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# Identification of Medicinal Plants using Deep Learning

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**ABSTRACT:** Medicinal plants have been an integral part of human health. More than 80% of plants collected from the forest are used in ayurvedic formulations. Plants are the essential source of medicines. Convolution neural network (CNN) from Deep learning are capable of image processing, feature extracting and making a system ideal for identifying medicinal plants using the visual characteristics. There are many Machine learning algorithms developed a tool for identifying the plants. Collecting the data, analyzing the data and the images, image preprocessing, training the model using CNN and machine learning to extract features then testing the model and finally comparing the results are the steps involved in the proposed system. Under convolution neural networks, the layers are formed with pooling then it forms fully connected layers which helps in feature extractions. The trained neural network model is evaluated on the test set to measure classification accuracy. On the training model, the accuracy's set was 95%. Let us look forward for the exact accuracy after training the model.

**KEYWORDS:** Medicinal plant, Tensor flow, Neural networks

## I. INTRODUCTION

Medicinal plants have been an integral part of human health and well-being for centuries. These plants are the source of numerous bioactive compounds used in the treatment of various ailments. Over 80% of plants used in ayurvedic formulations are collected from the forests. More number of plants of Indian origin have been found to be of medicinal value. Accurate identification of medicinal plants is essential for ensuring the efficacy and safety of herbal medicines.

Convolutional Neural Networks (CNNs), a class of Deep Learning (DL) models, have shown remarkable success in image classification tasks. CNNs are capable of automatically learning and extracting features from images, making them ideal for identifying plant species based on their visual characteristics. The application of CNNs in medicinal plant identification holds significant promise. It can provide a rapid, accurate, and scalable solution, reducing the reliance on human expertise and minimizing errors.

The proposed system include the collection and preprocessing of a diverse dataset of medicinal plant leaves, the design and training of a deep learning model for leaf classification, and the evaluation of the model's performance using metrics such as accuracy, precision, recall, and F1-score. The anticipated outcome is a highly accurate identification system that can significantly aid in botanical research and the development of herbal medicines.

## II. RELATED WORK

The identification of medicinal plants has long been a critical task in both traditional and modern medicine. However, these traditional methods are often limited by human error and the need for expert knowledge [1]. Recent advancements in machine learning have provided new tools for plant identification. Machine learning algorithms can analyze large datasets of plant images, identifying patterns and features that may not be apparent to the human eye. Random Forest and Support Vector Machine (SVM) algorithms have been used to classify plant species based on leaf morphology with moderate success [2]. Despite their potential, these methods often require extensive feature engineering and may not perform well with complex datasets [3]. Convolutional Neural Networks (CNNs), a subset of Deep Learning, have revolutionized image classification tasks by automatically learning hierarchical features from raw pixel data. Several studies have explored the use of CNNs for identifying plant species [4]. For instance, Lee et al developed a CNN model that achieved high accuracy in classifying plant leaves from the Flavia dataset [5]. Sun et al utilized a CNN architecture to identify medicinal plants, achieving an accuracy of 92% on their custom dataset [6]. Despite these advances, there remain significant gaps in the current research. Many existing studies focus on limited

datasets, which do not fully represent the diversity of medicinal plants found in different regions. Additionally, the majority of research has concentrated on leaf images, neglecting other plant parts such as flowers and stems, which can also be critical for accurate identification [7]. This study aims to address these gaps by developing a comprehensive CNN model trained on a diverse dataset of medicinal plant images. By expanding the scope of plant parts and testing the model in various environmental conditions, this research seeks to enhance the reliability and applicability of CNN-based plant identification in practical scenarios.

### III. METHODOLOGY

#### MODEL OF THE PROPOSED SYSTEM

The process of convolution tells that most of the time is dedicated for creating and collecting the dataset by capturing or by searching for the different types of images of medicinal plants. Once the data is collected completely, all the data images are preprocessed like at first reading the image, extracting RGB values, resizing the image, rotating the image and removing background. Then the next process is Data Augmentation used to increase the data without actually collecting the new data. This is achieved by applying various transformation to the existing data, creating multiple altered version of original data.

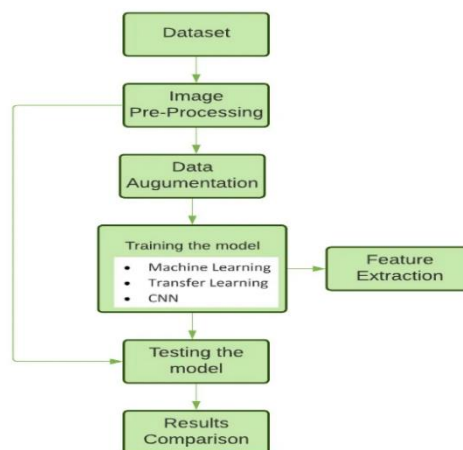


FIG 1 Flow chart for medicinal leaf identification

The further most step is to train the model using machine learning, transfer learning and CNN in which the feature extraction also takes place. Tensor flow is the frame work used in machine learning in which the model can be constructed and deployed. In CNN, convolution consists of 3 main components as the input image, feature detector and output image. To get the accuracy, the filter is taken as 3x3 matrix form. These 3x3 filters overlap each other and forms more number of filters which increase the depth of the features. Then the layers perform pooling which downsamples the feature maps extracted by convolution layers. Then flattens the 2D feature map to 1D vector and preparing the input into dense (fully connected layers). This dense layer learns and extracts the features by convolutional layers classifications

In the testing phase, once the model is trained, the trained images will be tested through the predictions and give the result on identifying the rare medicinal plant. To get the accuracy, the number of images and the number of epochs will affect. Epoch is a measure of the number of times the training is done. Once the number of epoch increases between 40-60, high accuracy can be obtained.

#### DATA COLLECTION

Effective data collection is foundational to the success of the medicinal plant leaf and testing the model in various environmental conditions, this research seeks to enhance the reliability and applicability of CNN-based plant identification in practical scenarios.



identification project. By sourcing high-quality images and applying rigorous quality control measures, the project will develop a robust dataset that supports the accurate and reliable identification of medicinal plant leaves using deep learning techniques. This comprehensive approach ensures that the final model is well-equipped to handle the diverse characteristics of medicinal plant leaves and contributes to advancements in botanical research and herbal medicine development. Some of the sample medicinal plant leaves are shown in fig.3.2.



FIG 2 Medicinal plant leaf samples

#### ANALYSIS

Analyzing of huge amount of data manually is a tough work which takes more time and more effort. Therefore, to overcome this problem we have a technique called Deep learning. In Deep learning, there are several classifications. One of is Tensor flow – one of the open source available. It provides all the libraries and resources to do classification and analyze the data.

#### CONVOLUTIONAL NEURAL NETWORKS (CNNs)

Modern technology is based on computer models known as artificial neural networks. There are different types of neural networks. One of them is the Convolutional Neutral Network (CNN). It is also a Deep Learning network that applied to image displaying problems. One imaging displaying problem is classification. It is used to detect what the image is and what is involved in the image. A CNN consists more convolutional layers which is in series of fully connected, grouped as a convolution layer and pooling. In this, series of convolution layer takes the convolution operation as the input. In the convolution operation, there are three main components as the input image, feature detector, output image. The feature detector is known as kernel.

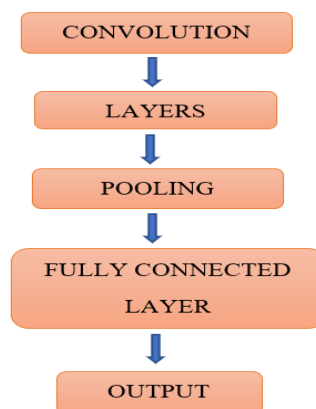


FIG 3 Flow chart of CNN

#### **IV. EXPERIMENTAL RESULTS**

The trained neural network model is evaluated on the test set to measure classification accuracy. The regularization parameters are adjusted in order to extract the optimal model features from the data. The model's accuracy on the training set was 95%. This precision is determined by the number of epochs committed. When evaluated on 300 photos of 20 uncommon medicinal plants, the test set accuracies ranged from 85% to 90%.

#### **V. CONCLUSION**

In proposed system, a robust technique using CNN for the identification of rare medicinal plants. Test accuracy of 90% was obtained by using the TensorFlow on the dataset that we created. The accuracy increases with the number of training which is meant by epoch. When the number of epoch increases, it can get high accuracy.

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