Project Title

A Project Report

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by

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Under the Guidance of

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ABSTRACT

The "Plant Disease Detection System for Sustainable Agriculture" addresses the critical issue of plant diseases, which threaten global food security and cause economic setbacks for farmers. These diseases are responsible for millions of dollars in crop losses annually and lead to excessive pesticide use, further harming the environment. Traditional methods of disease detection are slow, reliant on expertise, and often inaccessible to small-scale farmers.

To tackle these challenges, this project leverages cutting-edge AI techniques, particularly Convolutional Neural Networks (CNNs), to create a system capable of detecting plant diseases with high accuracy. The methodology involved curating a comprehensive dataset of diseased and healthy plant images from Kaggle, ensuring data diversity to represent real-world conditions effectively. The dataset underwent extensive preprocessing, including removing duplicates, resizing images, and normalizing pixel values.

A CNN model was designed and trained using the preprocessed dataset, achieving robust results in testing and validation. The system's performance metrics, including precision, recall, and crossvalidation results, demonstrated its reliability and generalizability. Additionally, the project integrated the model into a web application using Streamlit, enabling real-time disease detection via mobile and desktop devices.

This solution empowers farmers to take timely preventive actions, reduce crop losses, and promote sustainable agricultural practices. It represents a scalable, cost-effective, and accessible approach to enhancing agricultural productivity while safeguarding the environment.

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CHAPTER 1

Introduction

1.1Problem Statement:

Millions of crops are lost annually due to undetected plant diseases, resulting in economic losses, food insecurity, and environmental harm due to excessive pesticide use. Traditional disease detection methods are slow, expertise-dependent, and often impractical for small-scale farmers, creating an urgent need for an efficient and accessible solution.

1.2Motivation:

The need to enhance agricultural productivity and sustainability inspired this project. By utilizing AI, we aim to provide farmers with a tool that detects diseases early, reducing losses and promoting eco-friendly farming practices.

1.3Objective:

Develop a CNN-based system for accurate plant disease detection.

Create a scalable solution accessible to farmers.

Promote sustainable agriculture by minimizing pesticide overuse.

1.4Scope of the Project:

This project focuses on detecting diseases across multiple crops using image analysis. While the system achieves high accuracy for the included dataset, its effectiveness depends on the diversity and quality of training data.

CHAPTER 2

Literature Survey

2.1 Review relevant literature or previous work in this domain.

Research in plant disease detection has evolved from traditional image processing methods to advanced machine learning techniques. Traditional methods relied on manual observation or heuristic-based approaches, which were often time-consuming and required significant expertise. Machine learning models, particularly Convolutional Neural Networks (CNNs), have demonstrated significant promise in automating and improving disease detection accuracy. However, many existing systems lack real-world applicability due to limited datasets or high computational requirements.

2.2 Mention any existing models, techniques, or methodologies related to the problem.

Several methodologies have been employed in plant disease detection, including:

- Traditional Image Processing Techniques: These include edge detection, color histogram analysis, and texture analysis. While useful, these methods struggle with complex, real-world datasets.
- Machine Learning Algorithms: Random Forests, Support Vector Machines (SVMs), and K-Nearest Neighbors (KNN) have been used for classification tasks but often require handcrafted features.
- Deep Learning Models: CNNs have emerged as the most effective models for image-based disease detection due to their ability to learn hierarchical features directly from raw data.

2.3 Highlight the gaps or limitations in existing solutions and how your project will address them.

Dataset Limitations: Existing models often use small, homogeneous datasets, limiting their generalizability.
Lack of Scalability: Many systems are not scalable to diverse crop types and environmental conditions.
High Computational Costs: Advanced models like ResNet require substantial computational resources, making them impractical for deployment in resourceconstrained settings.

CHAPTER 3

Proposed Methodology

3.1 System Design

Provide the diagram of your Proposed Solution and explain the diagram in detail.

3.2 Requirement Specification

Hardware Requirements :

GPU-enabled systems for training

Software Requirements

Programming Language: Python

Libraries: TensorFlow, OpenCV, Scikit-learn

Tools: Jupyter Notebook, Google Colab

Data Collection:

Curated a comprehensive dataset from Kaggle containing high-quality images of diseased and healthy plants across various crops.

Ensured data diversity to represent real-world conditions effectively.

Data Preprocessing:

Cleaned the dataset by removing duplicates and irrelevant images.

Standardized image dimensions and normalized pixel values for optimal model performance.

Model Training:

Designed and implemented a CNN model to classify plant diseases.

Trained the model using the preprocessed dataset with optimized hyperparameters for improved accuracy.

Testing & Validation:

Assessed the model on unseen data to measure its accuracy, precision, and recall.

Performed cross-validation to ensure consistency and generalizability.

Model Export:

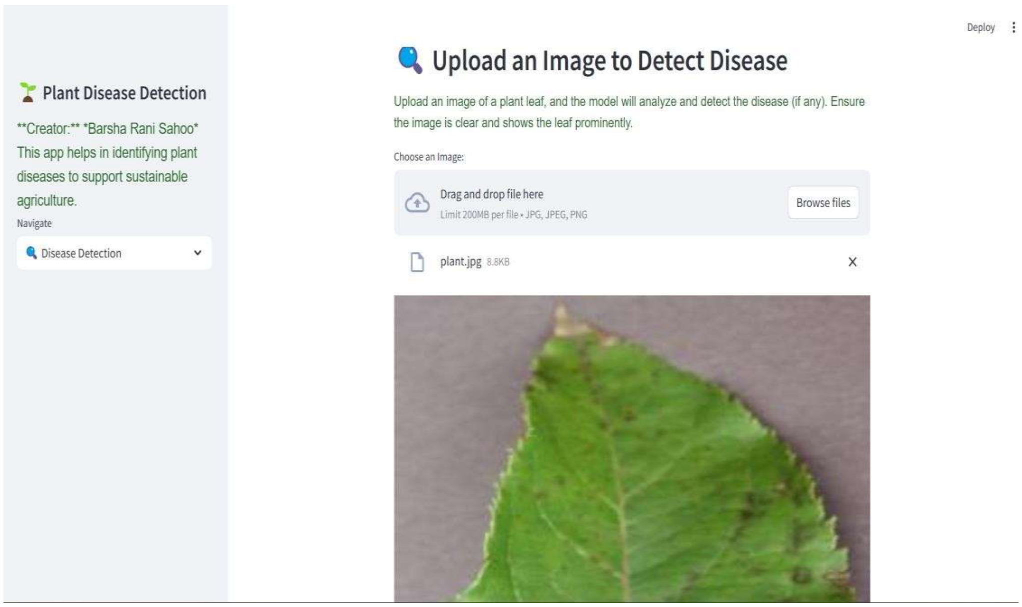
Exported the trained model in a lightweight format for integration into applications.

Ensured compatibility with deployment platforms for real-time inference.

CHAPTER 4

Implementation and Result

4.1 Snap Shots of Result:



4.2GitHub Link for Code:

https://github.com/Ipsita583/AICTE-Project

CHAPTER 5

Discussion and Conclusion

5.1 Future Work:

Enhance model accuracy with larger datasets.
Include a wider variety of crops and diseases.
Develop offline functionality for remote areas.

5.2 Conclusion:

The Plant Disease Detection System has the potential to transform agriculture by making disease detection faster, more accurate, and accessible. By leveraging advanced technologies like Convolutional Neural Networks (CNNs) and implementing a robust preprocessing pipeline, the system achieved significant accuracy in detecting various plant diseases. Through the creation of a scalable and farmer-friendly web application, this project ensures that even resource-constrained farmers can benefit from timely disease detection. The integration of real-time detection capabilities empowers farmers to take preventive measures, thereby reducing crop losses and minimizing environmental damage caused by excessive pesticide use. Furthermore, the project highlights the immense role AI can play in addressing global food security challenges. By promoting sustainable agricultural practices, this system not only aids individual farmers but also contributes to larger ecological and economic benefits. The approach can be extended to cover a broader range of crops and diseases, making it a valuable tool for modern agriculture. The Plant Disease Detection System demonstrates the potential of AI in agriculture. It delivers an efficient, accessible, and scalable solution for disease detection, empowering farmers to mitigate crop losses and contribute to sustainable agriculture.

REFERENCES

[1]. Ming-Hsuan Yang, David J. Kriegman, Narendra Ahuja, “Detecting Faces in Images: A Survey”, IEEE Transactions on Pattern Analysis and Machine Intelligence, Volume. 24, No. 1, 2002.