Optimizing Plant Health Monitoring with Machine Learning and Deep Learning.

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Abstract

This paper highlights how Artificial Intelligence (AI) can revolutionize the detection of plant diseases in agriculture to address the urgent need for effective solutions. As the population is rapidly growing and food demand rising, protecting the crops and boosting the yield is crucial. Traditional detection methods are slow, laborious and require specialized knowledge limited to a few, resulting in substantial economic and environmental harm. AI-driven plant disease detection provides numerous advantages to overcome agricultural challenges by making use of machine learning and deep learning. As these models have continuous learning capabilities, they improve over time, enhancing their effectiveness and adaptability. Real-world examples show how using AI to detect plant diseases helps farmers grow more food while using fewer pesticides. The proposed idea involves using the machine learning algorithm Random Forest along with feature extraction techniques like hu moments, haralick texture and color histogram to detect plant diseases. This approach offers several benefits over traditional methods such as enhanced accuracy, efficiency and scalability. The project is divided into five major phases: dataset acquisition, image preprocessing, segmentation, feature extraction and classification. The proposed system produces output with an accuracy of 96.12%. The dataset used is the New Plant Diseases Dataset which is recreated from the original PlantVillage Dataset using offline augmentation. Future research will include the use of the Convolutional Neural Networks (CNN) algorithm to enhance the capabilities of the plant disease detection system. Since CNN is a deep learning algorithm, it will improve the accuracy and robustness of disease classification.

Objectives

- To develop a machine learning algorithm capable of detecting plant diseases to prevent the spread of diseases and minimize crop losses.

- To provide the farmers with recommendations to make decisions about disease management and crop protection.
- To analyze the performance of the system with existing similar systems in this field.
- To evaluate the impact of the proposed machine learning and deep learning solutions on crop yield improvement and resource optimization.
- To explore the scalability of the proposed system for use in different agricultural contexts and crop varieties.