



# Outdoor Terrain Classification Algorithms Using SAM and YOLO

## Background

In the field of outdoor robotics, autonomous navigation, and environmental monitoring, accurate terrain classification is essential for informed decision-making. Identifying and understanding various terrain types and obstacles, such as grass, dirt, water bodies, and obstacles, is crucial for ensuring the safe and efficient operation of autonomous systems. This project aims to develop terrain classification algorithms using the innovative Segment Anything Model (SAM) in conjunction with You Only Look Once (YOLO) object detection to enhance the perception capabilities of autonomous systems in outdoor environments.

## Thesis task

The primary objectives of this project are as follows:

1. **Data Collection:** Assemble an extensive dataset of outdoor terrain images encompassing a wide range of terrain types, lighting conditions, and obstacles.
2. **SAM Integration:** Utilize the SAM model from Meta AI to achieve high-quality object segmentation with a single click.
3. **YOLO Object Detection:** Implement the YOLO framework for real-time object detection, focusing on terrain types and obstacles.
4. **Model Training:** Train the SAM-enhanced terrain classification model and YOLO object detection model using the collected dataset.
5. **Integration:** Combine the capabilities of SAM and YOLO to enable simultaneous object segmentation and terrain classification in outdoor environments.
6. **Evaluation:** Assess the algorithms' performance using various metrics, including accuracy, precision, recall, and F1-score, in a range of outdoor scenarios.

## General

The theoretic part of the thesis can be done completely in home office. For the field experiments, the student should be able to come to the chair to Dürnast (close to Weißenstephan). A general understanding of machine learning specially Computer Vision is beneficial. Structured and independent work is anticipated. The thesis is intended as Master's thesis, but can be adapted to fit different thesis needs on Master's level.

## Interested? Contact us!

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