Plant Disease Detection Project Report

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1. Introduction

The Plant Disease Detection project aims to assist farmers and agricultural specialists by using Artificial Intelligence to identify plant diseases through leaf images. This tool provides a fast and efficient way to diagnose diseases, reducing dependency on manual inspection and improving agricultural productivity.

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2. Objectives

- Build an AI model capable of identifying plant diseases from images.
- Create a user-friendly web app using Streamlit for disease detection.
- Provide detailed predictions with high accuracy and confidence.

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3. Dataset Overview

- Dataset Composition: Images of healthy and diseased plant leaves.
- Classes:
    1. Tomato-Bacterial Spot
    2. Potato-Early Blight
    3. Corn-Common Rust
- Preprocessing:
    - Resized images to 256x256 pixels for uniformity.
    - Applied normalization for better model performance.

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4. Methodology

1. Model Development:
    - Built a Convolutional Neural Network (CNN) using TensorFlow and Keras.
2. Streamlit Integration:
    - Developed a web app for easy interaction with the model.
3. Image Processing:
    - Used OpenCV to resize, normalize, and preprocess images for prediction.

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5. Features

- Image Upload: Supports .jpg, .png, and .jpeg formats.
- Prediction: Identifies plant diseases and provides confidence scores.
- Visualization: Displays uploaded images alongside predictions.

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6. Tools and Libraries

- TensorFlow and Keras (Model Training & Inference)
- Streamlit (Web App Interface)
- OpenCV (Image Processing)
- NumPy (Numerical Operations)

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7. Results

- Accuracy: Achieved high accuracy on the test dataset (average confidence > 90%).
- Success: Successfully classified all three diseases.
- Integration: The web app seamlessly integrates model predictions.

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8. Challenges and Learnings

- Challenges:
    - Variability in dataset images.
    - Adapting the model for real-time predictions.
- Learnings:
    - Enhanced understanding of CNNs, image preprocessing, and app deployment.

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9. Conclusion and Future Work

- Conclusion: Successfully demonstrated AI's role in agriculture.
- Future Improvements:
    1. Expand the dataset to include more diseases.
    2. Improve model accuracy with advanced architectures.

3. Add localization features to highlight diseased areas on leaves.

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10. How to Run the Project

1. Install necessary libraries:

   ```
   bash
   Copy code
   pip install streamlit opencv-python keras tensorflow numpy
   ```

2. Place the trained model file (`plant_disease_model.h5`) in the project directory.
3. Run the app:

   ```
   bash
   Copy code
   streamlit run plant_disease_detection.py
   ```

4. Upload a plant leaf image to detect diseases.