Vivekanand Education Society's
Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai, Approved by AICTE & Recognised by Govt. of Maharashtra)
NAAC accredited with 'A' grade

V.E.S.
Since 1962

Semester: VI

Title of the Project:
Plant Disease Detection

Group Members:
Member 1 :Nayaab Jindani (20)
Member 2: Dimple Dalwani (08)
Member 3: Nikita Chhabria (07)

Mentor Name: Dr. Ravita Mishra

Content

Introduction to Project

Agriculture is the backbone of many economies, providing food and resources for billions of people. However, crop production is constantly threatened by plant diseases, which can lead to **reduced yields, economic losses, and food shortages**.

Traditionally, farmers rely on **visual inspection** to detect plant diseases, but this approach has several limitations:

- It requires **expert knowledge**, which many farmers may not have.
- Early symptoms are often **difficult to identify**, leading to delayed intervention.
- Some diseases have **similar visual patterns**, making manual diagnosis inaccurate.

To address these challenges, **machine learning and deep learning** can be leveraged to develop an **automated plant disease detection system**. This project aims to build a **deep learning-based application** that can identify plant diseases from **leaf images** and provide quick, accurate predictions.

Problem Statement

Plant diseases can severely damage crops if not detected early, leading to reduced yield, financial loss, and environmental harm from excessive chemical use. Small-scale farmers often lack access to expert diagnosis. This project offers an AI-powered solution that analyzes leaf images to identify diseases. It empowers farmers to take timely, informed action for better crop health.

Objectives of the project

This project aims to:

1. **Develop a deep learning model** that can classify plant diseases from leaf images with high accuracy.
2. **Train the model using the Kaggle Plant Disease Recognition Dataset** and optimize it for better performance.
3. **Improve prediction accuracy** through techniques such as **data augmentation, transfer learning, and hyperparameter tuning**.
4. **Provide real-time feedback** to users, helping them take preventive actions against plant diseases.

Requirements of the system

Software & Tools:

- **Google Colab** – Model training
- **Python (Flask, TensorFlow/Keras, NumPy, OpenCV)** – Backend
- **HTML**– Frontend application
- **Kaggle dataset** – Training data
- **Jupyter Notebook/Colab** – Experimentation and visualization

Dataset Description

Dataset: Plant Disease Recognition Dataset (Kaggle)

Classes: Healthy, Powdery, Rust (can be expanded in the future)

Data Type: Leaf images (JPEG/PNG)

Size: Thousands of images across multiple plant species

Preprocessing: Image resizing (224x224), normalization, data augmentation

Literature Survey

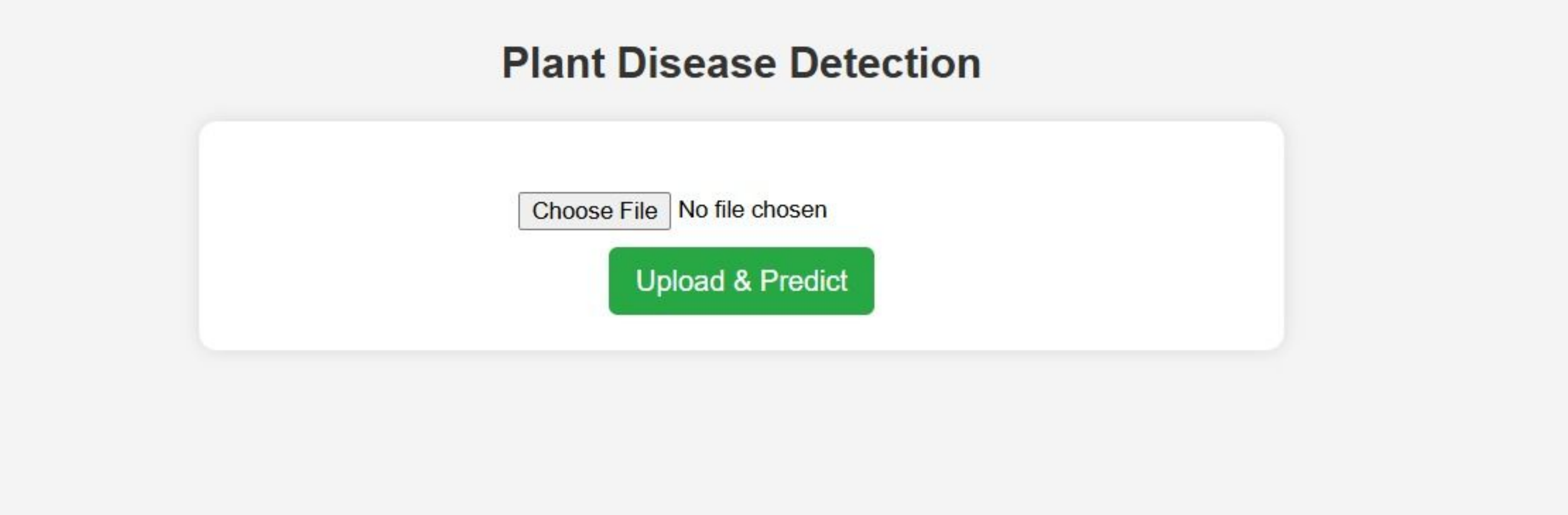
In the paper *"Plant Disease Detection Using Deep Convolutional Neural Network"* by J. Arun Pandian et al., published in *Applied Sciences* (2022), the authors present a 14-layer Deep Convolutional Neural Network (14-DCNN) for classifying plant leaf diseases. They used a large dataset of 147,500 images spanning 58 disease and healthy classes, including a 'no-leaf' category. To improve model performance and handle class imbalance, they applied data augmentation techniques such as Basic Image Manipulation (BIM), DCGAN, and Neural Style Transfer (NST). The model showed strong classification accuracy, evaluated through AUC-ROC curves and occlusion analysis, but its performance gains over existing methods were moderate. A noted limitation was its reliance on face-up leaf images, which could affect performance in varied real-world conditions.

In the paper *"Enhanced YOLOv8 Algorithm for Leaf Disease Detection with Lightweight GOCR-ELAN Module and Loss Function: WSIoU"* by Guihao Wen et al., published in *Computers in Biology and Medicine* (2025), the authors propose an optimized version of the YOLOv8 algorithm for improved leaf disease detection. The enhanced model incorporates a lightweight GOCR-ELAN module to reduce the number of parameters while preserving essential feature representations. Additionally, the standard convolution layers are replaced with a new ADown module to improve feature extraction in complex and occluded environments. A novel loss function, WSIoU, is also introduced to boost localization accuracy and reduce false positives. Evaluated on a Roboflow dataset with 5,494 images across 12 disease categories, the model achieves a 28.7% reduction in parameters and a 43.2% drop in computational cost, while improving MAP50 to 87.7%. With a final model size of just 4.55 MB, the proposed architecture outperforms the baseline YOLOv8 in both efficiency and accuracy, making it well-suited for real-time deployment in resource-constrained agricultural settings.

Proposed System

1. User uploads a leaf image via the web app.
2. The image is sent to the backend Flask API.
3. Deep learning model (Traditonal CNN,YOLOv8,EfficientNet) processes the image.
4. Model predicts the disease category (Healthy, Powdery, Rust).
5. The result and confidence score are displayed on the web application

Implementation



Implementation

Plant Disease Detection

Choose File No file chosen

Upload & Predict

Prediction: Rust

Confidence: 99.91%

Plant Disease Detection

Choose File No file chosen

Upload & Predict

Prediction: Powdery

Confidence: 94.9%

Conclusion

This project successfully demonstrates the application of deep learning in plant disease detection, providing an efficient and user-friendly solution for farmers and agriculturists.

By leveraging Convolutional Neural Networks (CNNs),YOLOV8,EfficientNet and training the model on a plant disease dataset, we have developed an AI-powered system that can classify leaf images into Healthy, Powdery, or Rust categories. The model is deployed using Flask as the backend and is accessible via a web application, allowing users to upload leaf images and receive disease predictions instantly.

References

Plant Disease Recognition Dataset (Kaggle)
https://www.kaggle.com/datasets/rashikrahmanpritom/plant-disease-recognition-dataset

https://www.mdpi.com/2076-3417/12/14/6982
https://www.sciencedirect.com/science/article/abs/pii/S0010482524017153