Assessment of potato late blight from UAV-based spectral imagery

What's it about?

Late blight is a major cause of crop loss. The disease, caused by *Phytophthora infestans*, can cause catastrophic crop loss if not controlled early. Visual monitoring for the disease requires significant time as well as human effort to walk the crop.

The drone used to monitor crops

(a) (b) (c) (d)

Symptoms of late blight in potatoes with (a) <25%; (b) 26-50%; (c) 51-75%; (d) >75% leaf area infected

The authors describe a method of detecting late blight using hyperspectral images taken by a drone. The drone was pre-programmed to fly in a set pattern over a 3.2ha crop, producing images with resolution down to 3cm^2, within about 8 minutes.

One issue encountered was the separation of weeds from potato plants; where weeds were not present the model was better able to recognise potato plants and separate them from areas of soil.

A number of different modelling approaches were developed and compared. Late blight was detected by changes in reflected wavelengths and the ragged shapes of plants which had lost their leaves.

What was concluded?

All the computer-generated models were able to detect areas with approximately 25% of leaf area or more affected by disease. There was a tendency to overestimate the diseased area by about 25%. The study indicates that drone images can be used to efficiently detect late blight in potato crops.

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Assessment of potato late blight from UAV-based multispectral imagery

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ABSTRACT

This paper evaluates a method for assessment and detection of potato late blight using UAV-based multispectral imagery. Traditional methods of detection and mapping of late blight are time consuming, require large human effort and, in many cases, are subjective. The approach evaluated integrates morphological operations and evaluates the performance of five Machine Learning (ML) algorithms: Random forest, Gradient Boosting Classifier, Support Vector Classifier, Linear Support Vector Classifier and K-Nearest Neighbours Classifier to detect zones of late blight occurrence. The main components of the proposed approach are: (i) radiometric and geometric correction of raw images; (ii) soil and weed removal by application of a thresholding technique; (iii) a supervised classification procedure using ML algorithms; and (iv) use of trained models to classify a new data set. The performance of the method is evaluated on two dates in an experimental potato field. Results showed that the Linear Support Vector Classifier and Random Forest algorithms had the best performance in terms of both accuracy metrics and run time. The study showed that the proposed method allows the detection of late blight with little human intervention.