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# A Survey on Ayurvedic Herb Identification using Deep learning

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**ABSTRACT:** Ayurvedic Herb Identification Project is a pioneering web-based platform that is considerable in its simplicity and usefulness to those who would like to discover and interact with the environment by way of identifying Ayurvedic herbs. The identification of these herbs is made possible through the use of image recognition in which the users can aim the camera on their mobile devices in real time at various herbs for quick and easy identification. This platform serves as a turning point for users of Ayurvedic practices through the incorporation of worm technology by enabling understanding and even growing herbs without studying too much or consulting books. The application is developed using plain HTML, CSS, and JavaScript which enables the user to have a design which is user friendly and also enjoyable. The backend is written in Python and is using Django framework which allows for protection of users with authentication and proper handling of data. Machine learning is employed in the project for the purposes of identifying the herbs accurately while OpenCV is used for image processing in real time to allow the user to view in depth profiles for each of the herbs including care instructions, medicinal uses, and suggestions on how to grow the herbs correctly based on the prevailing weather conditions. This is appealing to even the most experienced herbalists, as well as to those who are yet new to this form of medicine, as it encourages a healthy living, based on the resources provided by mother nature. The Ayurvedic Herb Identification Project successfully combines principles of Ayurveda and technology in a way that encourages the users of the system to play with herbs in a productive manner, thereby enhancing appreciation of wellness in general and the wellness of individuals in particular, and the ability for people to control what is done to their bodies given available information.

**KEYWORDS:** Artificial intelligence, computer vision, convolutional neural network, deep learning, machine learning, medicinal plants, opencv, real-time identification.

## I. INTRODUCTION

The Ayurvedic Herb Identification Project is a unique web application that gives a new dimension to people's association with the natural world, especially through the ancient science of Ayurveda. This project allows users to identify and explore herbs by simply connecting their devices to realtime image recognition technology on a data-backed backend of Ayurvedic herbs. The main feature of this system is the use of AI in its immediate processing which thus enables people to interact with the platform just by pointing at a plant. This hands-free piece of technology goes above and beyond mere digital interaction, building an entirely new experience that is not only more intuitive but also somewhat dreamlike. The usage of this technology is potentially infinite and includes the fields of wellness, education, and environmental science. One of the aspects that have gained traction lately is a healthier lifestyle, environmental consciousness, and natural ways of healing, and the Ayurveda Herb Identification Project helps those who want to connect more to nature. This, in turn, makes it ideal for students, health freaks, or those who just started herbal classes along with educators. It allows for real-time learning and herb identification, which gives the users access to the full information about the medicinal uses, cultivation tips, and care instructions even though they are in different locations. Undoubtedly, the main benefit of this initiative is its adaptability. Its multifaceted approach in indulging various sectors such as healthcare, where it can be used as a secondary support to natural wellness practices, education involving online or face-to-face botany or Ayurveda classes, and community health where the application might raise consciousness regarding holistic health, stand out. More so, using the platform's opportunity it is also beneficial to the local businesses which are engaged in gardening supplies production.

## II. LITERATURE SURVEY

[1] R.D.T.N. Rajarathna and V.G.T.N. Vidanagama, "Ayurvedic Leaf Recognition: A Classification and Comparison of CNN Architectures", Wayamba University Research Congress (2023) The present research investigates the capabilities of Convolutional Neural Networks (CNN) in classifying Ayurvedic medicinal leaves, and as such, VGG16, ResNet-50 and DenseNet121 architectures were implemented and tested on a dataset comprising of Jackfruit, Lemon, and Mango as well as Betel comestible leaves. An added challenge was that, the dataset which was used for storing pictures of such leaves was uploaded on the Google drive service and was enhanced using augmentation techniques for training purposes. Models were fine-tuned using weights which had previously been trained on ImageNet and trained on Google Collab Pro for 50 epochs with resultant accuracy metrics suitable for use in Ayurvedic applications. Strengths: High Accuracy: Image classification deep learning networks VGG16, ResNet50, DenseNet121 offers a great level of accuracy on leaf identification. Data Augmentation: This allows increasing the dataset size which enhances the model performance. Drawbacks: Narrow Focus: Learns only four classes of leaves and so it cannot be applied in a larger context. Dependence on Cloud Services: Google Drive along with Collab are cloud based services and thus an internet connection is a necessity limiting its offline use. [2] I.A.M. Zin, Z. Ibrahim, D. Isa, S. Aliman, N. Sabri, and N.N.A. Mangshor, "Herbal Plant Recognition Using Deep Convolutional Neural Network", Bulletin of Electrical Engineering and Informatics, Vol. 9, No: 5 | October 2020. This research employs deep Learning techniques, particularly Convolutional Neural Networks (CNNs) for the classification of herbal plants by their leaves and employs an enhancement technique called data augmentation. This technique which includes admixture of resizing images, flipping images and rotating images is aimed at minimizing the challenges because of the likeness of different species. Owing to the trials on the ready special purpose modified database of Malaysian herbs leaves, the system received a 99 perfect mark; hence a testament of the ability of CNNs in expediting plant recognition. Strengths: Enhanced Performance: This practical experience in plant identification, particularly within herbal databases containing such plants, explains the near perfect 99 percent accuracy that has been recorded with the application of CNNs. Data Augmentation: Certain alterations including, but not limited to, changes such as resizing, flipping and rotating images have been included which in turn strengthens the model towards real life variations of the leaves and hence readies the model for various shapes of leaves. Drawbacks: Limited Database Scope: In this instance, the design adopted is primarily based on a custom made database of malaysian herbs. This poses serious limitations on the models applicability to other herbs beyond this geographical area. Challenges associated with the usability of CNNs: Resources required for training the CNNs are high= efficient therefore ordinary users with personal computers may not be able to effectively use them. [3] P. B. R. Pushpa, M. N. Megha, and A. K. B. Amaljith, "Comparison and Classification of Medicinal Plant Leaf Based on Texture Feature", International Conference for Emerging Technology (INCET), Belgaum, India. Jun 5-7, (2020). This study presents a solution to the problem of identifying and classifying textures of medicinal plants automatically. The textured images of the plants are processed in a series of image processing steps such as enhancement, feature extraction, and classification techniques to identify the plants. Smartphone images of leaves are subjected to texture feature extraction using wavelet transform, Gray Level Difference Matrix (GLDM), and Gray Level Co-occurrence Matrix (GLCM). A K-Nearest Neighbor (KNN) classifier is used and the classification achieved an accuracy of 60%. In the opinion of the authors, better resolutions of images would carry better accuracy in the future classification. Strengths: This research method provides a variety of texture extraction techniques (wavelets, GLDM or GLCM), providing a wider perspective on analyzing the textures in plant leaves. International Journal of Research Publication and Reviews Vol ( ) Issue ( ) (2021) Page 000 The method is feasible and simple to use since it employs images obtained using a smartphone which can be easily adopted in the field. Weaknesses: With a classification accuracy of only 60%, the system's effectiveness and the reliability are considerably limited. Relying only on KNN classifier may not be the best; classification could be further improved by more sophisticated techniques such as CNNs. [4] S. Kavitha, T. Satish Kumar, E. Naresh, Vijay H. Kalmani, Kalyan Devappa Bamane, Piyush Kumar Pareek, "Medicinal Plant Identification in Real-Time Using Deep Learning Model", 8 October (2023). In this research, they designed a deep learning model based on MobileNet to recognize six medicinal plants with an accuracy of 98.3%. The model was embedded in a mobile application in which processing of plants' images is done in the cloud to enable a real-time plant identification service, thus providing an easy to use application for botany and health care. Strength: Responsive Web: The lightweight structure enables in-the-field recognition on smartphones. Increased Data: Enhances model generalization with the mere availability of few samples. Drawbacks: Few Species: The model can only recognize 6 plant species in its trained dataset. Network Requirement: It is based on cloud computing, therefore suitable for use over the net only. [5] Nidhi Tiwari, Bineet Kumar Gupta, Abhijityaditya Prakash, Kartikesh Tiwari, Sami Alshmrany, Arshad Ali, Mohammad Husain, Devendra Singh, "Developing A Neural Network-Based Model for Identifying Medicinal Plant Leaves Using Image Recognition Techniques", Journal of Advanced Zoology, Vol. 44,

Issue S-5 Year 2023 In this research, the image processing techniques using neural networks are used along with the proposed CNN models of AlexNet ResNet to profile the medicinal herbs. Identification accuracy of 96.82% was reached with the best performance coming from the 5-layer CNN architecture. The aim of this research is to create a mobile or online application that will aid in the identification of species, provide information on plants that have medicinal value, and contribute to the conservation of endangered plant species. Advantages: Illustrious CNN Models with Their High Accuracy: 5 layers of CNN have been capable of attaining a high accuracy of 96.82% suggesting its efficiency in the classification process of medicinal plants. Redundancy and Derivative: The model minimizes the long and grueling process of manually identifying a plant and the expertise of botany. Disadvantages: Hardware Demand: Implementing ResNet and AlexNet for the training of deep neural network illumination structures is very power-intensive which makes it hard to afford and impractical operation in real-time. Restricted Memory: Out of the entire dataset, only 30 plant species have been included in the model making it difficult to expect a wide range of changes when the model is used on other medicinal plants. [6] A. Fauzi, B. Soerowirdjo, and E. Haryatmi, "Herbal Plant Leaves Classification for Traditional Medicine using Convolutional Neural Network", IAES International Journal of Artificial Intelligence (IJ-AI) Vol. 13, No: 3 | September 2024 This study focuses on the use of Convolutional Neural Networks for identification of medicinal plant leaf images. Thus, a Custom Database was built that with 1,000 tree leaves picture which were gathered from four groups, such as Gulma siamo, Piduh, Sirih and Tobacco and trained a CNN model composed of 6 convolution layers, ReLU and Softmax output layers attaining 98.74% accuracy with auxilliary data augmentation (as opposed to 91.43% accuracy without auxilliary data augmentation). Strengths: Excellent Precision: 98.74% with data augmentation, up from 91.43% without it. Accurate Classification: The classification is exact across different variety of plant species. Data Augmentation: Enhanced robustness, strategies for generalization, and overfitting mitigation Drawbacks: Small Dataset: Only 1,000 pictures of 4 species are available leading to poor generalizability Image Quality Dependability: The algorithm may be less accurate when the images are low in quality. Power Hungry: Training for 100 epochs is quite resource-intensive.

### III. METHODOLOGY

"As people increasingly seek natural wellness and eco-conscious lifestyles, the traditional methods of learning and identifying herbs are limited by inaccessibility and a lack of interactivity. Relying on books and manual identification can be time-consuming, requiring specialized knowledge and access to physical resources. With the growing interest in Ayurvedic practices and herbal education, there is a need for an engaging, accessible solution that enables people to identify and learn about herbs in real-time, regardless of their location or background in herbal knowledge." Proposed Machine Learning Algorithm

Workflow Diagram:- The flowchart below depicts the functionality of the herb identification and recommendation application where users will be able to login, take a picture of a herb and get an identification as well as care recommendations and check if the herb can grow in the specific weather conditions. This app also has information on how to use various herbs, how to take care of them and their therapeutic properties.

- 1. System Initialization:** Essential Requirements: For the purpose of taking clear virtual images of herbs. Dependencies: Import necessary packages such as TensorFlow, Django, WeatherAPI and initialize the frontend (HTML, CSS, and JavaScript) environment.
- 2. User Authentication:** Users access the application by logging in or signing up using a frontend form that interacts with the Django backend. New Users: After successful sign-up, the member details are recorded in the database, followed by a redirection of the users to the Home Page.
- 3. Home Page Navigation:** From the Identify page users can take pictures and identify herbs or they can use the Explore dropdown for either resources on taking care of herbs and their medicinal uses or a guide to herbs.
- 4. Capture Herb Image:** On the Identify page, the front end provides the provision for users to take a picture with the camera of the device. The image is taken and image data is sent to the Django backend for further processing.
- 5. TensorFlow based plant recognition:** Model Inference: The herbal picture is uploaded to the server, which employs DenseNet121, ResNet50, or Inception V 3 based TensorFlow model to classify the herb. Output: The model gives results concerning the name and ID of the herb.
- 6. Herb information retrieval:** The server fetches the herb's details (such as its medicinal properties and how to take care of it) from a purposively created database, knowing the unique identification code of a herb. The herb information is then processed and made available for display.
- 7. Growth Feasibility Prompt:** The users are encouraged to answer this question, if they would like to grow the herb or herb nearest to them. If 'Yes' is checked by the user, then Applicability Check is answered by the system.

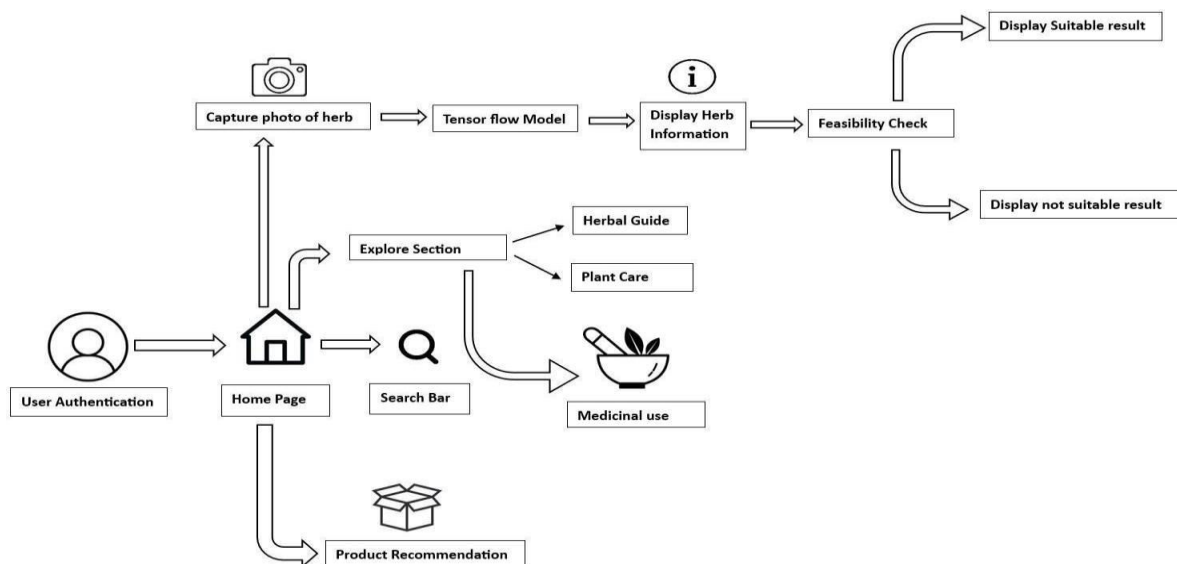
**8. Feasibility Check with WeatherAPI:** Geolocation details: The frontend either employs HTML5 geolocation capabilities to rectify the user’s location or elements belonging to the user. Current Weather: The local weather using WeatherAPI is called to the backend, and it is checked with the weather conditions set for growing that herb. Outcome: the backend system was able to classify the herb as “can be grown locally” or “cannot be grown locally”

**9. Show Practicality and Growing Tips:** The user interface provides the outcome of practicality level and growth related suggestions and tips in instances where growth is practicable and growing is not.

**10. Explore Section:** In the Explore section, the readers will be provided with facilities to access the following features:Herbal Guide: A repository of information and description relating to the numerous herbs. Plant Care:

Recommendations and guidelines regarding the maintenance of plants. Medicinal Uses: – The medicinal properties and applications of various herbs.

#### IV. WORKFLOW DIAGRAM



#### V. FUTURE SCOPE

The Ayurvedic Herb Identification Project presents an interesting idea of how one can effectively combine ancient Ayurveda with modern technological advancements. The app powered by AI allows users in real time, to recognizing plants where people can find medicinal herbs and benefits associated with them as well as care and growing tips. This easy to use device enriches the learning process making Ayurveda as well as botany much more interesting for students, health enthusiasts and professionals. Furthermore, the initiative promotes sustainable living through various eco-friendly activities and patronizing local businesses. The app has an interactive design that makes it mobile-friendly to all even persons with disabilities and looking to appreciate the beauty of herbal medication. As the app develops, it will be a key factor in linking individuals to nature, health, and the culture that has existed for many years while being environmentally sustainable for posterity

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