

Master/Bachelor Thesis – Semester Project

Autonomous Driving on Unstructured Scenarios



Background

The performance of autonomous driving algorithms in unstructured environments remains to be fully explored. Research on autonomous robots and vehicles in such scenarios can significantly contribute to the advancement of field exploration and rescue missions. However, current academic studies face challenges such as the **scarcity and inconsistency of datasets**, as well as **limited physical experimentation**. Master's students interested in exploring this field are warmly encouraged to undertake research in this area.

The term **unstructured scenarios** refers to an environment that lacks clear rules, uniform markers, standardized elements, or geometric constraints. In such environments, road boundaries are ambiguous, obstacle types are diverse, terrain is complex, and navigable areas change dynamically, making it difficult to rely on predefined models or rules for effective perception and decision-making. Typical unstructured scenarios include **forests, farmlands, mining areas, accident sites**, etc

Your Tasks

In this thesis, your jobs can be selected from the following tasks or your own ideas relative to this topic. To be specific:

1. **Data analysis:** Systematically integrating existing open-source unstructured scenario data to identify commonalities and differences.
2. **Cross-domain:** Conduct cross-domain research and exploration on existing open-source unstructured and structured scenario data.
3. **Calibration & Navigation:** Implement autonomous calibration and autonomous navigation of platforms in unstructured scenarios.
4. **VLA in Unstructured Scenarios:** Investigation of Vision-Language-Action Model Technologies in Unstructured Scenarios.

Requirements

Candidates are expected to have strong interest, hands-on skills, programming abilities, as well as literature search and reading capabilities.

Supervisor: Prof. Alois Knoll

Advisor: Yuchen Li

yuchen.li@tum.de

Lehrstuhl für Echtzeitsysteme und Robotik,

Fakultät für Informatik, Technische Universität München

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[2] G. Varma, et al. "IDD: A dataset for exploring problems of autonomous navigation in unconstrained environments," in Proc. IEEE Winter Conf. Appl. Comput. Vis. (WACV), 2019, pp. 1743–1751.

[3] Min, Chen, et al. "Autonomous driving in unstructured environments: How far have we come?." *arXiv preprint arXiv:2410.07701* (2024).