Identification of Medicinal Plants By Image Processing of Leaf Samples

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Abstract- *Creating an automated system for classifying medicinal plants takes time and effort. India is home to a wide variety of plant species, each of which has a unique set of therapeutic benefits. Humans find it challenging to recall the names of all plant species and their purposes, therefore background knowledge is essential for manual identification and classification. Because doing so will be advantageous to numerous sectors, including medicine, botanic research, and plant taxonomy studies, among others, it is imperative to preserve these medicinal plants. Current technology cannot match the diversity of medicinal plant species that exist in India. Utilizing textural traits that are crucial for distinguishing and classifying leaves, the recommended strategy makes it simpler to categorize medicinal plants.*

Current technology cannot match the diversity of medicinal plant species that exist in India. Utilizing textural traits that are crucial for distinguishing and classifying leaves, the recommended strategy makes it simpler to categorize medicinal plants. The three key steps of the proposed method are feature extraction, classification, and picture enhancement. After the photos of the leaves were shot with cellphones, the characteristics that may be compared between the images of the leaves were extracted using digital image processing techniques. The CNN classifier is then used to develop a machine learning classifier.

Keywords- CNN(Convolution Neural Networks), Deep Learning, Deep-CNN, Pre-Processing, Feature Extraction, Classification, Segmentation.

I. INTRODUCTION

An ancient medical practise called Ayurveda dates back to the Vedic period, or around 5000 years ago. In India, it is still in use today. Ayurveda is thought to be the oldest kind of medicine.Ayurveda is referred to as "The Science of Life" in Sanskrit. Ayurveda is still widely used both in its place of origin and all throughout the world, despite being suppressed for years under non-native control. The majority of the ingredients in ayurvedic medicines come from plants, including leaves, roots, bark, fruits, seeds, and more. There are allegedly 8000 plants with medicinal qualities that are native to India.

The fundamental ideas of this Ayurvedic approach are timeless and easily adaptable. Ayurveda is therefore one of the extremely few ancient medical systems that is still in use today.

Many ideas found in the old Ayurvedic literature that dates back thousands of years were adopted into ancient Tibetan, Traditional Chinese, and Early Greek medicine. Ayurveda is regarded as the "mother of healing" because of how widely and extensively it is used in the medical field.

Pharmaceuticals made from these Ayurvedic plants are produced on a large scale.

As a result, the production and sale of ayurvedic medicines has expanded into a thriving industry with an estimated annual income of Rs 4000 crores. As a result, India now has more than 8500 licensed manufacturers of Ayurvedic drugs. Concerns concerning the quality of the raw materials used in the creation of Ayurvedic products are raised as the sector becomes more commercialized. Large tribal communities lacking formal skills in plant identification usually gather these species.

The erroneous or a different kind of medicinal plant can occasionally be obtained from industrial facilities. Most of these industrial facilities don't have adequate quality control mechanisms to check these plants.

Additionally, it might result in some unpleasant surprises. In order to accurately identify the ayurvedic plant from leaf samples, a sophisticated method must be created.As a result, the drug's effectiveness and dependability will be preserved

II. LITERATURE SURVEY

[1] This study suggests using computer vision to identify ayurvedic medicinal plant species found in India's Western

Ghats. The described method detects leaves from photographs using a K-NN classifier and integrates SURF and HOG features.

[2] Jing Wei Tan and colleagues suggested utilizing the CNN model D-Leaf to classify leaves in plants. D-Leaf extracted attributes and an ANN of that order were used. Use Sobel edge detection to create images to separate the venation from a scaled leaf. The D-Leaf model was said to have a classification accuracy of up to 94.88 percent.

[3] The application of Convolutional Neural Networks (CNN) for the identification of Indian medicinal plants is discussed in this research. In this study, we look into morphological features, feature vectors from the front and back of a green leaf, and feature vectors in order to uncover a unique optimum combination of properties that boosts recognition rate. To create a database ofmedical plant leaves, front and rear views of the leaves of commonly used medicinal plants were photographed.

[4] In order to build a highly accurate system, R.hey train data with CNN architecture. Out of all the models that were trained, the one with the best model architecture successfully identified the associated medicinal plant 96.67% of the time.

[5] Scale Invariant Feature Transform (SIFT) was used by sed as a shape and colour descriptor. Nine grids and two HSV planes separate the image. Colour moments are computed and used as feature vectors for each grid in each plane. The minimal Distance function between the test and training sets serves as the basis for identification.

III. METHODOLOGY

Design overview:

The design overview gives a description of the architecture that would be applied to the construction of a software product. The major components that would be developed for the product are highlighted, along with their interfaces, and the system is given a thorough overview.

System architecture:

Among the numerous hidden layers that make up a Deep-CNN, a sub type of DNN, are convolutional, RELU, pooling, and fully connected normalized layers. Convolutional layer weights shared by CNN improve network performance while consuming less memory. The three main aspects of CNN are shared weights, particular connections, and three-dimensional volumes of the neurons. A convolution layer produces a feature map using a learned kernel and multiple input picture sub-regions. The ReLu layer is then used to appeal an irregular operative function when the faults are minimal in order to improve the convergence qualities.The usual pixel in a pooling layer is the one with the greatest value among them or the one that has the average value.

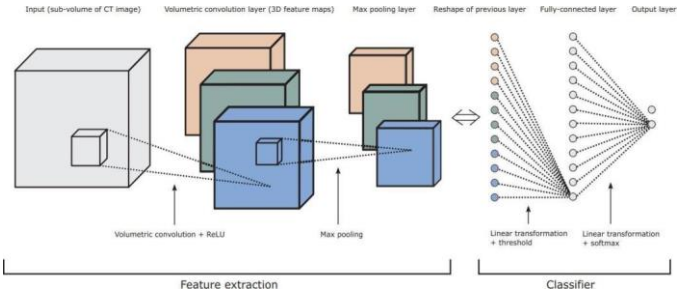

Figure 1: Deep - Convolutional Neural Network General Architecture

As a result, the sample size is considerably reduced. Convolutional layers and traditional Fully-Connected (FC) layers are occasionally merged in the output stage. Convolutional neural network designs frequently combine the pooling and convolution layers. Max pooling and means pooling are the two types of operations that the pooling layer frequently carries out. In mean pooling, the average neighbourhood is calculated inside the feature points, while in max pooling, it is calculated within the feature points up to a maximum. Mean pooling preserves background information while reducing the neighbourhood size limiting error. By minimizing the convolution layer parameter estimation defect caused by the mean deviation, max pooling maximizes the amount of texture information stored.

The proposed method follows three stages:

Datasets:

Leaf samples from various medicinal plants were collected. We collected at least 40 leaves from 26 different kinds of medicinal plants. Simple hand sampling ought to be carried out, and leaves that have sustained severe damage ought to be eliminated. Each medicinal plant species is given 60 picture samples, and 30 leaves from each species are chosen for scanning. Additionally visible are the leave's top and bottom faces.

Image segmentation:

A photograph is segmented when the visual image is split up into several pieces. This typically makes it simpler to identify borders and artifacts. Making it simpler to convert an

abstract image into a concrete image that can be quickly and clearly analyzed is the aim of segmentation.

Image preprocessing:

The tested image is restored using the median filter during the pre-processing stage by lessening the effects of acquisition degradations. There is discussion of several leaf picture preparation and segmentation techniques.Images need to be processed before they can be used for model training and inference. This includes adjustments to the shape, arrangement, and shade, among other things. Model pre-processing may also shorten model training time and accelerate model inference.

Convolutional Neural Network:

Among the numerous hidden layers that make up a CNN, a kind of DNN, are convolutional, RELU, pooling, and fully connected normalized layers. At the convolutional layer, CNN shares weights to improve network efficiency and consume less memory.The three main components of a convolutional neural network are shared weights, local connections, and three-dimensional volumes of the neurons.

A convolution layer combines several input picture subregions with a learned kernel to produce a feature map. The ReLu layer is then used to appeal a nonlinear operative function when the fault is minor in order to improve the convergence properties. The pooling layer selects the pixel with the highest value among them for a portion of the image or feature map, or the average value.

Layers of Convolutional Neural Network includes:
convolutional layer: The convolutional layercreates a characteristic map to forecast the class potential for each character using a filter that scans a small piece of the entire image at a time.

pooling layer: The convolutional layer uses a pooling layer (down-sampling) to create less information for each feature while maintaining the most important information (the convolutional and pooling layers' processes are typically repeated numerous times).

Fully Connected Input Layer: It uses a completely linked input layer to condense the output of earlier levels into a single vector that may be used as a process for the next layer.

Fully Connected Layer: The input produced by the feature research is given weights in order to precisely forecast a description.

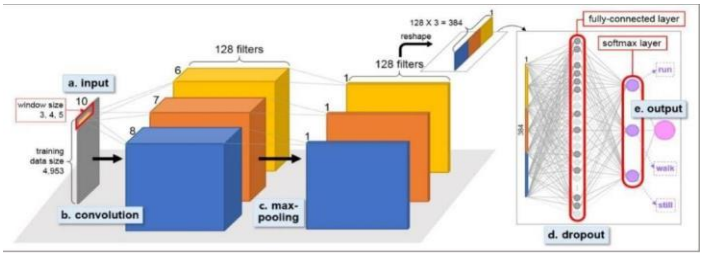

Figure 2: Convolutional Neural Network General Architecture

Data flow diagram:

A dataflow overview is a tool for reference how knowledge develops from one module to the next, as seen in Fig. This graph displays the data and yield for each module. On the map, there are no circles, and there is no power flow.

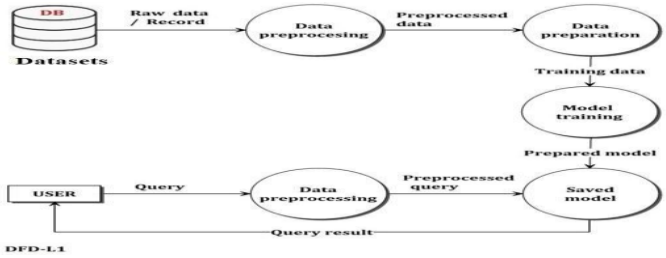

Figure 3: Data flow diagram of proposed model

Use case diagram:

The use case diagram serves as the boundary between the system of interest and its surroundings.

The actors are frequently system players who can be distinguished by their roles. Use cases are the distinctive roles that actors both inside and outside of the system play.

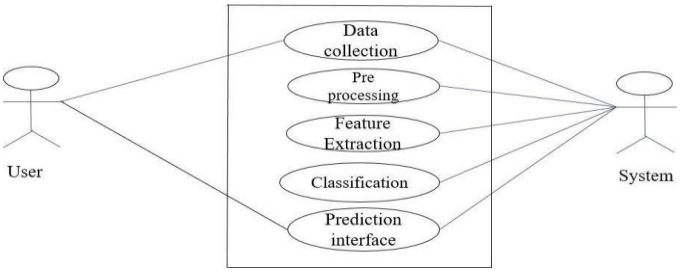

Figure 4: Use case diagram of proposed model

Class diagrams:

Class diagrams are the essential component of object-oriented modelling. They are used to showcase the different items in a system along with their properties, functions, and interrelationships, as seen in Fig 5.

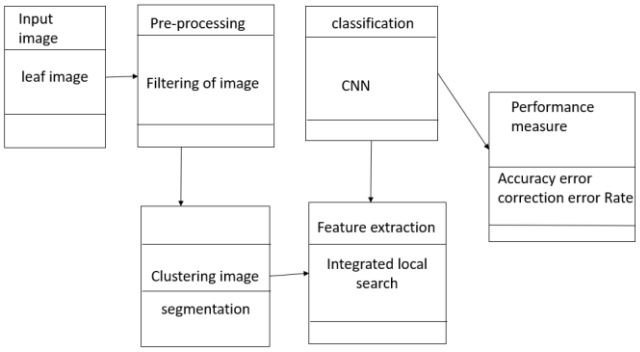

Figure 5: Class diagram of proposed model

IV. APPLICATIONS

1. Using a user-uploaded photo, one of the system's key goals would be to identify plants.
2. To create a graphical user interface that is simple to use. should ensure that the user interface is straightforward to use and understand.
3. To provide instructions for caring for the plant.
4. To deliver the most accurate findings conceivable.
5. To provide farmers a choice that will save them time and money.
6. To provide a dependable and successful system.

V. RESULTS AND DISCUSSIONS

- It has been suggested to identify Ayurvedic medicinal plants using photos of the front and back of the leaf. The work is based on a database the authors generated of illustrations of medicinal plant leaves.
- There are specific combinations of morphological, colour, and textural features that maximizes the identification rate of green leaves accuracy.
- Accuracy rates of up to 97.2% have been attained for identifying green leaves using this combination.

VI. CONCLUSION

Plants are vital to human survival. Herbs in particular have long been employed as traditional medicines by indigenous peoples. Clinicians frequently use their own extensive sensory or olfactory experience to identify plants. Recent developments in analytical techniques have made it considerably simpler to identify herbs based on scientific data Technologies.

People, especially those who are not accustomed to identifying herbs, will benefit greatly from this laboratory-based Analysis necessitates understanding of sample restoration and data interpretation, as well as arduous methods. A quick and reliable method of identifying herbs is thus required. For the purpose of identifying herbs, it is anticipated to be advantageous to combine computation and statistical analysis. This Non-destructive methods will be preferred for quickly identifying herbs, especially for persons who are unable to employ expensive analytical gear**.**

This study reviews numerous methods for recognizing plants and weighs the advantages and disadvantages of each.

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