Auto Service

Title: Data and Model Verification for Machine Learning in Autonomous Vehicles

Keywords

Autonomous Vehicles, Operational Design Domains, Constrained Random Verification

Description

Operational Design Domains (ODDs) represent an integral part of the specification of the expected operating conditions of autonomous vehicles. They provide the relevant environment description and verification criteria for developing autonomous vehicles. Especially for autonomous vehicles employing machine learning, the ODD defines completeness criteria for the data used during learning, as well as scenarios for verifying the performance of such systems.

The aim of this work is to:

- Create an ODD for Semantic Segmentation:
  - modelling an ODD language based on JSON (considering expressive power and algorithmic feasibility of the following topics)
  - subset of expected features from ongoing standardization activities (on ODDs and ontologies)
  - discrete (hierarchical) conditions (like weather in {sunny, rainy, …}) describing the driving environment
  - allowing for probability distributions and constraints (e.g. “disallow rain and strong wind at the same time”) on the conditions
- Explore the verification of a dataset and a learnt model against an ODD regarding the following questions:
  - How good does a dataset cover an ODD (with or without attached probabilities)? This relates to the topics of constrained random counting/sampling.
  - Does discrimination in a dataset translate to the learnt model?
  - How good is a model if we sample from the ODD with attached probabilities?
- Implement the required tooling (processing the ODD, evaluating data and model against ODD) and apply it to a dataset (Berkeley DeepDrive dataset or synthetic data generated with CARLA) and model for image segmentation.

Requirements

- Python and/or C++ programming
- Machine Learning, Logic, Algorithms (probably in the area of SAT Solving for constraint modelling and constrained random verification) and Probability Theory