Informatik 11
Embedded Software

RWTH AACHEN UNIVERSITY

Master Thesis

Receding Horizon Control Using Graph Search for Networked Vehicle Trajectory Planning

Problem Statement

The project GROKO-Plan aims at developing a graph-based planning method for optimal cooperative trajectories for interacting vehicles. In a broad sense, the goal of trajectory planning is to find a sequence of control inputs that take a vehicle from a starting position to an end position.

In order to reduce the complexity of the system model, it is discretized to a maneuver automaton, in which a finite amount of states and transitions describe the possible motion of the vehicle. Model-based trajectory planning becomes a graph search in this representation, which is illustrated in Figure 1.

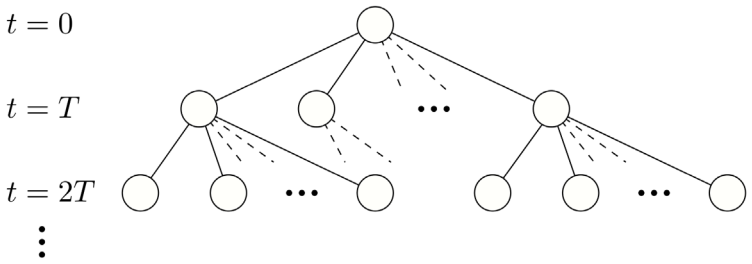

FIGURE 1 GRAPH SEARCH BASED ON THE MANEUVER AUTOMATON

The complexity of the graph search grows with the search depth, which makes real-time planning of trajectories for large search depths impossible. The goal of this thesis is to reduce the computational load during trajectory planning by implementing a receding horizon control strategy, similar to model predictive control (MPC).

Task

- Implementation of a graph search algorithm in a receding horizon control framework
- Comparison with optimization-based MPC
- Analysis of control strategy regarding stability, computation time and optimality
- Evalution in simulation / on real hardware (cpm.embedded.rwth-aachen.de)

Qualifications

- Knowledge of MATLAB and/or C++
- Affinity to mathematics
- General understanding of dynamical systems
- Knowledge of MPC beneficial
- Student of Automation Engineering, Computer Science, Electrical Engineering or a similar study program

Contact

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