

# Set-Based Prediction of Traffic Participants



Technische Universität München



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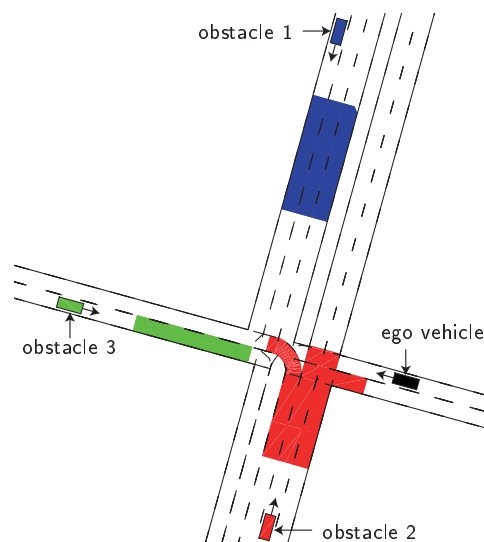
Lehrstuhl für Echtzeitsysteme und Robotik

## Background

Predicting the movement of other traffic participants is an integral part in the motion planning of most automated road vehicles. While simple predictions, e.g. based on assuming constant velocity, may suffice for deciding a driving strategy, predicting the set of all possible behaviors is required to ensure safe motion. We have developed an approach to verify planned trajectories online<sup>[1]</sup>: If the sets of all possible behaviors of other traffic participants do not intersect with the set of the intended motion, one can guarantee that the ego vehicle does not cause a collision.

## Description

We have recently published our MATLAB tool SPOT<sup>1</sup> [3], which computes all possible movements by considering physical constraints and assuming that the traffic participants abide by the traffic rules. SPOT is designed to over-approximate the set of possible movements in order to be used for verification. An example of the predicted motion of multiple vehicles at an intersection is shown in the figure below.



As further research, we wish to improve our over-approximative prediction:

- Considering further traffic rules,
- Considering occlusion due to limited sensor data,
- Considering interaction between road vehicles [2],
- Considering off-tracking of long vehicles (i.e. their overhang in turns).

## Possible Tasks

This document is not a specific thesis proposal, but a general description of possible topics in the area of set-based prediction of traffic participants. Please contact us if you are interested in our field of research.

Usually, a thesis comprises the following tasks:

- Familiarizing with prediction techniques in general (see e.g. [4]) and our set-based prediction in particular [3].

<sup>1</sup>[spot.in.tum.de](http://spot.in.tum.de)

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### Advisor:

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### Research project:

CAR@TUM: Set-Based Prediction of Traffic Participants

### Type:

BA, MA

### Research area:

Automated vehicles, prediction, verification, formal methods

### Programming language:

MATLAB

### Required skills:

Knowledge in dynamic systems, good mathematical background

### Language:

English

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- Developing a formal approach to consider the selected aspect in the prediction.
- Implementing this approach in MATLAB.
- Integrating this approach in the set-based prediction of SPOT.
- Evaluating this approach with respect to the safety of the ego vehicle.



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## References

- [1] M. Althoff and S. Magdici. Set-based prediction of traffic participants on arbitrary road networks. *IEEE Transactions on Intelligent Vehicles*, 1(2):187–202, 2016.
- [2] M. Koschi and M. Althoff. Interaction-aware occupancy prediction of road vehicles. In *Proc. of the 20th IEEE International Conference on Intelligent Transportation Systems*, 2017. [to appear].
- [3] M. Koschi and M. Althoff. SPOT: A tool for set-based prediction of traffic participants. In *Proc. of the IEEE Intelligent Vehicles Symposium*, pages 1679–1686, 2017.
- [4] S. Lefèvre, D. Vasquez, and C. Laugier. A survey on motion prediction and risk assessment for intelligent vehicles. *ROBOMECH Journal*, 1(1):1–14, 2014.