Medicinal Plant Identification Using Deep Learning Model

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ABSTRACT

Medicinal plants play a vital role in traditional Indian healthcare, cultivated and harvested for centuries to support wellness and cure ailments. Indian forests, rich in biodiversity, are home to numerous medicinal herbs that sustain ecosystems and benefit society. Given their importance, these plants have historically been a subject of intensive study, yet their accurate identification remains challenging. Identifying herb species, often with subtle visual differences, requires expertise and can be time-consuming, creating a need for more efficient methods. This study proposes a vision-based, deep learning (DL) model to streamline the identification process, enabling rapid and accurate recognition of herb plants. Focusing on six commonly used plants— betel, curry, Tulsi, mint, neem, and Indian beech— the model was trained on a dataset containing 500 images per plant. The images underwent preprocessing, including resizing and augmentation, to enhance sample diversity. For this task, the Mobile Net DL model was chosen due to its efficiency and suitability for real-time applications. The DL model workflow includes training, validation, and testing, with evaluation based on metrics such as accuracy, precision, and recall. Achieving an accuracy rate of 98.3%, the model demonstrated high reliability distinguishing medicinal plants by their leaves.

INTRODUCTION

Medicinal plants have been an integral part of traditional and modern medicine, offering numerous health benefits and therapeutic properties. However, accurately identifying these plants remains a challenge due to variations in species, similarities between different plants, and environmental factors that affect their appearance. Traditional identification methods, which rely on botanical expertise, are time-consuming and prone to human error. To address these challenges, deep learning has emerged as a powerful tool for automating plant identification with high accuracy.

The proposed system enhances traditional plant identification by providing a fast, automated, and scalable solution. With applications in herbal medicine, agriculture, and biodiversity conservation, this deep learning-based approach contributes to the accurate documentation and preservation of medicinal plant species. The results of this project demonstrate the potential of artificial intelligence in revolutionizing botanical research and medicinal plant studies, paving the way for more accessible and efficient plant identification methods.

LITERATURE SURVEY

[1] Identification of Medicinal Plants Using CNN-Based Deep Learning Models – The accurate identification of medicinal plants is essential for pharmaceutical research, biodiversity conservation, and herbal medicine. This study presents a deep learning-based approach using Convolutional Neural Networks (CNNs) to classify medicinal plant species. The model is trained on a dataset of labeled plant images, utilizing transfer learning techniques with pre-trained networks such as AlexNet and VGGNet. The results demonstrate improved classification accuracy compared to traditional machine learning techniques. The proposed system automates plant identification, reducing human dependency and errors while increasing efficiency in botanical studies.

[2] Deep Learning for Medicinal Plant Recognition Using ResNet and MobileNet – This research explores the application of ResNet and MobileNet architectures for classifying medicinal plants based on leaf images. The study leverages transfer learning, where pre-trained models are fine-tuned using a dataset of high resolution plant images. Experimental results show that MobileNet achieves faster processing speeds, making it suitable for mobile applications, while ResNet delivers higher accuracy for detailed classification. This study highlights the feasibility of lightweight deep learning models for real-time plant identification in mobile and web applications.

[3] Automated Medicinal Plant Identification Using GoogleNet and SqueezeNet – The growing use of medicinal plants necessitates efficient identification systems. This paper presents a deep learning model trained on a large dataset of plant images, implementing GoogLeNet and SqueezeNet architectures. The study compares the models' performances in terms of accuracy, computation speed, and resource efficiency. SqueezeNet proves to be highly efficient with minimal computational requirements, making it ideal for embedded systems. The research findings contribute to the development of AI driven plant recognition solutions for the pharmaceutical and agricultural industries.

[4] Hybrid Deep Learning Approach for Medicinal Plant Classification – Traditional methods of medicinal plant identification often require expert knowledge, leading to subjectivity and inefficiencies. This study integrates CNNs with Long Short-Term Memory (LSTM) networks to classify medicinal plants based on both image and textual data. The hybrid model processes leaf images using CNNs while incorporating botanical descriptions through LSTM networks. demonstrating the potential of multimodal learning for plant.

[5]YOLO-Based Medicinal Plant Detection and Classification – Object detection techniques are essential for identifying multiple plant species in natural environments. This paper proposes a deep learning model based on the You Only Look Once (YOLO) algorithm for detecting and classifying medicinal plants in real-time. The study utilizes an annotated dataset containing various plant species captured in diverse lighting and background conditions. Experimental results show that the YOLO-based model outperforms traditional classifiers in speed and accuracy, making it suitable for field applications in agriculture and environmental monitoring.

[6] Transfer Learning in Medicinal Plant Recognition Using EfficientNet – Recognizing medicinal plants with high precision is a critical task in healthcare and herbal medicine. This research applies EfficientNet, a scalable deep learning model, to identify plant species based on leaf morphology. The model is trained using a diverse dataset and fine-tuned to enhance feature extraction capabilities. EfficientNet achieves higher accuracy with fewer computational resources compared to conventional CNN architectures. The study emphasizes the potential of optimized deep learning models in creating practical solutions for plant identification.

[7]Multi-Spectral Image-Based Medicinal Plant Classification Using Deep Learning – Traditional plant classification models often rely on RGB images, limiting their ability to capture chemical variations in plants. This study incorporates multi spectral imaging techniques to enhance medicinal plant recognition. A CNN-based model processes multi-spectral data, analyzing variations in light absorption patterns to improve classification accuracy. Experimental results indicate that multi spectral imaging, combined with deep learning, significantly enhances plant identification, providing insights for botanical research and precision agriculture.

[8] AI-Powered Medicinal Plant Recognition Using Vision Transformers – With recent advancements in computer vision, transformer-based architectures have gained prominence in image classification. This paper explores the application of Vision Transformers (ViTs) for medicinal plant recognition, comparing their performance with CNN models. The study finds that ViTs excel in capturing fine-grained details in plant images, improving classification accuracy over large datasets. The research highlights the potential of transformer-based deep learning models in developing next-generation plant identification systems with enhanced interpretability and robustness.

PROBLEM STATEMENT

Medicinal plants have long been used across cultures for natural remedies, but accurate identification remains a significant challenge, as misidentification can reduce treatment efficacy and pose health risks due to potential toxicity. Traditional identification methods require deep botanical expertise, are resource-intensive, and rely on manual observations, making them impractical in real-time situations for those without extensive knowledge, such as healthcare professionals, herbalists, and rural communities. Recent advancements in deep learning and computer vision offer a solution through automated plant identification systems**,** though challenges persist due to high morphological diversity, species similarities, and environmental factors like lighting, angle, and background noise that complicate accurate classification. This research proposes a deep learning based model utilizing convolutional neural networks (CNNs) and optimization algorithms to enable real-time, reliable, and scalable identification of medicinal plants in diverse conditions. By addressing challenges related to species similarity, environmental variability, and computational efficiency, the model aims to assist healthcare practitioners, botanists, and the general public in accurate plant identification with minimal expertise. Beyond individual use, such a system can contribute to ecological conservation, sustainable harvesting, and scientific research by aiding in the preservation of endangered medicinal plants and supporting biodiversity. Ultimately, this research bridges the gap between traditional botanical knowledge and modern technology, promoting the safe and effective use of medicinal plants whil empowering communities and researchers in utilizing natural resources efficiently.

PROPOSED SYSTEM

The proposed system for real-time medicinal plant identification using a deep learning model integrates advanced technology with user accessibility, making it a valuable tool for both professionals and enthusiasts. It is built on a diverse dataset of medicinal plants, including high-quality images and metadata such as scientific names, common names, and medicinal uses. Preprocessing techniques like resizing, normalization, and data augmentation will enhance model robustness. A Convolutional Neural Network (CNN), potentially leveraging transfer learning from models like Reset or Mobile Net, will be used for efficient training and improved accuracy. Optimization during training will involve careful selection of hyperparameters and regularization to prevent overfitting. The trained model will be deployed via a mobile or web application with a user-friendly interface that allows instant identification by capturing plant images. Beyond identification, the application will provide medicinal information, safety precautions, and GPS-based insights into local flora. A feedback mechanism will enable users to report accuracy and contribute images for continuous model improvement. Rigorous validation using metrics like accuracy, precision, recall, and F1-score will ensure reliability, supplemented by real-world user testing in varied conditions. Ethical considerations regarding user data privacy and cultural significance will be addressed, ensuring respectful and informative content. Ultimately, this system aims to facilitate plant identification while promoting awareness,education, and conservation efforts within communities.

CONCLUSIONS & DISCUSSION

This study demonstrates the power of deep learning in automating medicinal plant identification, addressing the inefficiencies of traditional methods. By training and optimizing the MobileNet model on six widely used medicinal plants—betel, curry, tulsi, mint, neem, and Indian beech—it achieved an impressive 98.3% accuracy in distinguishing species based on leaf images, making it highly suitable for real-time applications. To enhance accessibility, the model was deployed on a cloud server and integrated into a mobile

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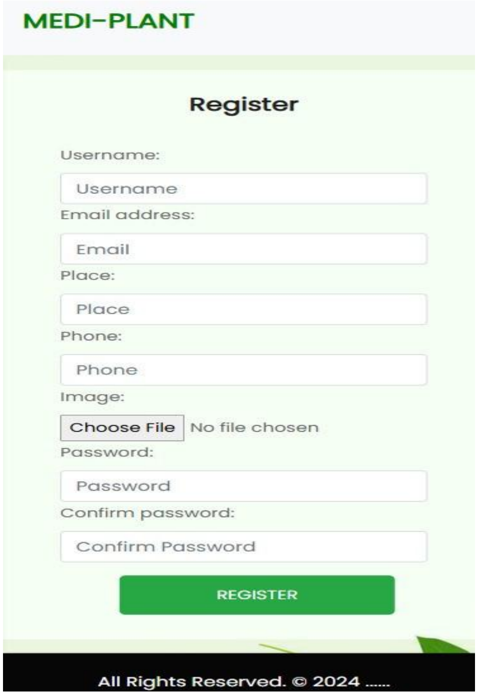
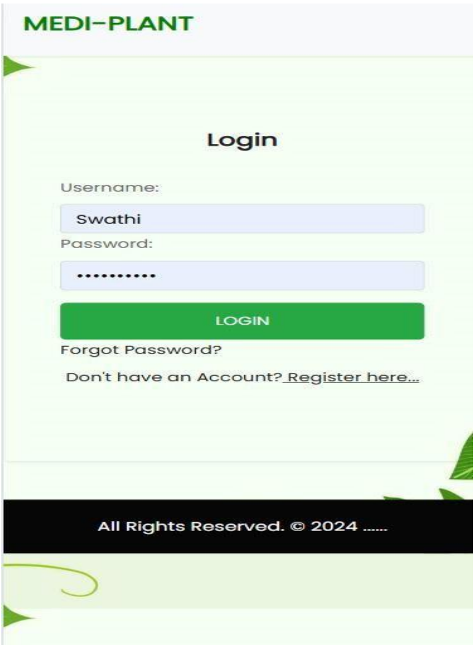
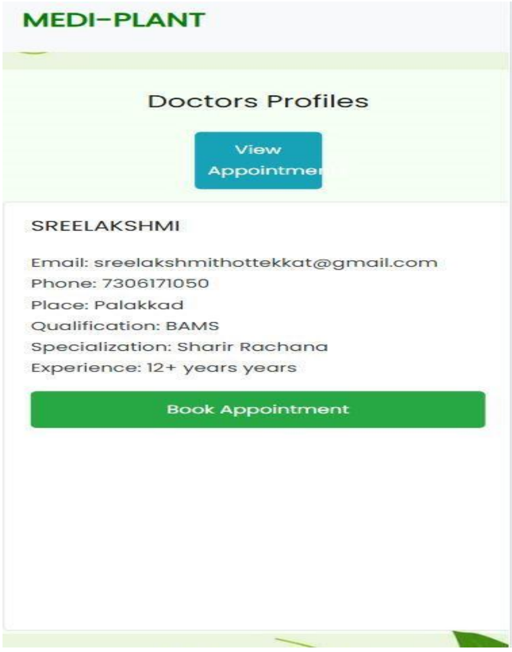
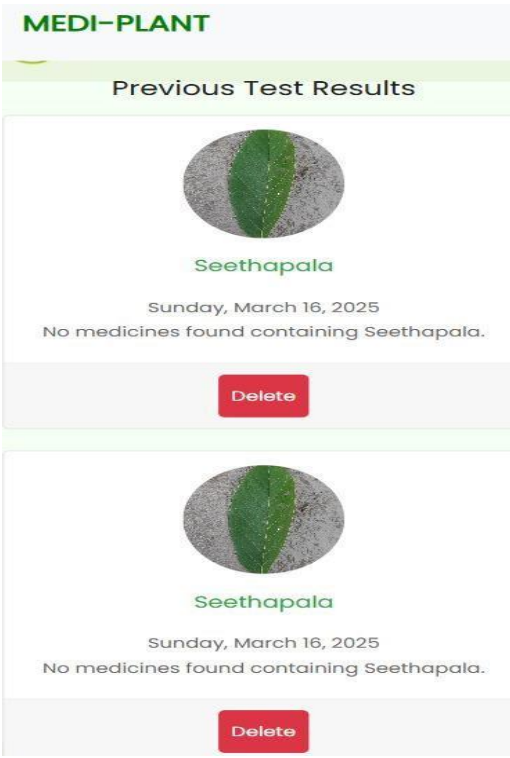
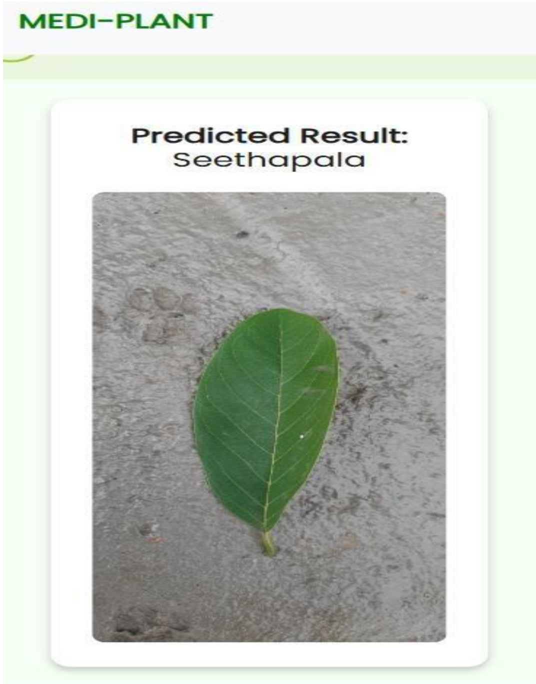
app, allowing users to identify plants from anywhere. This not only bridges gaps in taxonomic knowledge but also supports conservation, traditional medicine, and botanical research. Beyond being a practical identification tool, it aids in biodiversity preservation and promotes plant based healthcare, strengthening the synergy between technology and environmental conservation.











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