Autonomous Drone-Based Early Detection and Precision Control of Wheat Diseases

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Nearly 30 farmers take their lives everyday in India due to immense socioeconomic pressure from their families. One prevalent factor to this stress is the low crop yield, often caused by diseases in plants that go unnoticed until it is too late. By the time farmers detect these diseases they are forced to apply pesticide across entire wheat fields, not only increasing their costs, but also harming our environment. My research addresses this problem by an autonomous drone system for early detection of disease in wheat plants and the application of pesticides at targeted infected plants. The drone uses a Raspberry Pi 4 as an edge device to run a grid-based flight algorithm, an Arducam 12MP camera to capture high-quality images at each grid point, and a diaphragm pump for precision spraying. Upon capturing the image at each grid, it is sent to a VGG19-based CNN (90.81% accuracy) and Random Forest Model (93% accuracy) for classification, and their outputs are converted to a single decision using a hybrid decision fusion algorithm. If the decision reveals a disease class, then the pesticide-spraying system is activated. At a field test in UC Davis across 25 grids, the system was able to identify 17 grids correctly with confidence consistently above 80%. Altogether, this demonstrates the practicality of this prototype in a real farm, not only saving the livelihoods of countless farmers across the world, but also reducing unnecessary pesticide usage.

Awards Won: