Title: Interpretable machine learning methods for identifying plant stress in crops by using and optimizing UAV data

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Abstract:
Recent advancements in sensor technology, mechanization, and automation have significantly improved precision agriculture methods, enabling early and accurate detection of plant stress for reducing both qualitative and quantitative losses in crop yield and promoting sustainable agricultural practices. As farming becomes increasingly challenging due to unpredictable weather patterns in Germany, more accurate monitoring systems for crop stresses become more and more important, allowing farmers to take proactive measures to improve their management. Unmanned Aerial Vehicles (UAV) can provide high-resolution imagery and help to detect anomalies in plant growth and optimize crop health assessment, leading to better decision-making by farmers and ultimately improving food security. Machine learning methods offer significant advantages for the analysis of multidimensional and high-resolution UAV imagery. Hence, the aim of this PhD project is to develop and optimize adequate AI approaches for the derivation of crop-specific stress factors (e.g. nutrient deficiencies, water-deficit stress, weed-, pest- and disease-infestation) and the spatial detection of plant stress from multisensory UAV imagery (RGB, multispectral, hyperspectral, thermal) and provide guidelines to improve the UAV methodological framework. By achieving this goal, this research provides the technical basis for a selective and site-specific plant protection, which is of increasing relevance in agriculture.

Desired skills of the applicant:

- An above-average university degree (MSc or equivalent) in Geoinformatics, Computer Science or related discipline with focusing on remote sensing
- Sound background in remote sensing, ideally UAV-based systems and data analysis
- Knowledge in data fusion and machine learning, ideally including deep-learning (image classification and object detection, xAI)
- Programming skills (preferably Python)