International Journal of Information Technology & Computer Engineering
ISSN 2347–3657
Volume 13, Issue 2s, 2025

AI-Enhanced Plant Leaf Disease Identification And Treatment Recommendation System With Google Vision Tag Integration Users

Mohammed Hamed Hussain Awad [1], Shaik Ghouse [2], Mohammed Yousuf [3], Dr. S. Md.Mazhar Ul Haq [4]

[123] Final Year B.E. Students, Department of Artificial Intelligence and Data Science, ISL ENGINEERING COLLEGE, International Airport Road, Bandlaguda, Chandrayangutta, Hyderabad – 500005, Telangana, India

[4] Associate Professor, Department of **Artificial Intelligence & Data Science**, Osmania University, Hyderabad, Telangana, India
Email Id: 160521747035@islec.edu.in[1], mazhar@islec.edu.in [2]

ABSTRACT:
The AI-Enhanced Plant Leaf Disease Identification and Treatment Recommendation System leverages deep learning to automate and improve the accuracy of plant health diagnostics. A convolutional neural network (CNN) is trained on a diverse, augmented dataset of leaf images covering 15 disease categories and healthy samples. During inference, the system accepts user-uploaded leaf photographs, preprocesses them, and computes a binary health probability via a sigmoid-activated output layer.

Probabilities are visualized through dynamic bar and scatter charts, illustrating the confidence in "Healthy" versus "Diseased" classifications. When disease is detected, a dedicated Medicine Store module—hosted on a separate webpage—presents scientifically vetted treatment options; for healthy leaves, it offers preventative care products. The system's web interface, built with Flask and enhanced by Chart.js, ensures an intuitive user experience, while comprehensive evaluation metrics (accuracy, precision, recall, and loss) and real-time visualization uphold rigorous performance standards

By integrating AI-driven detection with actionable treatment recommendations, this solution empowers growers to make data-backed decisions, reduce crop losses, and streamline plant health management.

INTRODUCTION

Agriculture is the backbone of many developing economies, including India, where a majority of the population relies directly or indirectly on farming for their livelihood. Despite technological advancements in other fields, the agricultural sector still faces critical challenges—one of the most pressing being the early detection and diagnosis of plant diseases

Traditional methods for identifying plant diseases typically require expert agronomists or laboratory tests, which are often inaccessible to rural farmers due to geographical, financial, or educational barriers. Furthermore, delays in diagnosing diseases can lead to widespread crop loss, reduced yield, and financial damage.

To address this challenge, the *AI-Enhanced Plant Leaf Disease Identification and Treatment Recommendation System* has been developed. This system uses artificial intelligence and machine learning to analyze images of plant leaves, automatically detect signs of disease, and provide users with immediate treatment suggestions. By leveraging image classification models and data-driven intelligence, this system aims to modernize the agricultural diagnostic process, reduce farmer dependency on external experts, and support timely interventions that can save entire harvests.

LITERATURE SURVEY

AI-Enhanced Plant Leaf Disease Identification and Treatment Recommendation System with Google Vision Tag Integration

Using Deep Learning for Image-Based Plant Disease Detection

Mohanty, S.P.,Hughes — 2016

They implemented deppp learning models like AlexNet and GoogleNet on the plant Village datasets for plant diseasedetection.There cnn based system achieved over **99% accuracy**, showing the strong potential of ai for automatic disease identification using leaf images.**[1]**

Deep Neural Networks Based Recognition of Plant Diseases by Leaf Image Classification

S Sladojevic, S., Arsenovic, M., Anderla, A., Culibrk, D., Stefanovic, D. — 2016

Developed a deep learning system that classifies plant diseases from leaf images without pre-processing. The

DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP600-604

system classified 13 disease classes with significant accuracy and reduced manual involvement. **[2]**

Deep Learning Models for Plant Disease Detection and Diagnosis
H K.P. Ferentinos — 2018

Utilized multiple CNN models trained on over 87,000 images from 25 plants with 58 disease classes. Achieved best accuracy of 99.53%, confirming deep learning as an effective disease prediction approach.**[3]**

A Robust Deep-Learning-Based Detector for Tomato Plant Diseases

A. Fuentes, S. Yoon, S.C. Kim, D.S. Park — 2017

Their approach combined CNN and object detection (YOLO and Faster R-CNN) to detect multiple diseases and pest damage in tomato plants. The study introduced real-time detection with bounding boxes, making a significant step toward practical AI tools for farmers.**[4]**

METHODOLOGY

The system begins by collecting and preprocessing plant leaf images, which are then used to train a Convolutional Neural Network (CNN) model. The CNN learns features to distinguish between healthy and diseased leaves. A sigmoid activation function is used to classify whether the leaf is affected or not, outputting a value between 0 and 1. Once trained, the model analyzes user-uploaded leaf images and makes a prediction. Based on the result, the system displays the disease type (if present) and provides treatment recommendations.

A separate medicine recommendation interface offers relevant products and preventive solutions. Evaluation metrics like accuracy, precision, recall, and loss are used to measure model performance, which are also visualized using charts.

Data Preprocessing

Before feeding the data into the CNN model, it is preprocessed to ensure uniformity and efficiency:

- **Resizing:** All images are resized to a fixed shape (e.g., 128x128 pixels) to maintain consistency**.**
- **Normalization:** Pixel values are scaled between 0 and 1 to optimize training speed and accuracy**.**
- **Data Augmentation:** Techniques like rotation, zoom, flipping, and brightness adjustment are applied to enhance diversity and prevent overfitting**.**
- **Splitting:** The dataset is split into training (80%) and validation/testing (20%) sets.

Data Collection:

The foundation of the model begins with acquiring a comprehensive dataset.
High-resolution images of various plant leaves are collected from open-source repositories like **PlantVillage**, **Kaggle**, and agricultural research websites.
Each image is labeled according to its condition, such as "healthy" or specific diseases like **Early Blight**, **Late Blight**, **Leaf Spot**, **Mosaic Virus**, etc.
The dataset is divided into folders: one for training and one for validation..
CNN Model Architecture

A Convolutional Neural Network (CNN) is constructed with multiple layers:

- **Convolutional Layers** to extract features
- **Pooling Layers** to reduce dimensions
- **Dropout Layers** to avoid overfitting

1. **Flatten + Dense Layers** to classify final outputs
The final output layer uses a **sigmoid activation function** to provide binary classification (diseased or healthyIMPLEMENTATION

Model Training:

Loss Function: binary_crossentropy is used due to the binary classification task.

Optimizer: Adam optimizer is used for fast and accurate convergence.

Metrics Tracked: Accuracy, Loss, Precision, and Recall.

Epochs: The model is trained over multiple epochs (e.g., 15-25).

Training Results:
Graphs are plotted to visualize the trends of accuracy, loss, precision, and recall over each epoch.

These graphs are shown using Matplotlib, arranged in a 2x2 subplot layout

Model Evaluation

DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP600-604

After training, the model is tested using the validation dataset.

The model's predictions are evaluated by calculating:

- **Accuracy:** How many correct predictions the model made.
- **Precision:** How many predicted diseased leaves were actually diseased.
- **Recall:** How many actual diseased leaves were detected correctly.
- **Loss:** The error between predicted and true values.

Visual graphs (line charts) for each metric are displayed after training

Tools and Technologies Used

The **Cyber-Wraith** system is implemented using **JavaScript (ES6+)** as the primary language, with **React** for building the interactive frontend UI and **Electron** to package it into a cross-platform, desktop application. Styling is handled using **Tailwind CSS**, and animations The implementation of this major project involves designing a system that integrates machine learning techniques, particularly Convolutional Neural Networks (CNN), with a responsive web interface to detect plant leaf diseases through image analysis. The system not only classifies whether a leaf is healthy or diseased but also recommends appropriate treatments based on the disease identified. The implementation is broken into structured phases including data preparation, model training, model deployment, prediction display, treatment suggestion, and user interaction, ensuring that both the technical and user experience components are professionally aligned.

.

Module Description

The system is divided into several well-defined modules, each with a specific responsibility to streamline the overall functionality.

The **Image Upload Module** allows users to select and submit a plant leaf image for analysis through an intuitive interface.

The **Image Preprocessing Module** prepares the image using resizing, normalization, and transformation to match the CNN input standards.

The **CNN-Based Prediction Module** is the core component that classifies the image as healthy or diseased using a trained deep learning model. Post-classification, the **Visualization Module** displays the probability score of disease and health using interactive charts like bar and scatter plots.

The **Treatment Recommendation Module** dynamically presents disease-specific treatment options, including medicine names, images, and purchase links. Lastly, the **Navigation and UI Module** manages the transitions between pages, ensuring a user-friendly and visually appealing interface enriched with animations, layout structure, and styled components

Workflow Execution Summary

The overall system workflow initiates when the user accesses the main webpage and uploads a plant leaf image. Once the image is selected, it is previewed and passed to the back-end where the model processes it through the CNN pipeline:

1. During this process, the image undergoes transformation and is fed into the neural network for analysis. The trained model evaluates the image and outputs a probability score that indicates the presence or absence of disease.
2. These predictions are immediately visualized in multiple charts for clarity. Simultaneously, the system checks the disease status and triggers the logic to either suggest preventive care (if healthy) or recommend appropriate treatments (if diseased)
3. The user can then navigate to the medicine store module that fetches curated medicinal products related to the identified disease. The flow ensures seamless interaction between data processing, model inference, and user experience components in a highly efficient pipeline.

Simulated Intelligence Setup

- The simulated intelligence of this system is powered by a Convolutional Neural Network trained on a diverse dataset of labeled leaf images. The model mimics human intelligence by learning patterns of disease manifestations on plant leaves.
- During training, it learns feature hierarchies such as texture changes, color differences, and shape anomalies that typically indicate disease. It is configured to output a probability value using the sigmoid activation function, giving confidence levels of the prediction.
- To further enhance intelligence, the model's performance is evaluated using metrics like accuracy, loss, precision, and recall, which are recorded and visualized during training. The intelligence is simulated in such a way that it not only predicts the disease status but also triggers related treatments and recommendations, simulating a decision-making process similar to how an agricultural expert might

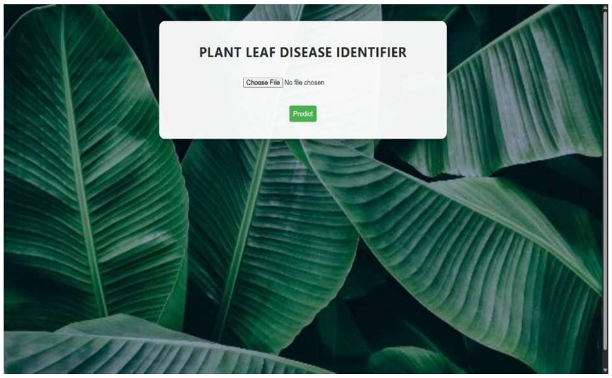
DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP600-604

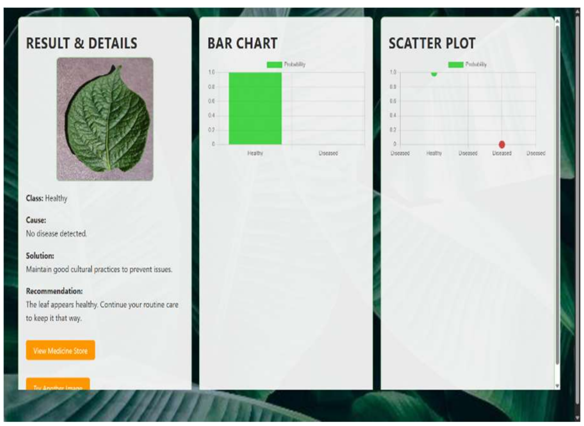
ISSN 2347–3657

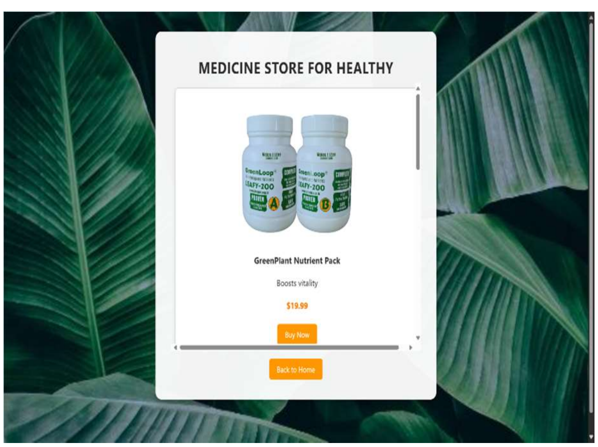
Volume 13, Issue 2s, 2025

evaluate and treat a diseased plant.

2. RESULTS:







CONCLUSION AND FUTURE SCOPE

Conclusion

1. **Accurate Disease Detection:**
   The developed system successfully identifies various plant leaf diseases using a trained Convolutional Neural Network model, offering accurate classification results. It enables farmers and agricultural experts to diagnose issues early and take preventive action.
2. **Real-Time Image Analysis:**
   With the integration of user-friendly image upload and prediction interfaces, the system provides real-time feedback on the plant's health condition, reducing manual effort and increasing decision-making speed.
3. **Interactive Visualization:**
   The platform provides visual representations of prediction results through bar, scatter, and line charts. These graphs help users understand the confidence level of the diagnosis, making it informative and easy to interpret.
4. **Automated Treatment Recommendations:**
   After identifying the disease, the system suggests targeted medicines and preventive actions through a treatment recommendation store, supporting effective agricultural intervention based on the identified issue.
5. **Integrated End-to-End Pipeline:**
   The solution integrates machine learning inference, frontend visualization, backend communication, and database storage into a seamless pipeline, demonstrating a complete and deployable AI-driven plant health monitoring system.

Future Scope

1. **Multilingual Support for Farmers:**
   Adding language options (such as Hindi, Telugu, Tamil, etc.) will help make the platform more accessible to regional farmers, increasing usability and reach.
2. **Voice-Based Input and AI Chat Support:**
   The system can be enhanced by allowing users to speak queries and receive spoken answers via AI chatbots, which could offer disease insights, climate-based care suggestions, and instant treatment tips.
3. **Integration with IoT Sensors and Drones:**
   Future improvements could include collecting real-time environmental data from IoT sensors or aerial imagery from drones to detect diseases before visible symptoms appear on leaves.
4. **Model Expansion to Fruits and Stems:**
   The CNN model can be expanded to include detection for diseases on plant fruits, stems, or soil conditions, providing a holistic crop monitoring system.
5. **Auto-Updatable Model with New Data:**
   A continuous learning mechanism can be added,

DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP600-604

ISSN 2347–3657

Volume 13, Issue 2s, 2025

where the system retrains the model with new user-uploaded data, improving accuracy and adapting to new or rare diseases over time.

REFERENCES:

[1] Mohanty, S. P., Hughes, D. P., & Salathé, M. (2016).
Title: *Using deep learning for image-based plant disease detection*
Published In: Frontiers in Plant Science
Context: This paper presents how deep convolutional neural networks (CNNs) can classify plant leaf diseases with high accuracy, providing the foundational technique for image-based diagnosis in your project.

[2] Sladojevic, S., Arsenovic, M., Anderla, A., Culibrk, D., & Stefanovic, D. (2016).
Title: Deep Neural Networks Based Recognition of Plant Diseases by Leaf Image Classification
Published In: Computational Intelligence and Neuroscience
Context: Introduces a CNN model trained on leaf images that accurately detects several diseases. It strongly aligns with your system's disease prediction module.

[3] Ferentinos, K. P. (2018).
Title: Deep learning models for plant disease detection and diagnosis
Published In: Computers and Electronics in Agriculture
Context: Explores various deep learning architectures like AlexNet and VGG for classifying crop diseases. This helps in deciding the best CNN architecture for higher prediction performance.

[4] Zhang, S., Wu, X., & You, Z. (2017).
Title: Leaf image based cucumber disease recognition using sparse representation classification
Published In: Computers and Electronics in Agriculture
Context: Focuses on sparse representation and image preprocessing techniques to classify cucumber leaf diseases. Offers ideas on enhancing preprocessing and feature extraction.

[5] Barbedo, J. G. A. (2013).
Title: Digital image processing techniques for detecting, quantifying and classifying plant diseases Published In: SpringerPlus
Context: Provides a comprehensive study of image processing methods like segmentation, thresholding, and feature extraction, which can be used to improve your model's preprocessing stag

DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP600-604