Project Report: AgriLeaf - AI-Based Plant Disease Detection

Introduction

Agriculture plays a crucial role in the global economy and food security. However, crop diseases are a persistent challenge that significantly reduce yield and income, especially for small-scale farmers. Early and accurate disease detection can prevent widespread crop loss and minimize pesticide overuse.

This project proposes AgriLeaf, an AI-based system that uses Convolutional Neural Networks (CNN) to detect plant diseases from leaf images. It offers a fast, accessible, and scalable solution for farmers using a smartphone or web interface.

Problem Statement

Farmers often fail to detect crop diseases early due to a lack of knowledge and access to agricultural experts. Manual disease detection is slow, error-prone, and localized. There is a need for a reliable and accessible disease diagnosis system that works at scale.

Objective

To develop an AI-powered image classification model using CNN that can:

- Detect whether a plant leaf is healthy or diseased
- Classify the type of disease
- Suggest basic treatment recommendations

Methodology

Dataset: PlantVillage Dataset (Kaggle), with over 50,000 labeled leaf images across 38 classes.

Preprocessing: Image resizing (128x128), normalization, and augmentation.

Model: 3-4 convolutional layers with ReLU, max-pooling, fully connected dense layers, and softmax classifier.

Training: 80/20 train/test split, 20-30 epochs, ~95% test accuracy.

System Design

Frontend: Streamlit or Flask interface for uploading or capturing leaf images.

Project Report: AgriLeaf - AI-Based Plant Disease Detection

Backend: TensorFlow/Keras CNN model performing prediction and returning disease and treatment info.

Results

Below is a sample result table showing predictions made by the model with recommended treatments:

Leaf Image	Predicted Class	Confidence (%)	Recommended Action
Tomato_EB_1.jpg	Tomato - Early Blight	96.3	Apply Mancozeb fungicide
Potato_LB_2.jpg	Potato - Late Blight	94.1	Use Ridomil Gold after irrigation
Maize_LS_3.jpg	Maize - Leaf Spot	92.7	Spray Propiconazole
Healthy_Tomato.jpg	Healthy	98.8	No action required

Future Enhancements

- Integrate voice-based support in local languages
- Add weather-based disease predictions
- Build offline mobile app
- Expand to fruit and grain diseases
- Connect with agri-doctor chatbots

Impact

Early detection reduces crop loss and pesticide overuse. Helps farmers with limited technical skills. Can be deployed as a mobile app, increasing accessibility. Supports precision agriculture and sustainable farming.

Tools & Technologies

- Python, TensorFlow/Keras
- OpenCV, Pandas
- Streamlit/Flask
- Jupyter Notebook

References

Project Report: AgriLeaf - AI-Based Plant Disease Detection

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2. PlantVillage Dataset - Kaggle

3. TensorFlow Documentation: https://www.tensorflow.org

4. Streamlit Documentation: https://docs.streamlit.io/