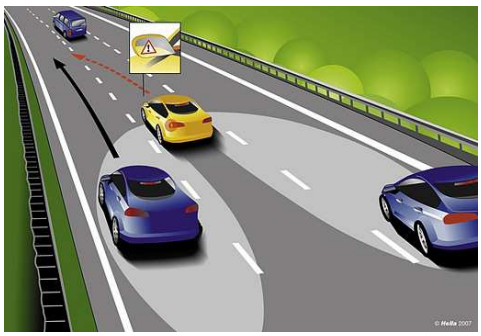
When is it beneficial to perform a lane change?

Motivation

According to the lawyers[1], unsafe lane changes are one of top causes of car accidents. Autonomous vehicle have a huge potential to reduce crashes by taking over driving duties, but also to increase driving comfort and efficiency. However, determining when is more beneficial to perform a lane change rather to keep the current lane is not a trivial task.

Description

This work addresses the problem of developing a real-time algorithm which provides to the autonomous vehicles an appropriate driving decision. First, a short literature survey is required, as different methods already exist to decide if a lane change should be performed of not (e.g. rule-based, utility-based, probability-based). Then, based on the target position and a cost function (e.g. penalize the number of lane changes, jerk), we determine if a lane change is desirable/beneficial or not for the ego vehicle, depending on the current traffic situation. Finally, the decision making algorithm should provide driving decisions compliant with the traffic rules (e.g. when possible, drive on the right-most lane).



[www.sae.org]

Tasks

This project will include the following tasks:

- Literature survey;
- Determine whether a lane change is desirable or not;
- Determine the inter-vehicle traffic gap and time to start the manoeuvre;
- Implement, test, and compare the algorithm with the human-driving behavior.

References

[1] J. Nilsson, J. Silvlin, M. Brännström, E. Coelingh, J. Fredriksson, *If, when, and how to perform lane change manoeuvres on highways*, IEEE Intelligent Transportation Systems Magazine, 2016;

[2] M. Ardelt, C. Coester, N. Kaempchen, *Highly Automated Driving on Freeways in Real Traffic Using a Probabilistic Framework*, IEEE Transactions on Intelligent Transportation Systems, 2012;

[3] A. Furda, L. Vlacic, *Enabling Safe Autonomous Driving in Real-World City Traffic Using Multiple Criteria Decision Making*, IEEE Intelligent Transportation Systems Magazine, 2011;

[1] https://seriousaccidents.com/legal-advice/top-causes-of-car-accidents/unsafe-lane-changes/

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Research project:
PUMA

Type:
BA / MA

Research area:
Automated Driving

Programming language:
Matlab

Required skills:
The candidate must be enthusiastic and self-driven. Matlab knowledge is required.

Language:
English

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