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Identification of Ayurveda Herbs Using Machine Learning

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ABSTRACT:Ayurveda is one of the oldest medical systems grounded on natural science. Ayurvedic medicines use natural herbs and plants, and their extracts. Ayurvedic medicine is made naturally with natural constituents that do not cause devastating effects on health. This can beregarded as an advantage of Ayurveda. Automatic recognition of the correct Ayurveda herb species that are used in the preparation of medicine is very important in the ayurvedic, folk, and herbal medicinal industry. The main factors needed to recognize a medicinal plant are its leaf shape, color, and textural features. Color and texture features from two sides of a plant leaf contain deterministic parameters to recognize the species. In the proposed system, a database of plant leaves is formed from scrutinized pictures of the leaves. Numerous automatic pre-processing operations are performed on every image in the dataset to reduce the noise in the image and resize it. Then, various features are extracted from the images of plant leaves. The leaves are then categorized grounded on the shape and dimension combination using machine learning classifiers. Finally, the system identifies and displays the name of the correct medicinal plant along with its features and usage through a web application. It is anticipated that for the automatic recognition of Ayurveda herbs this system will help the inhabitants to develop their understanding of medicinal plants, help biologists to Most of the plants are identified using their leaves. Although,leaves aremost commonly used for medicinal plant detection mechanisms, the stem, seeds, flowers, petals,and even the entire plant can be used in an automated process. The common steps to classify the plant species are capturing the image, removal of noiseand resizing it, extracting features, design and build up more effective plant species identification techniques, and also take part significantly in manufacturing of pharmaceutical drug.

KEYWORDS:leaf recognition; Ayurveda herbs; random forest; ensemble supervise Machine Learning algorithm.

I. INTRODUCTION

Ayurveda is an ancient kind of medical system practiced in India and has its roots in the Vedic times, around 5000 years ago. The main components of ayurvedic medicines are plant leaves and other parts of plants such as roots, bark and so on. Plants of Indian origin exceeding 8000 in number have been found to be of medicinal value. Herbal medicinal systems in India use combinations of a small subset of 1500 of these medicinal plants. Specifically, preparations of commercial Ayurvedic medicineuse 500 of these plants. More than 80% of the plants used in the preparation of ayurvedic medicine are collected from forests and wastelands, and the rest are cultivated in agricultural areas.

Inancient times, Ayurvedic physicians themselves picked medicinal herbs and prepared medicines for their patients. However, this process of manual recognition is often laborious and time consuming.

using the proposed methodology, and finally identifying or recognizing the correct medicinal plant.

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II. LITERATURE SURVEY

In Amrutha M Raghukumar et.al [1]. In this method, plant leaf images are used to extract characteristics, which are then used to classify the leaves.Shape, texture, and color aspects are taken into account by the system. The system gives more importance to the color and texture features. The GLCM matrix is used to extract thetextural properties.Then, a comparison of the performances of several machine learning classification techniques, including KNN and SVM, is conducted.The simulations were all carried out in MATLAB R2019a. SVM is less accurate than KNN, hence it is not preferable for this application.

In Keshav Kumar [2]. In this therapeutic approach, the author presents a technique for identifying and categorizing medicinal plant leaves usingconvolutional neural networks (CNN). Raw images are passed as inputs via a deep convolutional neural network. All the duplicate photos of leaves in the dataset are destroyed using a comparison technique which is implemented using python script. The deep neural network method classifies the leaves without extracting visual attributes. Then, a web application is used to sort and display the leaves of plants. This gives a more accurate classification. The proposed methodology obtained an accuracy of 96.8%.

In J. Samuel Manoharan [3]. In this work, the standard dataset is used which is refined via the medicinal laboratory. This system mainly focuses on improving the detection rate to identify herbal leaves. Hence, the two-stage authentication (TSA) procedure is used to improve classification accuracy. It has two phases namely edge based herbal plant detection and classification based herbal plant detection. Knowledge based controller is used as an edge detection operator and the features selected are extracted using the chi-square technique. CNN classifier is being used to classify the extracted images of leaves. The two phases are compared with ex-or gate operation is known as deep knowledge-based identification. Finally, the result is validated with a machine learning classifier. Even though this proposed system is effective, it consumes more time in computation and requires lots of storage space.

In M. Jayanka et.al [4]. The author proposed a fine-tuned model using the different parts of ayurvedic herbal plants. In this work, they have implemented a convolutional neural network (CNN)to recognize and classify ayurvedic plant leaves. Scanned and captured images were collected from Ayurveda Medicinal Hospital. Before submitting collected images to a neural network, their background was set to white color and resized to 256X256 pixels. The size of the dataset is increased using two data augmentation methods. The CNN model obtained an accuracy of 97.71% for identifying ayurvedic herbal plant leaves. The methods used for captured images did not detect the leaf part and its background accurately.

In GummadiDivyasree et.al [5]. In this proposed system, the VGG16 methodology is applied to identify the image and display the output as an image and its scientific and botanic name. The leaf which is mostly available in all seasons and can be captured easily compared to other segments was considered. The attributes such as shape, colour, and size are extracted from the image. The images are collected from the Mendeley Dataset which has 30 types of leaves which are represented by their scientific names. These are divided into tests, training, and validation for classification. Here deep learning classification technique VGG16 is applied and a web page is designed for displaying the usage of the leaf.

In R.Geerthana et.al [6]. In this paper, the system uses the Deep Learning concept. This system uses the CNN model to train the data and to achieve high accuracy. A dataset consisting of around 58k images is used. They selected five different Indian medicinal plant species such as Jatropha curcas, Pungai, kuppaimeni, Jamun (Naval), and Basil. The system also considers the features such as leaf shape, texture, and color. The design contains a total of five phases. In these phases, different model architectures were trained to obtain a 96.67% success rate in identifying the correct medicinal plant. But this model is limited to only five different plant species.

In KiranS.Gawli et.al [7]. In this research, a method for classifying photographs of plant leaves using computer vision and machine learning approaches is provided. Image pre-processing, image segmentation, feature extraction, andimage classification are the phases that make up the suggested methodology. Thesystem uses different classification methods for the classification of plant leaves. Here a plant is classified based on its leaves using the CNN algorithm. The colourand texture features were extracted from the images and given to the CNN classifier. Using the tensor flow framework, the model achieved an accuracy of over 94.26%. And 17 plant species were automatically classified by the proposed system.

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Figure: Table Analysis

Sl. No.	Title	Existing System	Methodology/Algorithm	Drawback
1	Comparison Of Machine Learning Algorithms For Detection Of Medicinal Plants	Identifying plants using Machine Learning	KNN and SVM	SVM is less accurate than KNN and hence is not preferrable for this application
2	Identification of Ayurvedic Medicinal Leaves using Deep Learning	Identification using image processing and neural network training	Image Pre-processing, Convolution Neural Network	CNN has high computational cost, needs lots of training data and is comparatively slow
3	Flawless Detection of Herbal Plant Leaf by Machine Learning Classifier Through Two Stage Authentication Procedure	Identification using Machine Learning Classifier	Image segmentation, Canny Edge detector, Single Classifier(CNN), Two Stage Authentication Procedure	The computation time is very large and also the pixel-based process consumes more storage space in the array of the algorithm used for pixel.
4	Recognising Ayurvedic Herbal Plants in Sri Lanka using Convolutional Neural Networks	Identification using Deep Learning	Convolution Neural Network, multi-layer neural networks	The system could not identify leaf part and the background part correctly because of time limitation and complexity of the methods used
5	Ayurvedic Leaf Identification Using Deep Learning Model VGG16	Identification using Deep Learning	Deep Learning, VGG16	VGG16 is a huge network and it takes more time to train its parameters
6	Medicinal Plant Identification Using Deep Learning	Identification using Deep Learning	Deep Learning, Neural Networks, Convolutional Neural Network, Regression	This CNN model is limited to only five different classes of plant species
7	Deep Learning for Plant Species Classification	Identification using Deep Learning	CNN classifier, tensor flow framework	It lags in comparison to methods that implement other neural networks or deep learning techniques
8	Comparison and Classification of Medicinal Plant Leaf based on Texture Feature	Identification using Machine Learning	K- nearest neighbour (KNN) classifier	The proposed system uses the images with some standard quality
9	Medicinal Plant Recognition based on CNN and Machine Learning	Identification using CNN and Machine Learning	CNN, ANN, SVM, KNN and Naive Bayes(NB)	It does not implement the colour image classification
10	Automatic Plant Image Identification of Vietnamese species using Deep Learning Models	Identification using Deep Learning	MobileNetV2, VGG16, ResnetV2, Inception Resnet V2, Support Vector Machine (SVM) classifier	The proposed method did not obtain maximum accuracy
11	Automated Real-Time Identification of Medicinal Plants Species in Natural Environment Using Deep Learning Models—A Case Study from Borneo Region	Identification using Deep Learning	EfficientNet-B1-based deep learning model	Performance accuracy was slightly dropped when the system was tested on the actual samples by using the developed mobile application in real time
12	Plant Leaf Identification based on Machine Learning Algorithms	Identification using Machine Learning	Support Vector Machine, Multilayer Perceptron, Random Forest, K-Nearest Neighbor, and Decision Tree algorithms	It does not focus on the ratio of length and width as a feature

In Pushpa B R et.al [8]. Here the system classifies the medicinal plants using the textural featureswhich mainly helps in the recognition of the leaf. The methodology includes phases like enhancement of images, extraction of features, and classification. The leaf images are captured using smartphonesand techniques such as digital image processing are used for feature extraction, and, finally, comparison is done among them.The design of an automatic classifier is done by implementing the K-nearest neighbor(KNN) classifier. The drawback of this system is that it uses images with some standard quality.

In BhanuprakashDudi et.al [9]. Here the system uses deep learning method for classification and recognition which uses computer vision techniquesto achieve high accuracy.The proposed system utilizes the Convolutional Neural Network (CNN) andmachine learning algorithms for deep learning of Ayurveda plant images. The system has achieved 98% of accuracy inmedicinal plant recognition. Calculations of performance metrics like precision, recall, F1-score, andsupport are done by

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the system. The accuracy of training and accuracy of validation are nearly equal. The drawback with this system is that it does not implement the classification of color images.

In Nguyen Van Hieu et.al [10].In the paper, the collection of image dataset was done from an open-source which resulted in the generation of 28046 images of 109 Vietnam plant species. Here they have used different convolutional models for the extraction of features, and they are VGG16, ResnetV2, Inception ResnetV2, and MobileNetV2. The resulting recognition rates are promising enough and MobilenetV2 reached the greatest level of 83.9%.This outcome shows the effectiveness of machine learning models for identifying plant species in the natural ecosystem, and upcoming projects must look into recommending more accurate systems on a greater dataset.

In Owais A. Malik et.al [11]. This research suggested designing and developing a real-time, automated system for identifying plant species. The system is proposed for the identification of medicinal plant species which are found in the Borneo region. For the task of identifying the species of plants, a DeepLearning network based model on EfficientNet-B1 was modified and trained using a merged public datasetand a private dataset of plant species. The proposed model's Top-1 accuracies were 84% and 87% for the private and public datasets respectively. Compared to the baseline model, the system exhibited a 10% improvement in terms of acciracy.

In D.M.C.Dissanayake et.al [12]. It includes pre-processing of the leaf dataset and their effective and accurate classification. In the pre-processing step, the system includes tasks such as handling the noise, enhancement of the images, and transformation. Features were thenextracted by consideration of the color, texture, and shape of the leaves. Subsequently, on the dataset, five machine learning algorithms were used for classification. The obtained accuracy of classification for the support vector machine is 85.82%, 82.88% for Multilayer Perceptron, 80.85% for Random Forest, 64.39% for Decision Tree algorithms, and it was 75.45% for K-Nearest Neighbors.

III. PROPOSED SYSTEM

The proposed system uses a dataset of plant leaves. The main phases included in the proposed methodology are described in detail in this paper.

a. Automatic pre-processing steps

Numerous pre-processing operations are performed automatically on every image in the dataset to reduce the noise in the image and resize it.

b. Feature extraction

Several base features and various shapebased features are extracted from the images of the leaves of plants. These are:width, length,perimeter, etc. Thus, many different attributes are derived for each leaf.

c. Classification

Finally, the plant species are classified as Ayurveda herbs using machine learning classification techniquesand their corresponding accuracies are compared. The proposed system uses the random forest algorithm and ensemble supervise machine learning algorithm, and Support Vector Machine(SVM) classifier for the classification purpose.

d. Displaying Result

After the classification,if the result is an Ayurveda herb, then the output is displayed as an image with the name of the medicinal plant and further a pop-up menu displaying the features of the respective Ayurveda herb. The features displayed are: the English name and scientific name of the herb, its constituents, benefits, and information about the already existing drugs that have been produced using this respective medicinal plant.

The block diagram of Identification of Ayurveda Herbs using Machine Learning is as shown in Figure 1.

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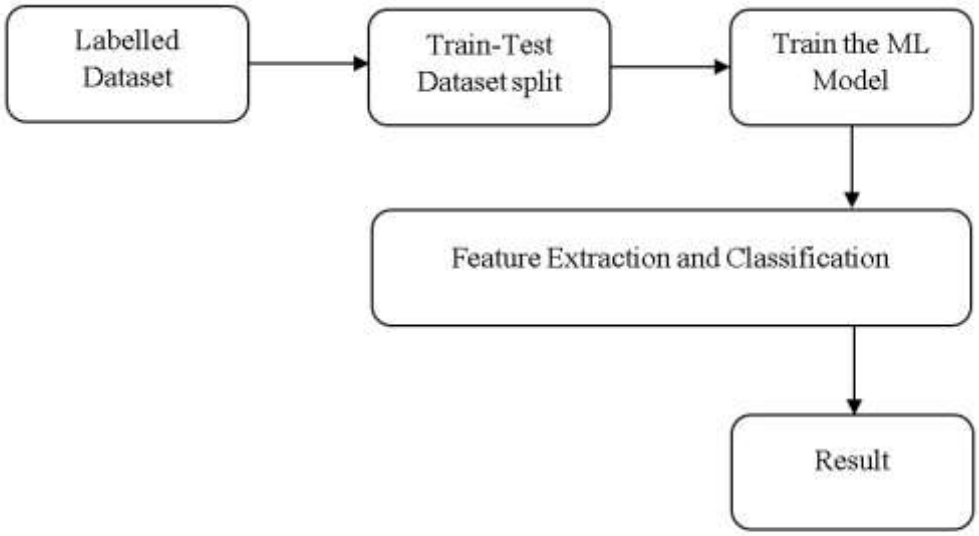

Figure 1. Block diagram of Identification of Ayurveda Herbs using Machine Learning

IV. CONCLUSION

In this project, we are going to implement a methodology to identify the Ayurveda herbs using machine learning classifiers such as random forest algorithm and ensemble supervise machine learning algorithm grounded on morphological features such as colour, texture, and other geometrical features. The consolidation of shape, colour, and textural features results in maximum accuracy of leaf recognition. The obtained results using this approach are very promising and thus indicate the aptness of this algorithm for Ayurveda herbs detection systems. This excellent performance indicates the usability of such computer-aided advanced techniques for the classification of biological specimens and their potential applicability in resisting the 'taxonomic crisis'. A web-based or mobile or computer system for the automatic identification of medicinal plant species will help the local population to enhance their understanding and knowledge of Ayurveda herbs, assist biologists to build up more competent species recognition tactics, and will also contribute significantly to the protection of endangered plant species.

For future research, probabilistic neural networks and deep learning neural networks would be investigated in an attempt to obtain even higher accuracies. This work can also be prolonged to a larger number of plant species. The science of Ayurveda can be consolidated in the field of agriculture and veterinary sciences to obtain beneficial outcomes. The project can also be extended to recognize medicinal plants based on other parts of the plant such as stem, root, axillary buds, phyllotaxis, etc.

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