



PROJECT SUBMISSION FORM

Master's Program in

Autonomous Systems

A. Student information

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2. Study info	<div>Enrollment number</div> <div>9050125</div>	<div>Started program</div> <div>10 October 2025</div>
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B. Project information

1. Project type	<div>R&D</div> <div><input checked="" type="checkbox"/></div>	<div>Thesis</div> <div><input type="checkbox"/></div>	2. Report dated	<div>Date (dd. mm. yyyy)</div> <div>26.04.2025</div>
3. Project duration	<div>From</div> <div>10.10.2024</div>	<div>To</div> <div>02.05.2025</div>		
4. Project info	<div>Title</div> <div>LiDAR Point Cloud Terrain Segmentation</div> <div>Abstract</div> <div>Forests present a highly heterogeneous environment composed of terrain, vegetation, tree trunks, tree stumps, and other natural elements. The irregularity of Earth's topography, combined with dense vegetation and occlusions, poses a significant challenge to distinguish terrain from other environmental components, particularly when using traditional machine learning approaches. A major bottleneck in this task lies in the feature extraction process from noisy and partially labeled 3D point-cloud datasets, which often lack semantic consistency and spatial clarity. This report proposes a robust and adaptable pipeline for semantic segmentation of 3D point clouds, using 2D annotations to guide learning. Our method integrates state-of-the-art feature extraction techniques and clustering algorithms to isolate tree stumps and terrain as independent semantic clusters. The proposed approach achieves a segmentation accuracy of 34.23\% for terrain and XX\% for tree stump detection classification in a forest UAV dataset of benchmark containing more than 2.5 million points. Furthermore, it demonstrates resilience to noise and generalizes well across different terrains. The results of this work are highly applicable to forest monitoring based on UAVs, with potential extensions to vegetation indexing, biomass estimation, and land use analysis in both forested and urban settings. The pipeline not only addresses the limitations of existing methods, but also sets a strong foundation for scalable, real-time environmental perception in ecological research and smart forestry initiatives.</div>			
5. Supervisors	<div>1st supervisor's name</div> <div>Prof. Dr. Sebastian Houben</div> <div>2nd supervisor's name</div> <div>Ahmad Drak</div> <div>3rd supervisor's/advisor's name</div> <div>Maximilian Johenneken</div> <div>4th supervisor's/advisor's name</div> <div></div>	<div>1st supervisor's affiliation</div> <div></div> <div>2nd supervisor's affiliation</div> <div></div> <div>3rd supervisor's/advisor's affiliation</div> <div></div> <div>4th supervisor's/advisor's affiliation</div> <div></div>		

C. Agreement

1. Candidate	<div>Date (dd. mm. yyyy)</div> <div>01.05.2025</div>	<div>Signature</div> <div></div>
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Please ensure that the items listed below are complete before submission to the department office:

- ☐ A hard copy of the report/thesis per supervisor (in the case of a thesis, copies should be signed and dated)

- These additional items, listed below, are required when submitting a MASTER'S THESIS:
- ☐ One additional signed and dated hardcopy of the thesis
 - ☐ For each hard copy (there should be number of supervisors + 1 copies), a CD/DVD containing:
 - ☐ The thesis in pdf format
 - ☐ Any software that you have produced
 - ☐ A document containing your name, supervisors' names, thesis title and abstract. If applicable, include the name of the company with whom the thesis was written
 - ☐ An additional CD as above
 - ☐ One copy of your transcripts (Notenspiegel)

I agree to the use of my project's title for MAS advertising and media purposes: ☐ Yes ☐ No