Benchmarks for Marine Motion Planning

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Fakultät für Informatik

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Background

Autonomous vessels is a research area enjoying increasing importance. Innovations from this field will make the oceans safer both for the crew and the environment and reduce pollution. Although there are much less traffic accidents on water than on roads, the consequences of a ship accident are often more severe as the case of Costa Concordia or the accidents of oil tankers showed. Motion planning between waypoints is a major tasks for developing autonomous ships. The approaches to implement motion planning for vessels vary from regular control theory [1] to machine learning approaches [2].

Concept of autonomous container ship
Source: Rolls-Royce

In order to compare several motion-planning approaches, benchmarks have to be created. With benchmarks, quantitative comparisons of approaches, which were build upon different specifications regarding comfort, safety, efficiency or other interests, are possible. In addition, these benchmarks would point out advantages and disadvantages of different approaches more clearly for different types of marine traffic scenarios.

Description

The goal of this thesis is to develop and implement a representation for marine traffic scenarios and create benchmarks in the developed representation. The marine traffic scenario representation should include different vessel types and other marine obstacles like islands, wind parks and oil platforms. Further, the map of the scenario should differentiate between land and sea areas and might already include marine traffic objects. In addition, the environmental forces are relevant for motion planning and have to be represented as well. The benchmark scenarios should be created from publicly available AIS data. Optionally, a simple motion planner could be implemented for motor vessels in order to generate a motion planning baseline for the marine traffic benchmarks generated.

Tasks

- Perform a literature review on marine motion planning
- Familiarize with CommonRoad [3] – a representation for traffic scenarios
- Develop a representation format for marine scenarios
- Generate example scenarios from AIS data
- *Optional:* Implement a simple motion planner for vessels

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Advisor:
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Research project:
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Type:
Bachelor's Thesis

Research area:
Motion planning, marine traffic

Programming language:
Python

Required skills:
Good programming skills, interest in ships and marine scenarios

Language:
German or English

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References

[1] Agnieszka Lazarowska. A trajectory base method for ship's safe path planning. *Procedia Computer Science*, 96:1022–1031, 2016.

[2] Siyu Guo, Xiuguo Zhang, Yisong Zheng, Du, and Yiquan. An autonomous path planning model for unmanned ships based on deep reinforcement learning. *Sensors (Basel, Switzerland)*, 20(2), 2020.

[3] Matthias Althoff, Markus Koschi, and Stefanie Manzinger. Commonroad: Composable benchmarks for motion planning on roads. In *Proc. of the IEEE Intelligent Vehicles Symposium (IV)*, pages 719–726, 2017.

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