Anomaly Detection with World Models for Autonomous Driving

Bachelor / Master Thesis
The scope is designed for a Master Thesis.
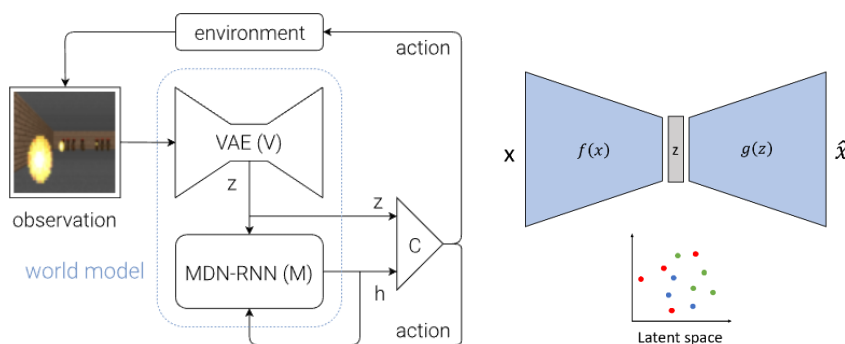For a Bachelor Thesis, we can customize it.

Autonomous Driving   **Deep Learning**   **Perception**   **Simulation**

In computer vision, we often deal with models that have no good understanding of the how the world works. This leads to cases, where neural networks are severely wrong, while we humans can easily identify the issue. Luckily, world models, which learn a representation of the world, come to the rescue. In this thesis, you will train a world model, that not only learns from 2D image data, but also 3D voxel data.

Ha and Schmidhuber: World Models (2018)

Elluswamy: Occupancy Networks (2022)

The Topic
- You will perform state-of-the-art research on current world models with latent state representations and world-model based anomaly detection methods
- You will use camera and lidar data from the CARLA simulation engine as training data
- You will detect anomalies based on reconstruction errors, prediction errors, and latent space evaluation with a single pass of your world model
- You will map found anomalies in a 3D voxel representation

Your Skills
- You study Computer Science or a related course of study
- You are deeply interested in topics such as Autonomous Driving, Robotics, Deep Learning or Computer Vision
- You are able to read and write scientific texts in English
- You are fluid in Python, first experiences with PyTorch
- You show an above-average degree of initiative and commitment as well as a thorough way of working

What We and I Offer
- You get exciting insights into our research and gain valuable practical experience
- We use the latest hardware and software. Together with us you work in first-class laboratories (on-site or remotely)
- Regular and extensive support: Weekly 1:1 meetings, bi-weekly student group meetings, monthly 1:1 strategy meetings
- Collaboration with other students to get tips, learn together, and fix issues quickly
- High-quality theses will be published on KITopen, with the code on GitHub
- We aim to publish this work in an IEEE paper with shared first authorship

Application
- Start: Immediately
- Shoot me an e-mail at daniel.bogdoll@kit.edu with your CV, grades, and a few sentences why you are interested. No cover letter necessary ☺