Plant Disease Detection System for Sustainable Agriculture

Problem Statement:

Develop a Convolutional Neural Network (CNN)-based model capable of detecting and classifying plant diseases from images of leaves of various crops such as tomato, potato, maize, cotton, etc. The model should accurately identify both healthy and diseased plant conditions by recognizing their typical leaf visual features. It aims to assist and position small-scale farmers in making early detection and effective disease management decisions.

The objective is to build an efficient CNN-based model that accurately detects and classifies plant diseases from leaf images by implementing both classic and modern image preprocessing techniques, followed by training a CNN model and integrating the system into crop management practices.

Learning Objectives:

- ✓ Understand CNN architectures and their application in image classification.
- ✓ Gain expertise in preprocessing techniques and image augmentation.
- ✓ Train and evaluate deep learning models.
- ✓ Deployment of the model as part of an integrated crop management solution.

Dataset Acquisition and Preparation:

*Collect a diverse dataset of leaf images representing various plant species, including healthy and diseased leaf samples.

Pipeline for Plant Disease Detection:

1.Data Collection & Data Loading:

- Obtain datasets categorized into:
  - Healthy leaves
  - Diseased leaves (different categories based on disease type)
- Structure:
  - train/

    *category1

    *category2….
  - test/

    *category1

*category2….

2.Data Management:

- Store datasets (preferably zipped) on a cloud service like Google Drive.
- Implement logic to automatically fetch datasets into the local system or workspace.

3.Image Preprocessing and Augmentation:

- Resize images.
- Normalize pixel values.
- Apply data augmentation techniques:
    - Rotation
    - Flipping
    - Zooming
    - Shifting
    - Brightness adjustment(opacity)

4.CNN Model Development:

- Build a CNN architecture consisting of:
    - Convolution layers
    - Pooling layers
    - Dropout layers
    - Fully connected layers
- Train the model on the processed dataset.
- Validate the model using the test dataset.

5.Evaluation/Test:

- Assess model accuracy, precision, recall, and F1 score.
- Perform error analysis on misclassified samples.

6.Deployment:

- Deploy the model on a simple web application where users can upload images of leaves and receive predictions about the health status of the plant.

Conclusion:

This system can empower farmers with rapid and reliable disease identification capabilities, thereby improving crop yield, reducing pesticide usage, and promoting sustainable agriculture practices.