![KIT logo] Karlsruher Institut für Technologie

Applied Informatics and Formal Description Methods
Cooperative Autonomous Systems
Kaiserstraße 89
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Master Thesis
Auto-Labeling System with Agentic AI for Perception in Autonomous Driving

Background:

In autonomous driving, high-quality labeled data is essential for training perception systems, enabling them to accurately detect and track objects in complex environments. However, manual annotation is a highly labor-intensive, time-consuming, and expensive process, particularly when dealing
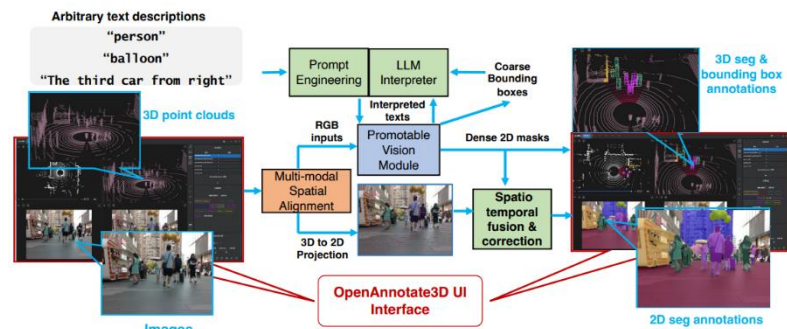
with large-scale multi-modal datasets such as LiDAR and RGB, as well as collaborative perception datasets involving multiple perspectives. To address these challenges, automated auto-labeling systems have been developed to improve efficiency and reduce dependency on human annotators. Recent breakthroughs in Large Language Models (LLMs) and Vision-Language Models (VLMs), alongside Agentic AI frameworks, offer transformative potential.This thesis aims to design and implement an innovative auto-labeling system that harnesses Agentic AI to advance multi-modal perception in autonomous driving. The focus will be on improving annotation accuracy, robustness to challenging conditions, and scalability across LiDAR and RGB datasets.

Your Tasks:
- Analysis of SOTA in Auto-Labeling of Multi-Modal Datset
- Build a system to annotate multi-modal data (RGB, Thermal, LiDAR) using LLMs and VLMs for contextual understanding and validation.
- Validation with Real and Simulated Data to assess performance.
- Benchmark the system's accuracy and efficiency against existing SOTA methods.

Your Profile:
- Strong background in machine learning and computer vision.
- Experience with multi-modal sensor data processing (e.g., camera images, LiDAR point clouds, GPS time-series).
- Knowledge of deep learning frameworks (e.g., PyTorch or Tensorflow) and practical experience of LLM/VLM
- Ability to work independently and tackle complex, open-ended research problems.

Start date: Immediately   **Duration:** As per the applicable examination regulations.

If you are interested or have any questions regarding this thesis position, feel free to contact:

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[1] Zhou, Yijie, et al. "Openannotate3d: Open-vocabulary auto-labeling system for multi-modal 3d data." 2024 IEEE International Conference on Robotics and Automation (ICRA). IEEE, 2024.
[2] Zhou, Yijie, et al. "ALGPT: Multi-Agent Cooperative Framework for Open-Vocabulary Multi-Modal Auto-Annotating in Autonomous Driving." IEEE Transactions on Intelligent Vehicles (2024).