PRACTICE ABSTRACT nº 15

Early detection of late blight in potato crops using drone imagery and AI-based models

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Potatoes are the **main vegetable consumed in Morocco** with an average of 30 to 45 kg per inhabitant per year. At the national level, its production for the year 2014 reached 1,814,350t. This production is intended for more than 98% for the national market. In the province of El Hajeb, potatoes covered an **average of 5,200 ha, or 41% of the total market gardening area**, during the period 2010–2016. In total, 65% of this area is managed by drip irrigation. Total production reaches an average of 180,000t, of which 65% is in seasonal cultivation (March-July) and the rest out of season (August-December). The yields obtained are around 30 t/ha.

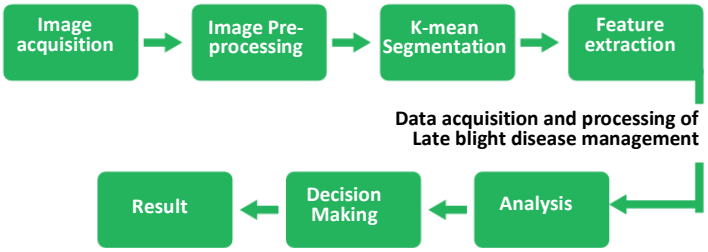
Late blight, caused by *Phytophthora infestans*, is one of the **most devastating diseases affecting potato crops in the region**. So timely detection and management are crucial to minimize yield losses and reduce excessive fungicide application. This project proposes a drone-based early warning system leveraging **multispectral imaging** and **deep learning models** (MobileNet and EfficientNet) to detect late blight at different infection stages. The system captures high-resolution aerial images using drones equipped with multispectral sensors, processes the images to extract vegetation indices such as NDVI and NDRE, and classifies infected regions using convolutional neural networks (CNNs).

General procedure for early detection and management of Late blight disease

1. **Agronomic trials are reconducted during autumn and winter seasons (2022-2023),** which are more suitable for the development of the disease (humidity requirement).
2. **Development of algorithm for early detection of the disease** will be based on scenes collected by the drone.
3. **Use of Mobile application for notification** to farmers regarding the risk related to the disease and **best timed treatments scheduling.**

We focus on the **use of multispectral wavebands (red-edge) and near-infrared) and spectral vegetation indices** as relevant features predictors of general stress in plants.

The incidence and severity of late blight symptoms are **assessed in experimental plots by visual observation of leaf symptoms** using **appropriate sampling and the late blight disease rating scale**.



Results

The prototype includes an automated pipeline for **data collection, image processing, disease classification, and user visualization**. A mobile application provides **alerts** and **disease progression analysis** to assist farmers in making informed decisions. Comparative performance analysis of MobileNet and EfficientNet demonstrates that EfficientNet achieves higher accuracy (94.2%) in classification compared to MobileNet (92.5%).

Despite its advantages, the system has certain constraints, including weather dependency, potential misclassifications, and the need for periodic model retraining. However, its **automated, scalable, and precise monitoring capabilities** significantly improve current disease management practices. This research contributes to the advancement of **precision agriculture** by integrating **remote sensing, AI, and decision-support systems** for sustainable crop protection.

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