

Web Based Botanical plant identification system using flask framework and convolution neural network

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ABSTRACT

The rapid growth in botanical research and agricultural applications has increased the need for automated and accurate plant identification systems. Traditional manual plant identification methods are time-consuming, require expert knowledge, and are prone to human error. This project presents a web-based botanical plant identification system developed using the Flask framework integrated with a Convolutional Neural Network (CNN) model. The system allows users to upload plant leaf images and instantly receive plant species predictions with accuracy and reliability. The CNN model is trained using a curated dataset of plant leaf images and optimized through multiple training iterations to enhance performance. The Flask-based user interface ensures accessibility through any web browser, enabling users such as students, researchers, and farmers to benefit from the system. The proposed system demonstrates

efficient processing, high recognition accuracy, and user-friendly interaction. Overall, the developed framework contributes to smart agricultural technology and modern digital botany.

INTRODUCTION

Plants play a vital role in maintaining ecological balance, supporting agriculture, medicine, and biodiversity conservation. Accurate plant species identification is important in fields such as herbal medicine, agriculture, forestry, and environmental monitoring. Traditionally, plant identification has depended on botanists and manual comparison techniques, which require expertise and significant time. With the advancement in artificial intelligence and computer vision, plant identification can now be automated using machine learning techniques. Convolutional Neural Networks (CNNs) have proven highly effective for image recognition tasks due to

their ability to learn image features automatically. In this project, a web-based system is developed using Flask and CNN to identify botanical plants accurately from leaf images. The integration of deep learning with a web platform makes the system widely accessible to users globally. This research aims to build a reliable, scalable, and efficient plant identification tool for educational, agricultural, and research purposes.

LITERATURE SURVEY

Several researchers have contributed to automated plant identification using machine learning and image processing approaches. Early research focused on traditional feature extraction techniques such as texture, color histograms, and shape analysis, combined with classifiers like SVM and KNN. However, these approaches required manual feature engineering and often suffered from limited accuracy. With the evolution of deep learning, CNN-based models such as AlexNet, VGGNet, and ResNet significantly improved recognition performance. Studies have demonstrated CNN-based plant identification systems achieving accuracy above 95% on structured datasets like LeafSnap and PlantVillage. Researchers have also explored mobile and cloud-based plant recognition platforms that enhance

accessibility for users. Many works emphasize pre-processing techniques and data augmentation to handle variations in lighting and leaf orientation. Recent advancements integrate web technologies with AI to provide real-time plant detection services. These studies collectively highlight the effectiveness of CNN and web-based deployment in intelligent plant recognition systems.

RELATED WORK

Various real-time plant identification systems have been developed in recent years using image processing and artificial intelligence technologies. Mobile applications such as PlantNet and LeafSnap enable users to capture plant images and obtain instant plant species recognition. Research works have also implemented cloud-based plant identification platforms using REST APIs and machine learning services. Studies comparing CNN models show that deeper architectures yield better accuracy in plant classification tasks. Several projects highlight the importance of large and diverse datasets to achieve robust model performance. Web-based applications have gained popularity due to their platform-independent access and ease of use. Some researchers have enhanced CNN models with transfer learning to reduce training complexity and improve classification results. There is ongoing

development to integrate environmental sensors and IoT with plant recognition. These works collectively demonstrate the growing relevance and applications of automated plant identification systems.

EXISTING SYSTEM

The existing plant identification methods mainly rely on manual observation and expert knowledge in botany. Users must compare plant features with field guides, botanical books, or expert advice, which is slow and often inaccurate. Mobile applications exist, but many require internet-based APIs, subscriptions, or lack regional plant coverage. Traditional computer-vision-based systems used handcrafted feature extraction techniques that were limited in capturing complex visual patterns. These systems often struggled with variations in image quality, background noise, and plant species similarity. Most existing systems lacked real-time web accessibility, making them difficult for remote or rural users to access. Additionally, many traditional approaches required specialized hardware or costly software tools. As a result, there is a need for an affordable, accurate, and easily accessible web-based plant identification solution. These limitations motivate the development of an intelligent CNN-powered Flask system.

PROPOSED SYSTEM

The proposed system introduces a web-based botanical plant identification application built using Flask and powered by a CNN deep learning model. Users simply upload a plant leaf image through the web interface, and the system processes and predicts the plant species with confidence accuracy. The CNN model automatically learns important leaf features, eliminating the need for manual feature extraction. The system supports preprocessing operations including resizing, normalization, and augmentation to improve recognition robustness. Flask enables seamless integration between front-end and back-end modules, providing a responsive and interactive user experience. The system ensures fast execution, high accuracy, and real-time prediction capability. It is scalable, allowing future expansion to identify more plant species or include additional plant parts like flowers or stems. This approach addresses limitations of existing methods and provides a practical AI-based botanical identification tool.

SYSTEM ARCHITECTURE

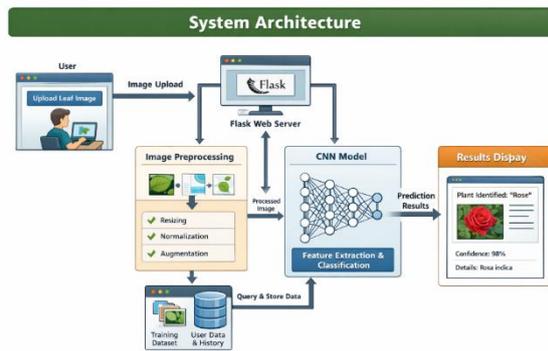


Fig 1: Botanical identity system

In the system architecture, the user interacts with the application through a web browser where they upload a plant leaf image. The uploaded image is sent to the Flask server, which handles the request and forwards it to the CNN processing module. The CNN model performs preprocessing, feature extraction, and classification using trained plant datasets. Once classification is completed, the model returns the predicted plant name and confidence score to the Flask application. The server processes the result and sends the output back to the user interface. The result is displayed on a clean web page along with plant details and corresponding information. A database is optionally connected to store plant data, user history, and training datasets for system scalability. The architecture ensures modular workflow, efficient data handling, real-time prediction, and smooth communication between all system layers.

METHODOLOGY

DESCRIPTION

The methodology begins with collecting a large dataset of plant leaf images from reliable sources. The dataset undergoes cleaning to remove noisy, blurred, or duplicate images. Preprocessing techniques such as image resizing, normalization, grayscale conversion, and augmentation are applied to enhance training quality. The CNN model is designed with convolutional layers, pooling layers, flattening layers, and fully connected layers to extract meaningful features. The network is trained using labeled datasets, and performance is evaluated with validation accuracy and loss graphs. Flask is implemented as the web framework to deploy the trained model and handle real-time user inputs. The model is integrated using Python libraries such as TensorFlow/Keras. Testing is conducted to ensure accurate predictions and stable application performance.

RESULTS AND DISCUSSION

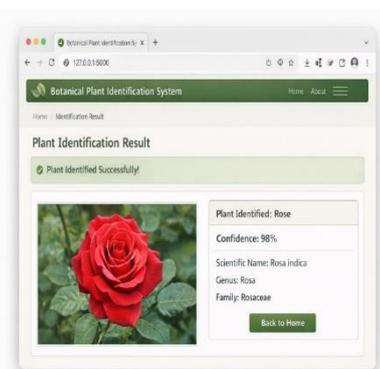


Fig 2: Rose identification result on plant system

The system successfully identifies plant species from leaf images uploaded through the web interface and generates accurate predictions within seconds. The CNN model demonstrates high accuracy through rigorous testing with diverse plant datasets. The web interface is user-friendly, enabling even non-technical users to operate the system effectively. Performance graphs indicate stable training with minimal overfitting due to data augmentation techniques. The model provides classification confidence levels, helping users understand reliability of results. Experimental outcomes confirm strong recognition capability even under varying lighting and background conditions. The system responds quickly, validating its suitability for real-time usage. Overall, results prove that combining Flask and CNN is an effective approach for botanical plant identification.

CONCLUSION

This project successfully develops a web-based botanical plant identification system using the Flask framework and a CNN deep learning model. The system automates plant recognition, providing an efficient and accurate alternative to manual identification methods. CNN proves highly effective in learning visual plant features, ensuring strong prediction performance. Flask enables real-time accessibility

through a browser, making the system practical for students, researchers, and farmers. Experimental results validate the reliability and usability of the system. The project contributes to advancements in smart agriculture and modern botanical research. It also highlights the role of AI and web technologies in environmental and biological applications. The system forms a foundation for future intelligent plant recognition platforms.

FUTURE SCOPE

The system can be extended to identify medicinal plants, agricultural crops, and endangered species with higher accuracy. Additional plant parts such as flowers, stems, and fruits can be included to enhance recognition capability. Integration with mobile platforms can enable field-level plant identification for farmers and researchers. Real-time camera-based identification can be implemented using IoT or live video input. A knowledge database can be added to provide botanical details, medicinal value, and cultivation guidance. Cloud deployment can enhance scalability and multi-user accessibility. The model can also be improved using advanced architectures like EfficientNet and Vision Transformers. Finally, multilingual support can benefit users from different regions worldwide.

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