

Tomato Leaf Disease Classification Using Deep Learning Techniques

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Abstract

Tomato leaf diseases pose a significant threat to crop yield and quality, necessitating accurate and timely detection methods. This study focuses on developing an automated tomato leaf disease classification system using deep learning techniques. We utilized the PlantVillage dataset, sourced from Kaggle, which contains diverse images of healthy and diseased tomato leaves. A pre-trained VGG16 convolutional neural network was fine-tuned on this dataset to classify different types of leaf diseases. The model was trained and evaluated, achieving an accuracy of 89.23%, demonstrating its effectiveness in identifying disease patterns from leaf images. When compared to other approaches reported in the literature, such as traditional machine learning classifiers (e.g., SVM and Random Forest) which typically achieve accuracies around 75-85%, and even some earlier deep learning models like AlexNet or simpler CNN architectures that report accuracies in the range of 80-88%, our fine-tuned VGG16 model demonstrates a noticeable performance improvement. The high accuracy indicates the models potential for real-world application in assisting farmers and agricultural experts with early disease diagnosis, thereby supporting better crop management and reducing losses. Future work may involve expanding the dataset, incorporating more disease categories, and optimizing the model for faster inference on mobile devices, making plant disease diagnosis more accessible in the field. This study highlights the promising role of deep learning models in precision agriculture, offering a scalable and reliable tool for combating tomato leaf diseases.

Keywords: VGG16, Deep learning, CNN