

Plant Rx: AI-Based Medicinal Plant Recognition for Smart Herbal Healthcare

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Abstract: Medicinal plants play an important role in traditional healthcare, but identifying plant species from their visual appearance can be challenging for people without specialized botanical knowledge. Manual identification may require considerable time and access to expert references. This paper presents PlantRx, an AI-based medicinal plant recognition system designed to identify Indian medicinal plants from uploaded images and provide relevant herbal information. The system uses the EfficientNet-B0 deep learning model to classify images into 40 medicinal plant classes. After classification, it displays the predicted plant name and confidence score, along with information about medicinal properties, traditional uses, plant parts, preparation methods, benefits, and safety information. A web-based interface developed using Python and Flask provides access to the system, while MySQL supports the storage of user information, plant details, and prediction history. PlantRx aims to improve access to medicinal plant identification and educational information through a centralized platform. Quantitative model accuracy and comprehensive testing results must be established using verified experimental data before the system's performance can be conclusively assessed.

Keywords: Plant Rx, medicinal plant recognition, artificial intelligence, EfficientNet-B0, deep learning, image classification, herbal healthcare.

I. INTRODUCTION

Medicinal plants are widely associated with traditional healthcare practices and are an important source of botanical knowledge. However, identifying plant species from photographs can be difficult for non-specialists because different plants may have similar leaf shapes, colours, and textures. Environmental conditions, lighting, and image quality can further complicate identification.

Conventional identification methods often depend on botanical experts, books, and online references. Although these approaches provide useful information, they may require additional time and prior knowledge. Artificial intelligence and deep learning offer an alternative approach by learning visual patterns from labelled images and predicting the plant class of a new image.

PlantRx is an AI-based web application designed to recognize medicinal plants from uploaded images and present associated herbal information. The system uses EfficientNet-B0 for image classification and integrates the prediction process with a web interface and database. It is intended to support educational activities and access to medicinal plant information.

Problem Statement

Identifying medicinal plants accurately can be challenging for individuals who lack botanical knowledge. Existing identification methods may require expert assistance or consultation of multiple information sources. Furthermore, plant identification alone may not provide users with sufficient information about traditional uses, benefits, preparation methods, and precautions. Therefore, PlantRx aims to combine image-based plant recognition with access to structured herbal information through a user-friendly digital platform.

Objectives

The main objectives of PlantRX are: (1) To develop an AI-based system for identifying medicinal plants from images. (2) To implement an EfficientNet-B0 model for classifying 40 medicinal plant categories. (3) To display the predicted plant name and associated confidence score. (4) To provide information about medicinal properties, traditional uses, plant parts, preparation methods, benefits, and safety. (5) To develop a web interface using Python and Flask. (6) To use MySQL for managing relevant user, plant, and prediction records. (7) To maintain prediction history for registered users. (8) To evaluate the system using documented functional and model-performance tests.

Scope

The project focuses on image-based recognition of the 40 medicinal plant classes included in the model, together with access to associated herbal information. Its scope includes image submission, classification, result display, and the relevant database-supported features. The system is intended for educational and informational use and should not replace expert botanical identification or professional medical advice.

II. MATERIAL AND METHODS

Existing System

Conventional medicinal plant identification commonly relies on manual observation, botanical references, or expert knowledge. Some digital applications provide image-based plant classification, while users may need to consult other sources to find detailed information about the identified plant.

The major limitations addressed by PlantRx are:

- Dependence on manual identification and specialized knowledge.
- Difficulty distinguishing plants with similar visual characteristics.
- Need to consult separate sources for identification and herbal information.
- Limited integration of identification results with user prediction history.
- Dependence of classification performance on image quality and training data.

These are the project's identified problem areas; specific claims about competing applications should be supported by verified comparative research.

Proposed System

PlantRx combines deep learning-based plant recognition with a web-based information interface. Users upload a medicinal plant image, which is processed by the image-classification model. The model predicts one of the supported plant classes and provides a confidence score. The application then displays the predicted plant name and corresponding medicinal information.

The system uses EfficientNet-B0 for image classification, Flask for web application functionality, Python for application development, PyTorch for deep learning, and MySQL for data storage, as described in the project presentation.

System Architecture

The system can be described using three logical layers. The presentation layer uses HTML, CSS and JavaScript to provide the web interface. The application layer uses PHP to process application requests and implement server-side logic. The database layer uses MySQL to store and retrieve application records, according to the implemented schema.

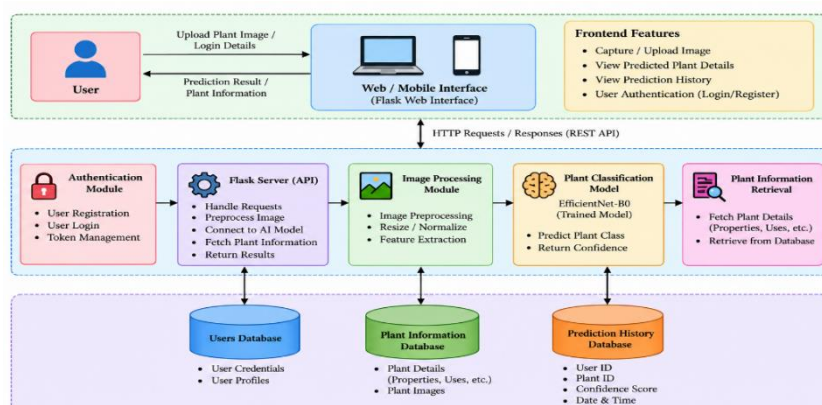


Fig. 1. System Architecture of PlantRx

Technologies Used

Technology	Purpose
Python	Application development and model integration.
EfficientNet-B0	Deep learning-based image classification.
PyTorch	Deep learning model implementation.
Flask	Web application and request handling.
MySQL	Storage of user, plant, and prediction records.
HTML, CSS, JavaScript	Web interface, as applicable to the implemented frontend

Implemented Modules

- **User registration and login:** Provides account access for registered users, if implemented in the current application.
- **Image upload:** Accepts a medicinal plant image submitted by the user for recognition.
- **Donation Management:** Supports monetary and item-based donation records. Donation information is associated with the relevant organization and can be accessed through the available donation-history functions.
- **Image preprocessing:** Prepares the image in the format required by the classification model. The exact resizing and normalization procedures should match the implementation
- **Plant classification:** Uses EfficientNet-B0 to predict a plant class from the 40 supported categories.
- **Plant information retrieval:** Presents the associated medicinal properties, traditional uses, plant parts, preparation methods, benefits, and safety information available in the system.
- **Prediction result display:** Displays the predicted plant name and model confidence score.
- **Prediction history:** Maintains the prediction history of registered users, as specified in the project presentation.
- **Database management:** Uses MySQL to manage relevant user records, plant information, and prediction history.

Testing Methodology

The PlantRx application should be tested against its functional requirements. Testing should cover user registration and authentication, medicinal plant image upload and validation, AI-based plant classification, display of plant names and confidence scores, retrieval of medicinal plant information, prediction history management, and database operations. Each test case should record the input, expected outcome, actual outcome, and pass/fail status. Model classification performance should be evaluated separately using a documented test dataset with verified labels. Metrics such as accuracy, precision, recall, and F1-score should be reported only when they have been calculated and verified. Tests that have not been performed or whose outcomes have not been confirmed must remain pending.

III. RESULTS

Functional Testing

The project report contains a test plan consisting of 7 test cases covering registration, authentication, donation operation s, admission requests, expense management, organization administration and access control. Actual outcomes must be verified before final results can be reported.

Test ID	Scenario	Expected outcome	Actual result
TC01	Valid User Registration	Account is created successfully	verified
TC02	Valid User Login	User is authenticated and dashboard is displayed	verified
TC03	Invalid Login	Error message is displayed	verified
TC04	Image Upload	Valid plant image is accepted for prediction	verified
TC05	Image Validation	Error message is displayed for an invalid or unsupported image	verified
TC06	Plant Prediction	Plant Prediction	verified
TC07	Plant Information	Medicinal information about the predicted plant is displayed	verified
TC08	Prediction History	Completed prediction is saved and displayed in history	verified
TC09	Empty Image Input	Validation message is displayed	verified
TC10	Database Operations	Correct plant information is retrieved from the database	verified
TC11	User Logout	User session is terminated successfully	verified
TC12	Unauthorized Access	Access is denied or the user is redirected to the login page	verified
TC13	Unsupported Plant Image	Appropriate message is displayed, if unsupported-class detection is implemented	verified

Table I. Representative functional test cases

The table presents representative scenarios from the project's test plan. The expected outcomes are not evidence that tests passed. Actual results must be completed from testing records.

Results Summary

The final testing results of the PlantRx application should include the total number of test cases executed, passed, failed, and retested, where applicable. Testing should cover user authentication, medicinal plant image upload, plant classification, display of confidence scores, retrieval of medicinal plant information, prediction history, and database operations. The pass rate should be calculated using the formula: $\text{Pass Rate} = (\text{Number of Passed Test Cases} / \text{Number of Executed Test Cases}) \times 100$. The verified test counts and calculated pass rate should be reported only after the test cases have been executed and their outcomes documented. The classification performance of the AI model should be evaluated separately using a labelled test dataset, with metrics such as accuracy, precision, recall, and F1-score reported only when the values have been calculated and verified.

Observed Application Functionality

The implemented system provides role-based access and workflows for organization browsing, donations, admission requests, resident management, expenses and platform administration. Insert actual screenshots of the login page, organization browsing, donation interface, Organization Admin dashboard, Super Admin dashboard and transparency/reporting interface. Include only screens that exist in the working application, and remove sensitive personal information.

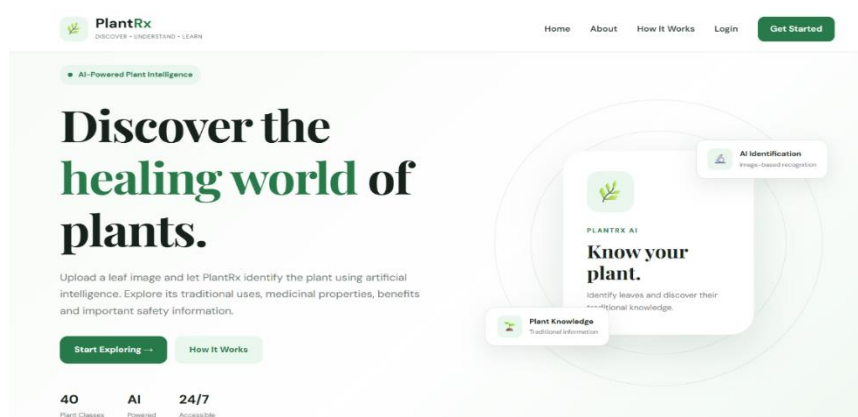


Fig. 2. Normal User Dashboard

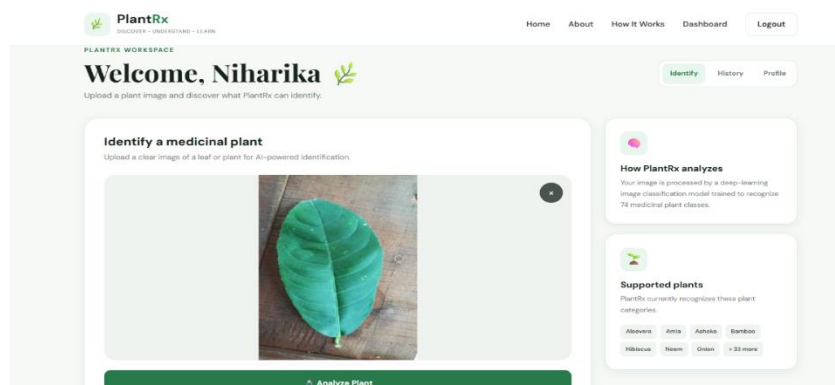


Fig. 3. Picture Uploading

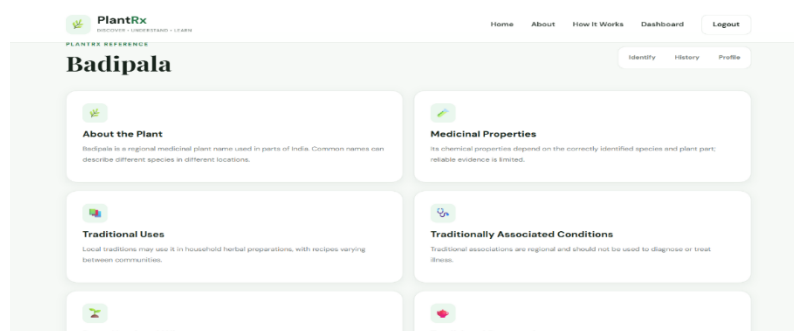


Fig. 4. Plant Description

IV. DISCUSSION

PlantRx integrates medicinal plant image classification with access to related herbal information. The use of EfficientNet-B0 provides the proposed deep learning approach, while Flask supports the web interface and MySQL supports the storage of relevant information and prediction history.

The integration of identification and information retrieval may reduce the need for users to consult multiple sources for basic educational information. However, the usefulness of the system depends on the quality and diversity of the training images, the similarity between plant species, the accuracy of the associated information, and the reliability of the implementation.

The confidence score represents the model's confidence in its prediction and should not be interpreted as a guarantee that the identification is correct. The model's performance must be established through a documented evaluation using independent test images. Medicinal information should also be presented responsibly, without implying that an identified plant is automatically safe for consumption or treatment.

V. CONCLUSION

PlantRx: AI-Based Medicinal Plant Recognition for Smart Herbal Healthcare is an AI-based project designed to identify medicinal plants from images and provide related herbal information through a web application. The system uses EfficientNet-B0 to classify images into 40 medicinal plant categories and is designed to display the predicted plant name, confidence score, and associated information. Python, PyTorch, Flask, and MySQL form the main technology stack described in the project presentation.

The project aims to improve access to medicinal plant identification and educational information through an integrated platform. Further evaluation is required to establish quantitative classification performance, document functional test outcomes, and identify limitations. The system should be used as an informational aid rather than a substitute for expert identification or professional medical guidance.

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