

Bachelor or Master Thesis

LiDAR-Based Rut Depth Analysis for Forestry Machines

In forestry, the use of heavy machinery is part of the daily practice of timber harvesting. When driving on skid trails, the formation of ruts and depressions is inevitable. To prevent soil damage and to safeguard long-term soil fertility, clear regulations for machine use now exist in Germany, varying by federal state. These regulations particularly specify a maximum permissible rut depth that must not be exceeded.



As part of this thesis, it will be examined to what extent the resulting rut depths can be measured precisely using LiDAR technology. There are already [papers](#) on this topic that detect rut depth with a mobile 2D LiDAR. However, LiDAR measurement technology has advanced considerably in recent years. The aim, therefore, is to extract relevant soil information from 3D LiDAR point clouds, classify the wheel tracks, and determine rut depth. Established methods from the scientific literature that enable reliable classification will also be taken into account. Finally, the accuracy of the applied method will be compared with manually collected reference measurements of rut depth. Recorded LiDAR data are available for the investigation.

Planned Tasks:

- Research and familiarization with this topic
- Implementation of a solution (or multiple solutions) for rut depth measurement
- Validation and evaluation of the results using recorded LiDAR data and reference measurements
- Documentation and presentation of results

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.

Type of Thesis:

- Focus: Algorithm Development, Data Processing, Sensor Technology
- Fields: Forest Machinery Technology, Computer Science

Start and Duration:

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

Prerequisites:

- Interest in assistance systems, programming and sensor technology
- High degree of independence and motivation
- Good academic performance
- Very good writing skills in German or English
- Programming knowledge in ROS, Python or C++ is an advantage

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