Cluster B

AI data, tooling and infrastructure

B1 – 3D Gaussian splatting reconstruction for enhanced parking

This project will focus on a 3D model of the surroundings for improved viewing in parking scenarios. It could provide better stitching properties and allow to move the virtual camera around. A 3D model could also be useful for measuring distance between car body and object.

In this master thesis project, you will focus on:

- Making 3D Gaussian splatting work well with fish-eye lens cameras.
- Target to run this on vehicle, so the solution would have rather heavy restrictions on compute.
- Develop a test protocol for how a 3D reconstruction for parking purposes should be evaluated.

B2 - Hierarchical AD Data Curation using Self-Supervised Vision Foundation Models

Autonomous driving relies on efficient deep learning models to drive safely, and a key enabler is a robust data curation pipeline that surfaces valuable training samples.

Self-supervised vision foundation models learn to capture rich information from raw data without the need for expensive labels, and their internal representations can be exploited to sample diverse and informative subsets of the data.

This thesis aims to explore and adapt hierarchical clustering and sampling applied to vision foundation model representations of multi-camera autonomous driving video streams.

In this master thesis project, you will focus on:

- Extracting embeddings with vision foundation models such as V-JEPA 2/2, DINOv2/v3, CLIP, or Qwen3-VL-Embedding
- Developing data sampling strategies based on hierarchical clustering and sampling over these embeddings
- Investigating data diversity and value metrics to compare different vision foundation models and sampling strategies

B3 - Holistic Multi-Camera LIDAR Calibration via 3D Gaussian Splatting

This thesis aims to explore whether target-based LiDAR–camera calibration can be improved or complemented by a target-free, data-driven optimization that estimates joint rig extrinsics directly from a short logged drive.

In this master thesis project, you will focus on:

- Exploring a frontier calibration approach based on 3D Gaussian Splatting, where the driving scene itself becomes the calibration target.
- Working with real multi-sensor vehicle data, including LiDAR and a multiple-camera wide-FOV fisheye rig.
- Developing a research-grade method by improving convergence, robustness, dynamic-object masking, scene selection, and coarse-to-fine optimization.
- Identifying the method's strengths, limitations, and failure modes, including when it converges reliably, when it breaks, and what scene or motion conditions affect performance.
- Benchmarking against existing calibration pipelines, including target-based and data-driven methods.

B4 - Geometry-Preserving Weather Editing for Occupancy-Guided Driving World Models

The goal of this project is to investigate occupancy-consistent weather editing for driving world models. Given a driving scene with an associated occupancy, BEV, or world-volume representation, the model should generate camera images or short video clips under different text-specified conditions, such as “sunny day,” “rainy night,” or “foggy morning,” while preserving the same road layout, object locations, and scene geometry.

The project will build on recent research in driving world models and occupancy-guided scene generation. The project will also study a pipeline in which an existing or lightweight pretrained image/video generation model is conditioned on both structured scene information and text prompts. If computational resources allow, the project will also explore a lightweight fine-tuning strategy.

B5 - Robust 3D Head Reconstruction for Digital Human Generation

High-quality digital humans are becoming increasingly important in fields such as autonomous driving, virtual reality, gaming, and human-computer interaction. A key challenge is automatically reconstructing an accurate 3D representation of a person's head from images or scans while preserving identity and geometric detail.

This thesis aims to investigate state-of-the-art methods for estimating complete head meshes from image-based 3D reconstruction and evaluate their suitability for generating high-quality digital humans.The project will investigate and compare modern approaches for 3D head reconstruction from photographs or image sequences.

In this thesis project, you will focus on:

- Reviewing recent literature on 3D face and head reconstruction.
- Implementing and evaluating state-of-the-art reconstruction methods.
- Comparing parametric and neural representations (e.g., FLAME-based and neural approaches).
- Evaluating reconstruction quality, identity preservation, and geometric accuracy.
- Investigating methods for converting reconstructed meshes into animation-ready digital humans.
- Exploring opportunities for automation of the complete reconstruction pipeline.

B6 - Diffusion based image synthesis from 3D reconstructed point cloud – LUND OFFICE

Simulation environments are essential for training, testing, and evaluating autonomous vehicle functions. They make it possible to study safety-critical scenarios, rare events, and complex vehicle maneuvers without the cost and risk of real-world testing. However, some autonomous driving functions require simulations where the ego vehicle deviates significantly from the trajectories observed in collected driving data. In these cases, image generation becomes challenging because available image data may be sparse or incomplete from the new viewpoints.

To address this limitation, simulation environments can be based on 3D reconstructed scenes. Dense 3D point clouds and lidar data provide an explicit representation of the surrounding environment and can support image generation from alternative vehicle positions and trajectories.

In this master thesis project, you will focus on:

- Conduct a literature study on available reconstruction techniques.
- Explore and develop diffusion-model-based methods for generating full-scale images of traffic scenes using 3D point clouds and lidar.
- Test your solution
- Document your findings, approaches and potential improvements