where it is requested (primarily implementation code or scripts with comments and conclusions from the results, no extensive written reports required).
- ▶ Prepare one lecture during the course.
- ▶ Complete a final project, give an oral presentation at the project seminar, and submit a short written report.

Examiner for the course is Björn Olofsson. Course credits will be registered in LADOK when all course requirements have been fulfilled.