A Multimodal UAV-Ground Dataset for Precision Agriculture

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Résumé

The advent of precision agriculture has highlighted the growing demand for high-resolution, multimodal data capable of capturing the complexity of crop dynamics in the field. As the agricultural sector increasingly shifts toward data-driven decision-making, integrating aerial and ground-based measurements has became essential for monitoring plant health, optimizing resource use, and improving yield forecasting. In this context, drones equipped with multispectral imaging sensors offer unprecedented capabilities for capturing detailed spatial and spectral information across vast agricultural landscapes.

This study introduces a new multimodal dataset designed for precision agriculture applications, combining high-resolution UAV imagery with synchronized ground-level biophysical measurements. Data acquisition was conducted using a DJI Matrice 300 RTK equipped with a 10-band MicaSense Dual Sensor over several agricultural sites in northern France. The resulting drone imagery, captured at a 5 cm ground sampling distance (GSD), underwent photogrammetric processing to generate orthomosaics, digital elevation models, and reflectance indices. Calibration procedures involving a sun sensor and reflectance panel ensured radiometric consistency.

Alongside the aerial data, field campaigns provided synchronized measurements of leaf area index (LAI), soil moisture, biomass, and irrigation records. Flight parameters were carefully optimized to balance resolution, coverage, and operational constraints-flying at ˜70–75 m AGL, 8 m/s speed and 80%/75% forward and side overlap. After processing, we generated a range of useful products-like orthomosaics, elevation models, and vegetation indices.

This dataset provides a crucial link between aerial observations and ground-truth measurements, enabling robust validation and development of data-driven agricultural models.

Keywords: Multimodal learning, UAV, multispectral imagery, soil moisture, crop yield prediction, precision agriculture.

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