Cooperative Robotic Systems for Precision Agriculture and Plant Health Management

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Introduction

- Aerial and ground robotics for plant-centric crop management.
 - Nutrient deficiency detection/quantification [Nitrogen (N)/ Potassium (K)]
 - 3D Reconstruction of plants
 - Optimized precision fertilizer recommendation

• Benefits:

- Improved crop yield and quality
- Decreased environmental impact
- Decreased input costs (fertilizer)



Nutrient Deficiency Detection

- Assessment via RGB imagery then Hyperspectral imaging
- Unified N/K deficiency detection using Multi-modal sensor fusion
- Multi-resolution approach working across spatio-temporal data

3D Reconstruction

 Reconstruction and segmentation for model-based assessment (~90%)

Autonomy, Multi-Spectral, and Sensor Fusion

- Autonomous path planning to locally cover the crop area and globally ensure auto-homing and full area coverage over 3D morphologies.
- Multi-spectra image alignment and map projection.
- Multi-modal sensor fusion for onboard localization and mapping.







Future Tasks

- Extend to deficiencies other than Nitrogen.
- Precision Fertilizer Recommendation
 - Spatio-temporal and deficiency-aware crop monitoring
 - Computer modeling for optimal fertilizer recommendation based on the EPIC model.
- Use a ground robot (e.g., Rowbot) in collaboration with UAVs for data gathering.
- Technology transition and open-sourcing.