ITraCS: Interaction-based Trajetory Prediction for Collision Avoidance in Automotive Safety Systems

Abstract

- State-of-the-art active safety systems assume simplified presumptions about environmental events which is unproblematic for short prediction times
- For longer prediction times, the interaction between the traffic participants needs to be properly modeled to accurately predict their movement on longer timescales
- ITraCS aims to model the interaction between traffic participants with a probabilistic model to enable a predictive, deescalative action for a possibly critical situation

Research Question

- How can the interaction of the relevant surrounding traffic participants be modeled with a *probabilistic prediction framework* in a possibly critical situation?
- How can the interaction of traffic participants be efficiently included into a method for the predictive deescalation of critical situations in mixed traffic?

Related Work

- Modelling interactions with machine learning techniques [1]
- Use of POMDPs to model uncertain environments with intention assignment [2]
- POMDPs for interactive decision making in lane change scenarios [3, 4] or intersections [5, 6]

Research Focus and Future Steps

- Application and implementation of the POMDP framework for the prediction of an arising critical traffic scenario
- Use of the POMDP output for the EGO decision process in predictive safety functions
- Integration of statistics about real traffic data for accurate state estimation in different scenarios
- Evaluation of the implemented framework

References

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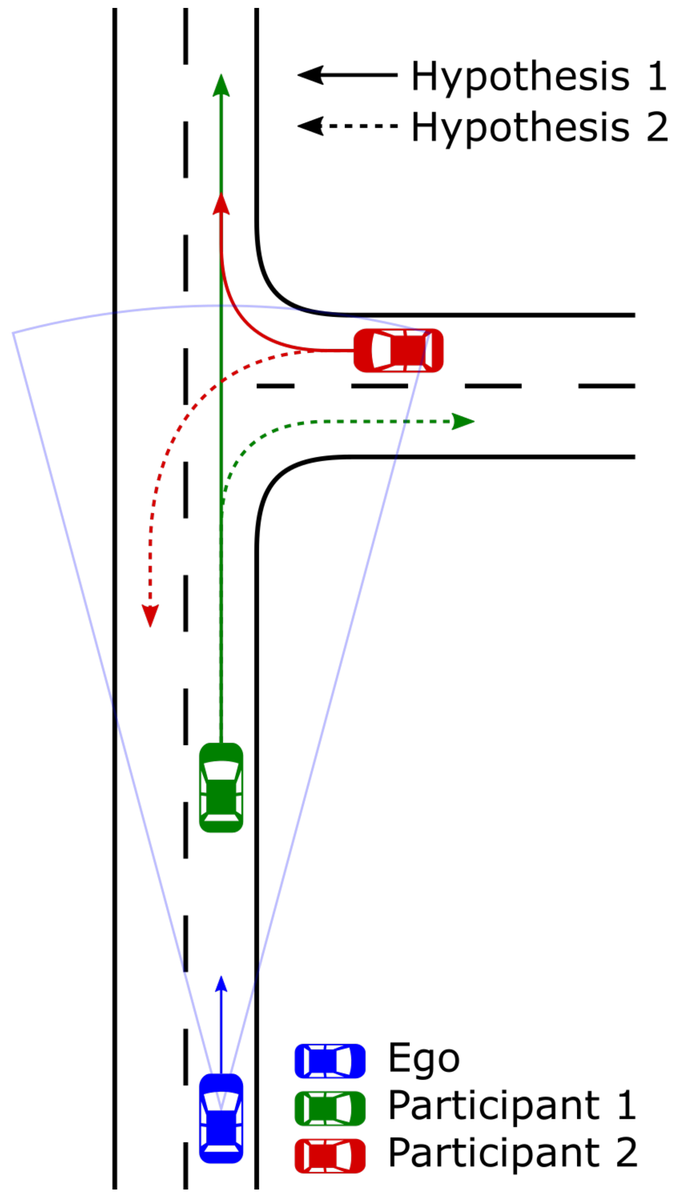
Methodology

- Use of a *Partially Observable Markov Decision Process* (POMDP) [7] to model the uncertainties and the interaction between traffic participants
- Traffic objects are assigned a set of main hypothesis / trajectories given by only infrastructural constraints to define the possible states of a participant



- Actions are defined to accomodate for trajectories varying from the main hypothesis, e.g. evasive maneuvers due to the situation
- Application of the basic assumption: „Traffic participants try to avoid crashes as soon as they realize the criticality of a situation“ to model a suitable reward function and to find a probable action sequence for each participant respectively by applying Bellman's principle
- If the probable action sequence for a relevant object is computed and is leading to a critical situation for the EGO vehicle, a preemptive, deescalative maneuver can be executed

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