Implementing a Novel Multimodal Neural Network Approach Using Dynamic Hyperparameter Selection Within an Unmanned Aerial Vehicle for the Early Detection of Crop Diseases

Acharya, Laasya (School: William Mason High School)

As global food demand continues to increase, food supply continues to be consistently damaged by crop disease. At least 20% of crops worldwide are lost in the harvest and post-harvest stages. Early disease detection can help mitigate these losses; however, current detection systems are lacking in accuracy and efficiency. The proposed solution involves an Unmanned Aerial Vehicle (UAV) working in tandem with a multimodal neural network system for the widespread early detection of crop diseases. The network utilizes aerial and close-up images and videos. This model is then integrated into the UAV for the full system. All inputs (2000 total across 15 crop diseases) were validated by experts in the field. The dataset was split into 80%/20% for training and testing. The model's image branch consists of 9 total layers with 6 distinct types and the model's video branch consists of 6 distinct total layers. Dynamic hyperparameter selection was established during the training stage, allowing the model to select its own hyperparameters based on the ongoing epoch accuracy. The next stage was testing, which replicated how the model would be employed in a real-life situation. The UAV model with the integrated neural network establishes an autonomous method for disease detection in crops through an AI model. In conclusion, this project shows that a multimodal network with dynamic hyperparameter selection can be developed in conjunction with a UAV for the early detection of crop diseases.

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