

Plant Disease Prediction

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Abstract: *The rapid advancement of artificial intelligence has enabled data-driven automation in precision agriculture. Among these technologies, deep learning has emerged as a highly effective solution for disease diagnosis in plants through image analysis. Manual identification of crop diseases is prone to human error and limited scalability, creating a strong need for automated, real-time systems. This study proposes a robust Convolutional Neural Network (CNN)-based model for plant disease detection and classification using Python and TensorFlow, with the aim of enhancing crop management and yield prediction.*

The proposed model utilizes a MobileNetV2 transfer learning framework trained on the PlantVillage dataset, which includes more than 50,000 labeled leaf images from multiple plant species. To improve generalization, extensive data preprocessing and augmentation (rotation, flipping, scaling, and normalization) were applied. The CNN extracts spatial features from leaf textures and color patterns, enabling accurate classification of common diseases such as

Blight

Rust

Leaf Spot

Mildew

Experimental results show that the model achieves a training accuracy of 97% and a validation accuracy of 95%, with a low cross-entropy loss of 0.08. Additionally, the model records a precision of 94%, recall of 93%, and an F1-score of 93.5%, indicating reliable classification performance across all disease categories.

The findings demonstrate that the integration of deep learning into agricultural diagnostics can significantly reduce the dependence on manual inspection and expert intervention. This system supports early disease identification and facilitates targeted treatment recommendations. The work contributes to the advancement of smart farming ecosystems, providing a foundation for future extensions such as real-time mobile deployment, IoT-based disease monitoring, and cloud-integrated crop management platforms..

Keywords: Deep Learning; Convolutional Neural Network (CNN); Plant Disease Detection; MobileNetV2; Image Classification; Python; TensorFlow; Data Augmentation; Precision Agriculture; Smart Farming; Artificial Intelligence.

