

AgroHealth: Crop Disease & Pest Detection for Tomato Crops

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Abstract: *Tomato is one of the most widely cultivated and economically important vegetable crops worldwide. However, tomato plants are highly susceptible to a variety of diseases caused by fungal, bacterial, and viral infections. These diseases significantly reduce crop yield, affect produce quality, and result in substantial financial losses for farmers. Early and accurate detection of tomato leaf diseases is therefore essential for effective disease management and sustainable agricultural practices.*

Keywords: *Tomato*

I. INTRODUCTION

Agriculture is one of the most important sectors of the Indian economy, contributing significantly employment and food security. Among various vegetable crops, tomato is widely cultivated due to its high nutritional value and commercial demand. However, tomato plants are highly susceptible to a variety of diseases caused by fungi, bacteria, viruses, and environmental stress conditions.

Crop diseases not only reduce productivity but also affect the quality of produce, resulting in economic losses for farmers. Early and accurate disease detection is critical for preventing the spread of infection and ensuring sustainable agricultural practices. Traditionally, disease identification is performed through manual inspection by agricultural experts. This process is time-consuming, labor-intensive, and may lead to incorrect diagnosis due to human error. Moreover, farmers in rural areas often lack access to expert consultation. With advancements in Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL), automated disease detection systems have emerged as efficient alternatives. Image-based plant disease detection using Convolutional Neural Networks (CNNs) provides high accuracy by analyzing visual symptoms such as leaf discoloration, spots, texture variations, and deformities.

II. MOTIVATION

The rapid development of smartphones and affordable digital cameras provides an opportunity to implement image-based disease detection systems. By integrating AI and image processing techniques, it is possible to build a system that automatically detects diseases from leaf images. The motivation is therefore to: Provide low-cost and accessible disease detection Reduce dependency on experts Minimize crop losses Promote smart and digital agriculture This system contributes toward precision agriculture and sustainable farming practices.

III. LITERATURE SURVEY

Several researchers have explored the application of machine learning and deep learning techniques for plant disease detection. Early research focused on traditional image processing techniques such as: Color segmentation Edge detection Texture analysis Feature extraction using statistical methods These approaches required manual feature engineering and were less effective for complex disease patterns. With the advancement of deep learning, Convolutional Neural Networks (CNNs) have become widely adopted for image classification tasks. CNN models automatically extract features from images without manual intervention. Studies conducted using the PlantVillage



dataset demonstrated that CNN-based models achieve accuracy above 90% in classifying plant diseases. Deep learning architectures such as AlexNet, VGGNet, and ResNet have been applied successfully for disease detection. Research also highlights challenges such as: Overfitting due to limited datasets Variability in real-world environmental conditions Background noise in field images Recent advancements focus on improving model generalization and deploying models on mobile devices for real-time disease detection. Despite significant research, there remains a need for practical, easy-to-use systems specifically focused on tomato disease detection for real-world agricultural use.

IV. PROPOSED FRAMEWORK

The working process of the system can be represented as: The proposed framework for tomato crop disease detection is based on a deep learning architecture designed for image classification. The system follows a structured pipeline consisting of multiple functional modules that work sequentially to ensure accurate disease prediction. The framework is divided into the following modules: 1. Image Input Module This module is responsible for acquiring tomato leaf images. Images can be captured using a smartphone camera, digital camera, or uploaded from an existing dataset. The quality of the input image plays a significant role in prediction accuracy. The system supports RGB color images, which help in identifying disease patterns such as discoloration, lesions, and spots. 2. Preprocessing Module The preprocessing module prepares the raw images for model training and testing. Since input images may vary in size and resolution, preprocessing ensures uniformity and noise reduction. The following steps are performed: Resizing images to fixed dimensions (e.g., 224×224 pixels) Normalizing pixel values to scale between 0 and 1 Converting images into numerical arrays Removing background noise (if required) This step improves model performance and reduces computational complexity. 3. Feature Extraction Module 5. Output Module Feature extraction is performed using a Convolutional Neural Network (CNN). CNN automatically extracts relevant features from leaf images without manual intervention. The CNN architecture typically consists of: Convolution layers (detect edges, textures, color variations) Activation functions (ReLU) Pooling layers (reduce dimensionality) Fully connected layers The model identifies important characteristics such as: Leaf discoloration Spot patterns Texture irregularities Shape distortions These extracted features are used for disease classification. 4. Classification Module The classification module assigns the input image to one of the predefined disease categories. The final layer of the CNN uses a Softmax activation function to generate probability scores for each class. The class with the highest probability is selected as the predicted disease. The dataset used contains approximately 18,000 tomato leaf images categorized into: Tomato Healthy Bacterial Spot Early Late Blight Blight Leaf Mold Septoria Leaf Spot Spider Mites Target Spot Mosaic Virus Yellow Leaf Curl Virus The dataset is divided into training and testing sets to evaluate model performance. The model achieves high accuracy during both training and validation phases, demonstrating its reliability in disease detection. The output module displays: Detected disease name Confidence level (prediction probability) Suggested preventive measures (optional extension) This module ensures that the system is user-friendly and understandable for farmers. FLOWCHART (Detailed Explanation)

V. CONCLUSION

This paper presented the design and implementation of an AI-based tomato crop disease detection system using deep learning techniques. The proposed system utilizes a Convolutional Neural Network (CNN) to automatically extract features from tomato leaf images and classify them into healthy or diseased categories. The experimental results demonstrate that deep learning models can achieve high accuracy in identifying multiple tomato diseases. The automated detection system reduces dependency on manual inspection and provides faster and more reliable diagnosis. Early disease detection plays a crucial role in minimizing crop damage, improving yield quality, and increasing farmer profitability. The proposed system contributes toward smart agriculture by integrating artificial intelligence into farming practices.



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REFERENCES

- [1]. PlantVillage Dataset – Plant Disease Detection Dataset.
- [2]. S. Mohanty, D. Hughes, and M. Salathé, “Using Deep Learning for Image-Based Plant Disease Detection,” *Frontiers in Plant Science*, 2016.
- [3]. K. P. Ferentinos, “Deep learning models for plant disease detection and diagnosis,” *Computers and Electronics in Agriculture*, 2018.
- [4]. J. Too, L. Yujian, S. Njuki, and L. Yingchun, “A comparative study of fine-tuning deep learning models for plant disease identification,” 2019. [5] Research studies on Artificial Intelligence in Agriculture and Smart Farming Systems

