

Title: Integrated AI analysis of geometric and spectral UAV data using machine learning to derive high-resolution bio-physical and bio-chemical plant properties in agroforestry systems

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Abstract:

Agriculture, forestry and the food system play a major role in the global greenhouse gas (GHG) balance. This results in the need for adjustments to agricultural practice to meet the 2030 Climate Action Program while increasing resilience to weather extremes and other impacts of global warming. One approach for reducing GHG emissions and adopting agriculture to climate change are agroforestry systems, which are characterised by the spatial integration of trees (especially fruit, fast growing or timber trees) and field crops.

The main objective of this PhD project is to develop and investigate suitable methods for monitoring and assessing biodiversity in agroforestry systems by combining high spatial resolution multispectral and LiDAR data from Unmanned Aerial Vehicles (UAV) systems. This should be done by an integrated AI analysis of geometric and spectral UAV data using machine learning to derive high-resolution bio-physical and bio-chemical plant properties in agroforestry systems. These parameters form the basis for a 3D modelling of biomass in arable and tree strips (yield/biomass/carbon monitoring). In addition, multi-temporal data (summer/winter) are combined in order to be able to integrate additional information from different tree conditions (leafy/non-leafy) for biomass modelling. Finally, the analysis of the interaction of tree strips/landscape elements and arable crops, as well as the mapping of CO₂ storage as a function of above-ground biomass and site factors must be of interest.

Desired skills of the applicant:

- An above-average university degree (MSc or equivalent) in Agricultural Sciences, Geography, Geoinformatics or related discipline
- preferable a strong interest and knowledge in agriculture and environmental processes
- Sound background in remote sensing, ideally UAV-based systems and data analysis
- Knowledge in data fusion and machine learning, ideally including deep-learning
- Programming skills (preferably Python)