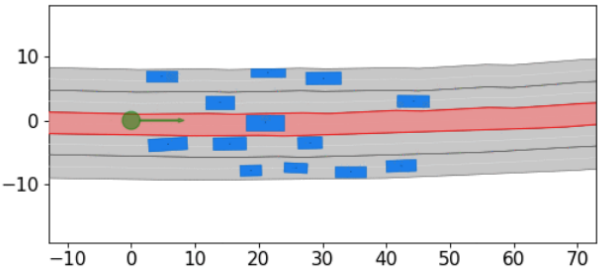
Generation of Efficient Traffic Rule Monitors

According to current legislation [1, 2] the driver of a vehicle is responsible in case of an accident. However, in case of autonomous vehicles the car manufacturer would be held responsible for the accident. In order to avoid any liability claims, the car manufacturer has to ensure that autonomous vehicles obey traffic rules at all times. Since traffic rules are very unprecise and only partially applicable to autonomous vehicles, e.g., the safe distance rule at a highway (cf. figure below), the laws have to be concretized and formalized. The formalized traffic rules can be evaluated by monitors based on temporal logics [3, 4].



At a highway several traffic rules have to be evaluated in parallel.

Description

The aim of this thesis is to develop a framework for the evaluation of traffic rules. This includes the evaluation of different types of temporal logics for monitoring traffic rules and the formalization of various traffic rules. The framework should provide a feedback on traffic rule violations to improve possible trajectories. Additionally, a user interface for the management of traffic rules and the generation of monitors should be developed.

Tasks

- Familiarizing with temporal logics
- Familiarizing with CommonRoad [5] and our previous work on formalized traffic rules
- Formalize traffic rules, especially for highway scenarios
- Compare different types of temporal logic (e.g. STL, LTL) regarding applicability
- Develop a tool for the creation of efficient traffic law monitors
- Evaluate CommonRoad scenarios regarding the traffic rule compliance of traffic particpants
- Develop a feedback loop for violated traffic rules
- Optional: Apply the monitor to a motion planner

References

[1] Economic Comission for Europe: Inland Transport Committee, "Vienna Convention on Road Traffic," Nov. 1968. [Online]. Available: http://www.unece.org/fileadmin/DAM/trans/conventn/crt1968e.pdf

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[3] A. Rizaldi and M. Althoff, "Formalising traffic rules for accountability of autonomous vehicles," in *Proc. of the 18th IEEE International Conference on Intelligent Transportation Systems*, 2015, pp. 1658–1665.

[4] A. Rizaldi, J. Keinholz, M. Huber, J. Feldle, F. Immler, M. Althoff, E. Hilgendorf, and T. Nipkow, "Formalising and monitoring traffic rules for autonomous vehicles in isabelle/hol," in *Integrated Formal Methods*, N. Polikarpova and S. Schneider, Eds. Cham: Springer International Publishing, 2017, pp. 50–66.

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-

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[5] M. Althoff, M. Koschi, and S. Manzinger, "Commonroad: Composable benchmarks for motion planning on roads," in *Proc. of the IEEE Intelligent Vehicles Symposium*, June 2017, pp. 719–726.

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