

Semesterarbeit/Masterarbeit

Foundation-Model-Assisted 3D Auto-Labeling Pipeline for Missed and Unknown Objects in Autonomous Driving

With the advancement of autonomous driving, many autonomous driving (AD) stacks are aiming at SAE level 4. However, even level 4 AD systems still encounter corner cases (CCs) and will disengage once they cannot solve the situation. A major cause of these disengagements is perception deficit, where pre-trained perception models fail to detect critical elements in the scene—either by completely missing them (Missed objects) or because the objects fall outside their predefined training categories (Unknown objects). To tackle these specific CCs will be an essential problem in autonomous driving. Therefore, this work focuses on bridging this perception gap by developing an automated 3D pseudo-labeling pipeline to generate explicit 3D bounding boxes specifically targeted at these missed and unknown dynamic objects.

Work packages:

In the project, you will develop a framework for generating explicit 3D pseudo-labels targeted at missed and unknown objects using multi-sensor fusion and foundation models. Furthermore, you will investigate the accuracy of the generated 3D bounding boxes based on point cloud projection techniques. The project can be described with the following tasks:

- Literature review: Foundation models for unknown object detection, and auto-labeling.
- Implementation: Expanding an existing pipeline (VESPA) to specifically handling objects that are not detected by conventional closed-set perception models.
- Evaluation: Validating accuracy and efficacy of generated labels.

Requirements:

- Very good programming skills in Python and PyTorch.
- Knowledge of Computer Vision and Deep Learning (Must), Foundation models such as VLMs, SAM (Desired).
- High personal motivation and independent working style.
- Very good language proficiency in English.

Recommended literature:

- [VESPA: Towards un\(Human\)supervised Open-World Pointcloud Labeling for Autonomous DrivingCARLA parking spot](#)
- [CODA: A Real-World Road Corner Case Dataset for Object Detection in Autonomous Driving](#)
- [Fail2Drive: Benchmarking Closed-Loop Driving Generalization](#)
- [Auto-labeling of point cloud sequences for 3D object detection using an ensemble of experts and temporal refinement](#)

Possibility for publication in case of excellent work.

The thesis should clearly document the individual work steps. The candidate undertakes to complete the term paper independently and to indicate all scientific aids used. The submitted work remains the property of the chair as an examination document.

Prof. Dr.-Ing. M. Lienkamp

Betreuer: Hojun Lim, M. Sc.

Ausgabe: _____

Abgabe: _____