

Winter wheat biomass and yield prediction from drone image analysis using deep learning

Background

As global food demand rises, accurate and timely crop yield predictions become crucial for ensuring food security. Traditional methods, like field surveys and satellite remote sensing, have limitations in spatial and temporal granularity. Unmanned Aerial Vehicles (UAVs) offer a solution with their high-resolution data capture capabilities. Specifically, the fusion of RGB and multispectral (MS) data from UAVs, combined with textural and structural information, provides a comprehensive view of crop health and growth. When integrated with advanced machine learning techniques, such as deep learning, this multimodal data can be harnessed to predict winter wheat biomass with enhanced accuracy, offering valuable insights for agricultural decision-making.



Possible topics of focus (by agreement)

The primary objectives of this project are as follows:

- 1. Multimodal Data Fusion:** Integrate RGB and MS datasets of varying resolutions to formulate a comprehensive dataset encapsulating both color and spectral attributes of winter wheat.
- 2. Image Segmentation:** Employ image processing and Features engineering techniques to separate background from the foreground (plants) for the purpose of estimate plant height and Vegetation Fraction (VF), and green leaf area.
- 3. Deep Learning Model Development:** Applying a deep learning framework for biomass prediction or object detection (ear counting to serve as an indicative metric for yield) by utilizing the derived features including spectral, textural, and temporal features.

Prerequisites (depending on work package):

- Recommended lectures:
 - o available in SS: Precision Agriculture (WZ1060)
 - o available in WS: Remote Sensing of Agriculture and Vegetation (LS10003)
- (Good) Proficiency in Python with TensorFlow
- Knowledge of machine learning
- Motivation for agricultural topics

Contact Information:

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