Multi-View Robotics Imaging System for Distinguishing Visually Similar Wheat Diseases

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Abstract

Plant diseases threaten global crop production and cause damaging yield losses. This problem requires an accurate detection method for effective assessment of plant diseases, especially for breeding programs. Although advances in technologies such as RGB/spectral imaging and machine learning have progressed significantly, existing data collection systems struggle to capture high-quality multi-view images of lower-canopy portion of the plants that are essential for distinguishing diseases appearing similar from above the canopy. Drones have been commonly used to detect plant diseases; however, they lack the capacity of multi-view imaging at the lower-canopy. This makes them infeasible for distinguishing crop diseases. To fill the gap, this research proposes a lightweight, ground-based robotic platform integrating a 6-DOF manipulator with RGB and RGB-depth cameras. The system dynamically determines the 3D coordinates of target plants, which will further guide the robotic arm to capture multi-view RGB images from the corresponding plant. Expected outcomes for this study include a minimalist robotics system that can capture lower-canopy and multi-view RGB images of winter wheat for discriminating between two visually similar rust infections to support breeding programs. We aim to advance precise, adaptable and cost-effective data collection using a robotics arm system for plant disease assessment.

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