Karlsruhe Institute of Technology

Institute of Vehicle System Technology
Institute of Mobile Machines

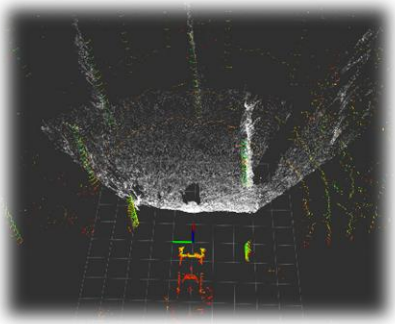
Prof. Dr.-Ing. Marcus Geimer

MOBIMA MOBILE MACHINES

Bachelor/Master Thesis

Computer Vision-based Tree Detection and Species Classification under Challenging Forest Conditions

With the advancement of automation in forestry machinery, computer vision is becoming essential for enabling autonomous driving and intelligent operation in forest environments. Tasks like tree detection and species classification are gaining attention in intelligent forestry but remain underexplored—especially under challenging conditions such as fog, occlusion, or lighting variation. While we have previously applied advanced models like Mask R-CNN for forest object segmentation and built a multi-view RGB camera setup, no systematic work has been done on species recognition or robust detection in such conditions. This thesis aims to fill that gap by applying and developing SOTA models in complex, real-world forest scenes.





The project will primarily use public datasets, with optional data collection for specific cases. Students are encouraged to explore other innovative directions such as LLM for vision. We fully support publishing high-quality research outcomes in high level international conferences or journals. The topic is ideal for students from computer science, robotics, or mechatronics who are interested in applying cutting-edge vision algorithms to real-world autonomous driving systems in the forest.

Planned Tasks:

- Literature review and familiarization with tree detection and species classification in forestry
- Selection and preparation of suitable datasets (public or small-scale custom)
- Implementation and training of SOTA neural networks for robust classification under varying conditions
- Evaluation and validation of model performance in diverse environments
- Documentation and concise presentation of results, with publication as a goal

Type of thesis:

- Focus: Data Augmentation, Robust Perception in Complex Environment
- Fields: Computer Vision, Machine/Deep Learning

Start and Duration:

- Start: To be agreed upon
- Duration: 3-6 months

Prerequisites:

- Basic understanding of machine learning and computer vision
- Solid Python skills (e.g. PyTorch, OpenCV)
- Strong self-motivation and good scientific writing skills in English or German
- Practical experience with computer vision projects is a plus

If you are interested in this topic, feel free to get in touch. The scope of the work can be adapted or extended based on your individual strengths and interests.

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