Division of Control, Automation and Mechatronics
Department of Signal and Systems (S2)
Chalmers Institute of Technology

Master thesis proposal

Threat assessment and collision avoidance strategies at traffic intersections

Keywords

Intelligent transportation systems, collision avoidance, threat assessment algorithms

Background

Recent advances in sensing and vehicle technologies have enabled significant progresses in the area of the active safety of passenger cars. Safety systems, assisting the driver in complex accident avoidance maneuvers, are already available in passenger cars. Even more complex vehicle systems, with autonomous driving capabilities, are expected to be available soon. But automobile technologies present several interesting safety challenges. For instance, algorithms predicting dangerous situations are necessary to prevent accidents or faulty interventions of existing safety systems.

Problem description

In this thesis, we are interested in threat assessment algorithms for traffic intersections' scenarios. The objective is to provide to each vehicle mechanisms enabling decision making with respect to a potential collision. More precisely, each vehicle must be able to assess, from the data provided by sensors, if other vehicles are following a (not know) conflicting trajectory. This thesis should focus on the fundamental aspects of the underlying prediction algorithms and decision making problems.

Purpose and goals

The goal of this master thesis is to study, develop and demonstrate "provable safe" decision and control algorithms for traffic intersection scenarios. In particular, given a set of vehicles following a given trajectory (not know to the other vehicles), the objective is to design a threat assessment algorithm able to identify other vehicles' dangerous trajectories. Furthermore, formal analysis methods verifying a set of safety requirements should be provided for a subsequent control strategy. The resulting control/decision algorithms should be integrated in cutting edge simulation environments such as, for instance, PreScan, and the DENSO's demo vehicles (Volvo S60) may also be used to collect data in real setups.

DENSO

Requirements

- a highly motivated student from the master program in Systems, Control and Mechatronics or student with a similar background. Knowledge in automatic control and signal processing is required.
- the ideal candidate should have interest in both the theoretical and experimentation aspects of the problem.
- solid programming skills are required and a particular experience with MATLAB/SIMULINK is an asset.
- Effective communication skills in English both oral and especially written are also appreciated.

The student should also be interested in developing further skills during this thesis.

The master student will gain

- competences on
  - *(i)* safety systems;
  - *(ii)* simulation and implementation techniques.
  - *(iii)* automobile applications.
- Industrial experience with one of the leaders on technical consulting and one of the world's largest automotive components suppliers.

Further information and contacts:

This thesis project is the result of collaboration between DENSO, ÅF and Chalmers. For any question, please contact:

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DENSO Corporation is one of the world's largest automotive components suppliers with headquarters in Kariya, Japan. DENSO SWEDEN is located in Göteborg at the Research and Technology development area of the Lindholmen Science Park.

ÅF is leading the way in technical consulting. Our base is in Europe, but our business and clients extend right across the globe. Active Safety is one of ÅF's core technology areas. The corporate spirit is summed up by the motto: "ÅF – innovation by experience.

Chalmers has a long tradition of research in Transportation Systems, with intensive collaboration with society and automotive industry. A large part of such research is performed at the Department of Signals and Systems (S2), which is engaged in both fundamental and applied research spanning a large variety of domains.