MAHATMA EDUCATION SOCIETY'S

PILLAI COLLEGE OF ARTS, COMMERCE & SCIENCE

(AUTONOMOUS), NEW PANVEL

Plant Disease Prediction CNN Image Classifier

IN PARTIAL FULFILLMENT OF

MASTER OF INFORMATION TECHNOLOGY

SEMESTER IV 2024-25

PROJECT GUIDE

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Mahatma Education Society's

Pillai College Of Arts, Commerce & Science

(Autonomous)

Affiliated To University of Mumbai

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CERTIFICATE

This is to certify that **Mr Sharon Philip,** a student of **S.Y. M.Sc. IT, Semester IV,** has successfully completed her project work in the subject of **Deep Learning** during the academic year 2024-25. The project has been carried out under the guidance of **Prof. Nisha Yadav,** as a partial requirement for the fulfilment of the curriculum for the **Degree of Master of Science in Information Technology** from the **University of Mumbai.**

Place: New Panvel

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Signature of Faculty

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Plant_Disease_Prediction_CNN_Image_Classifier

1. Introduction

Plant diseases pose a significant threat to agriculture, leading to reduced crop yield and economic losses. Traditional methods for detecting plant diseases require expert knowledge and are time-consuming. Deep learning techniques, particularly **Convolutional Neural Networks (CNNs)**, have proven to be effective in **automated plant disease classification** using image datasets. This project aims to develop a **CNN-based image classifier** to predict plant diseases from leaf images.

2. Problem Statement

The early detection and classification of plant diseases are crucial to prevent outbreaks and minimize damage. Manual detection is impractical for large-scale farming. An **automated system using deep learning** can provide accurate and efficient plant disease classification, enabling farmers to take early action.

3. Technology Stack

- **Programming Language**: Python
- **Deep Learning Framework**: TensorFlow, Keras
- **Image Processing**: OpenCV, Pillow (PIL)
- **Dataset Handling**: Kaggle API, NumPy
- **Visualization**: Matplotlib
- **Deployment**: Gradio for UI

4. Dataset

The **Plant Village dataset** is used, containing thousands of labelled images of plant leaves categorized as either healthy or diseased. The dataset is downloaded from Kaggle and consists of:

- **Segmented Images**
- **Color Images**
- **Grayscale Images**

Dataset Preprocessing:

- Image resizing (224x224 pixels)
- Normalization (scaling pixel values to [0,1])
- Data augmentation (rotation, flipping, zooming)

5. Model Architecture

The CNN model is designed with the following layers:

1. **Conv2D Layer**: Extracts features from the image.
2. **MaxPooling Layer**: Reduces dimensionality and computational complexity.
3. **Flatten Layer**: Converts 2D features into a 1D array.
4. **Dense Layers**:
    - Fully connected layer with **256 neurons** and ReLU activation.
    - Output layer with **softmax activation** to classify images into different disease categories.

6. Training & Results

Model Compilation:

- **Optimizer**: Adam
- **Loss Function**: Categorical Crossentropy
- **Metrics**: Accuracy

Training Details:

- **Epochs**: 5
- **Batch Size**: 32
- **Validation Split**: 20%
- **Evaluation Metrics**: Accuracy, Precision, Recall, F1-score

Performance Evaluation:

- **Accuracy achieved**: Displayed using accuracy vs. epoch graph.
- **Loss Analysis**: Loss vs. epoch graph for monitoring convergence.

7. User Interface (UI)

A **Gradio-based UI** is developed to allow users to upload plant leaf images for real-time classification.

Features:

- Upload an image
- Model predicts and displays the disease category
- User-friendly interface with instant results

8. Conclusion

This project successfully demonstrates the application of **CNNs in plant disease prediction**. The trained model can classify various plant diseases with high accuracy, offering a **cost-effective and scalable solution** for agricultural disease monitoring. Future enhancements could include **expanding the dataset, improving model architecture, and integrating the system with mobile applications** for real-world deployment.

9. OUTPUT