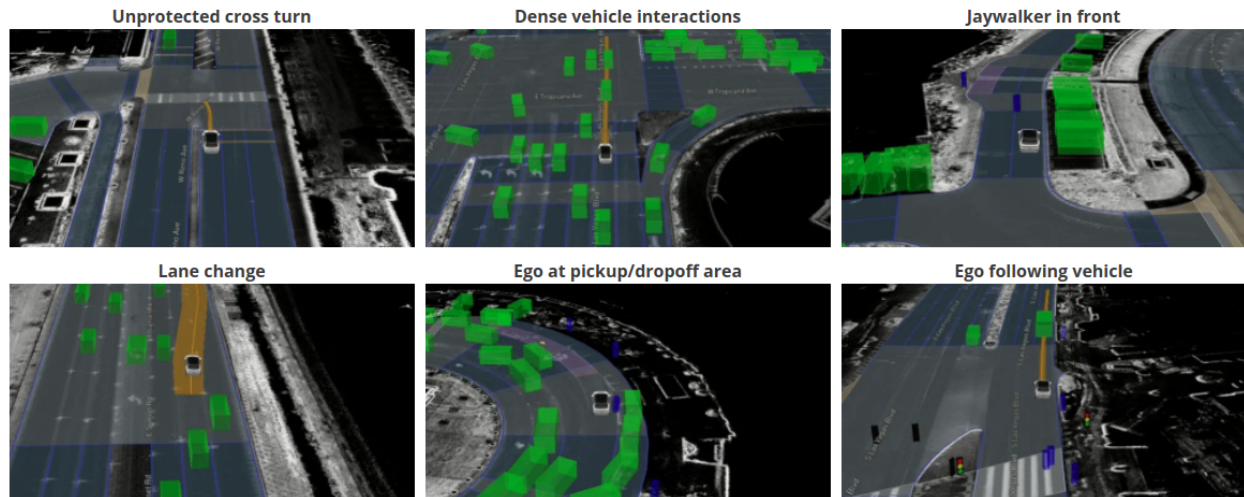2022-05-12, MSc project at Cognitive Robotics department, TU Delft

MSc project: **Automated discovery of behavior prediction metrics for autonomous vehicles**

Background: *Motion forecasting* or *prediction* is the task of estimating the position of a vehicle several seconds into the future. This task is typically evaluated by computing the L1 or L2 distance between the predictions and ground-truth. These distance based metrics are overly simplistic as they neither take into account the multimodal nature of prediction (turning left or right may both have 50% chance at a T-section), nor the temporal nature or the psychological aspects of human decision-making. While previous works have handcrafted more complex metrics for a small number of scenarios (lane changes, roundabouts etc.), there has been no study on large scale datasets with dozens of scenarios. Furthermore there are no automated approaches to identify suitable metrics for a given scenario.

Goal: The goal of this MSc thesis is to investigate how behavior prediction methods can be evaluated across multiple scenarios and to automatically discover suitable scenario-specific prediction metrics.
- Literature review of motion forecasting and scenario specific metrics (e.g. [1])
- Familiarize yourself with the nuPlan dataset [2] and its scenarios
- Implement the most common metrics in the literature
- Find ways to automatically mine suitable metrics, e.g.:
    - Use a large-scale dataset to evaluate which metrics are relevant in which scenario
    - Perform Natural Language Processing (NLP) on existing papers to mine for the metrics that are traditionally used in specific scenarios.
- [Find ways to combine the metrics of different scenarios into a single global metric
- Write a paper with your results

Supervisors at the Cognitive Robotics department:
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Prerequisites:
- Applies only to MSc Robotics students

To apply, please include the following when you contact us:
- Short motivation letter stating:
  - Why are you interested? What would you like to achieve/contribute (theoretical, applied)?
  - Intended starting date, and what courses will you have left by then
  - Relevant experience (courses, tech. projects, internships, etc.), and skills
- Your CV
- Your BS and MS course transcripts

References:
[1] Siebinga, O., Zgonnikov, A., & Abbink, D. (2021). Validating human driver models for interaction-aware automated vehicle controllers: A human factors approach. https://arxiv.org/abs/2109.13077
[2] Caesar, Holger, et al. "nuPlan: A closed-loop ml-based planning benchmark for autonomous vehicles." CVPR 2021 ADP3 workshop.