A Novel Approach to Citrus Disease Management: Leveraging Computer Vision, Machine Learning and Convolutional Neural Networks

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Huanglongbing (HLB) is an incurable disease that affects citrus trees. This citrus disease is also often referred to as "citrus greening." This disease was first spotted in China in the early 1900s and was kept under control for a century. The disease started infecting plants in Florida – the largest orange-producing state in the United States – in 2005. By 2012 HLB had spread most citrus farms in the entire state of Florida and started to wreak havoc in the billion-dollar citrus industry in Florida. The disease also threatens the citrus industry in California and other states. There are microscopic, molecular, and spectroscopic techniques to detect HLB on citrus plants today, but they require a laboratory setting. These techniques are hard to implement on a large citrus grove. The only way growers could manage this disease today is by visually inspecting the plants and then removing the infected plants to control the problem. In this research project, an AI-powered method and process were defined, and an economically sustainable system was developed to identify HLB disease on the citrus plants and provide early detection signals on the citrus growers. The goal of this project was to research and develop a predictive model using Computer Vision, Artificial Intelligence, and Deep Learning using Convolutional Neural Networks to identify citrus leaves infected with the HLB disease and to implement a remotely piloted aerial system to detect the citrus leaves infected with the disease in citrus groves using the predictive AI model. When citrus plants or citrus leaves were placed in front of the HLB detection system, the system was able to identify accurately 90% of the time whether the plants were infected with HLB, and thus, the project achieved the engineering goal.

Awards Won:

Fourth Award of $500