Integrating Shielding into Realistic, Perception-Based Autonomous Systems

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Motivation

Bilateral AI is the concept of combining symbolic (logic-based) and subsymbolic (data-driven) approaches into a unified system that aims to achieve high performance while supporting formal reasoning and, where applicable, formal guarantees. This topic investigates how **shielding**, a model-based safety mechanism, can be integrated into realistic, perception-based autonomous systems.

The resulting system combines machine-learning-based perception with formal, model-based safety reasoning, taking a step towards safer and more trustworthy autonomous systems.

Goals and Tasks

- Get familiar with the provided framework, the simulation environment CARLA 0.9.16 and the PRISM Modeling language
- Train a Convolutional Neural Network (CNN) for real-time pedestrian detection; together with a regressor for distance estimation.
- Design suitable probabilistic models for the ego vehicle and pedestrian behaviour.
- Construct and evaluate a set of interesting scenarios that demonstrate the effectiveness your integrated shielding approach.

A typical safety-critical scenario in CARLA.

Literature

- M. Plank
  Safety Shielding for Safe Autonomous Driving
  https://doi.org/10.3217/q4w6z-wxd74
- A. Dosovitskiy et al.
  CARLA: An Open Urban Driving Simulator
  https://arxiv.org/abs/1711.03938

Courses & Deliverables

☑ **Master Project**
Project code
Report
Presentation

– OR –

☑ **Master's Thesis**
Initial presentation
Project code
Thesis (60+ pages)
Final presentation

Recommended if you're studying

☑ CS ☑ ICE ☑ SEM

Prerequisites

- Basic knowledge in perception-based machine learning (e.g. CNNs)
- Programming (Python)

Advisor Contact

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