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Classification of Selected Medicinal plants leaves Using Image processing and Machine Learning

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Abstract: Human survival depends heavily on plants since they give us air, food, clothing, fuel, medicine, gums, and environmental protection. Numerous plants have a high therapeutic potential and are rich in active components. There are numerous useful plant species now going extinct and destruction occurring as a result of reasons like climate change, population growth, professional secrecy, a lack of governance for research activities and a lack of understanding of medicinal plants. The process of manually identifying therapeutic herbs takes a lot of hours, so professional assistance is required. Automatic classification and medicinal plants identification are required to solve this issue for the benefit of humanity as a whole. Image processing research is currently focused on the computerized grading and naming of therapeutic plants. The primary processes in the identification of medicinal plants and the classification process, which have an impact on the overall accuracy of the classification system, are feature extraction and classification.

Keywords: Medicinal leaves, Convolution Neural Networks (CNN), Ayurveda, image processing, Machine learning

I. INTRODUCTION

Image processing research is now being done on the automatic classification and identification of medicinal plants. Leaves and other botanical components including roots, bark, and other components are the key ingredients in ayurvedic remedies. Over 8000 plants with Indian ancestry have medicinal use. Herbal remedies from various Indian medical systems use a mix of a few of these plant, numbering 1500. Particularly, 500 of these herbs are used in commercial Ayurvedic medicines. The majority of plants used in ayurveda preparations are gathered from waste areas and woods, with the remainder being grown on agricultural land [1]. When things were old, To make the remedies for their patients, doctors themselves selected the medicinal herbs. Only a few practitioners still use this method now. Ayurvedic medication manufacturing and sales now generate more than Rs 4000 crore in annual revenue Most of these units don't have enough quality control procedures in place to check these plants. In addition, there is a lot of uncertainty due to regional name variants. Some plants arrive in dry state, thus the manual must account for this. All Much more challenging is the identifying task. Ayurvedic medicine is rendered useless by improper usage of medicinal plants. Additionally, it might result in unpredicted negative effects. To continue the sector's current expansion while preserving the legality and effectiveness of medications, The company's use of Ayurvedic drugs and raw materials requires strict quality control procedures. [2] In order to identify a plant, a skilled botanist examines all of its distinguishing characteristics, including its leaves, flowers, roots, seeds, and stem. All other objects—Besides the leaf, there three-dimensional, which makes computer analysis more difficult. But since they are 2D objects, plant leaves can be used to determine the species of the plant. Obtaining images of leaves is simple, and document scanners, mobile phones, and affordable digital cameras are all viable options. In contrast to flowers and seeds, it is accessible all year long.

II. RELATED WORK

A Brief Survey on the identification of medicinal plants leaves Systems

In most of the research; They have focused their attempt by using the color and texture of the flower as the features [1]. As the methodology, they have followed three phases namely the image capturing, image processing and Neural Network phases. The images were captured using a digital camera. The flowers have placed at the center of the camera. The dataset has 18 categories of flower images. Flower identification and classification are the most important task that needs to get accuracy. This phase consists of four steps for image processing as image filtering, image segmentation, region detection, and feature extraction. NN was used to classify the images based on color and texture. For the methodology they have divided their approach into four steps as image enhancement, image segmentation features extraction and classification The overall results differ from the types of flowers. Some flowers get 69% accuracy and some have 80% accuracy. At the conclusion they have concluded that the number of images of flowers depends on getting the accuracy of the training

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result Most of the researchers have used the image processing techniques for feature extraction and CNN for the classification In their approach consists of four steps as pre-processing, segmentation, hand-design feature extraction and classification. To segment the flower from the background they have used saliency-segmentation-based approaches to select the Region-Of-Interest (RIO) on flower images. And have used a common segmentation technique called mean-shift algorithm.

III. PROPOSED METHODOLOGY

1.) Pre-processing: The input images are preprocessed before the model training. Images are rescaled, rotated at a certain angle, zoomed and flipped. The images are resized to 150x150 pixels. The testing images are also pre-processed in the same manner.

2) Model: The proposed system consists of a deep learning framework CNN built as shown in "Fig -2". The model has 2 convolutional layers each followed by 2x2 max pooling and ReLU as the activation function. The input to the convolutional layer is an image of 150x150 size with 64 filters and 3x3 kernel size. At the end of the model, there are 2 Fully-Connected layers with softmax as the activation function.

3) Training and Testing: The model is trained under 50 epochs with a batch size of 64. It was observed that there were 12 steps perepoch. Checkpoints are assigned after every 5 epochs, thus saving the model. The image used for validating the model was also preprocessed in the same way as the input image. 80% images are used for training and 20% are used for testing.

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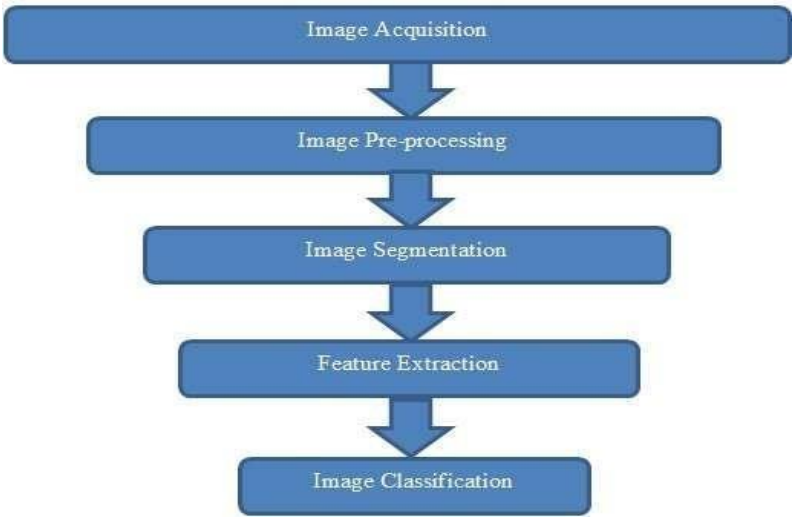

IMAGE ACQUISITION

A laptop-connected digital camera is used to capture the photographs. The acquired pictures go through more processing.

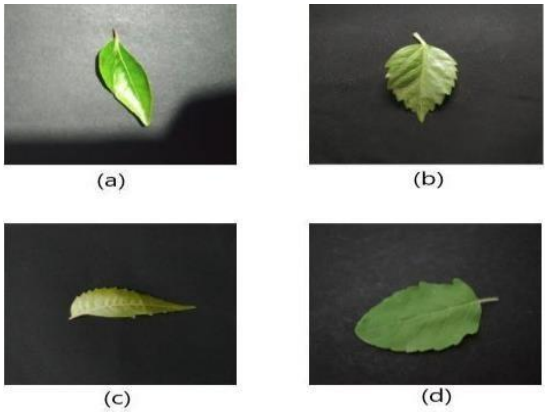

Fig: Leaves Samples

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IMAGE PRE-PROCESSING

Images are pre-processed using the camera takes their picture in order to enhance their quality. The color conversion, noise cancellation, histogram averaging, green masking, and other pre-processing techniques may be used. In this case, color transformation is used to improve the image's quality. Greyscale and HSI conversion of RGB images is done in order to improve quality.

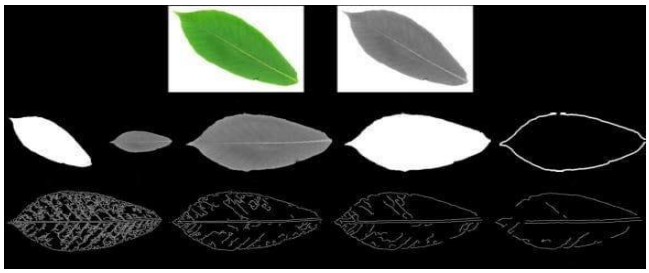

Fig: Image Pre-processing of leaf

IMAGE SEGMENTATION

Pre-processing is done on the images the camera takes in order to enhance their quality. Other pre-processing techniques include color transformation, noise reduction, histogram equalization, green masking, and others. Color manipulation is performed in thisinstance to enhance the image's quality. RGB photos are converted to greyscale and HSI to enhance quality.

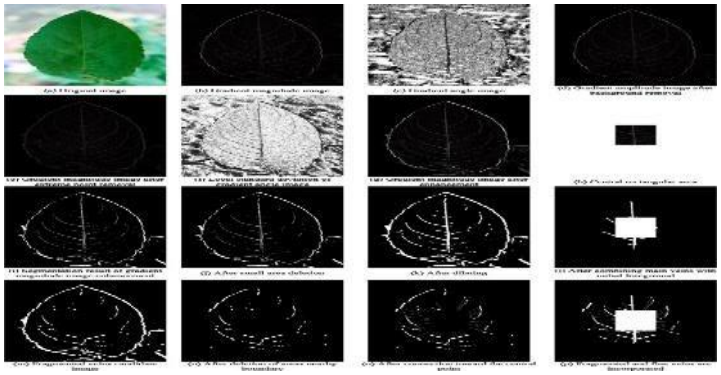

Fig: Segmented image

FEATURE EXTRACTION

An image has numerous characteristics, primarily colour, texture, and shape. Here, we're focusing on three characteristics: colour histogram, texture that seems like colour, form, and texture

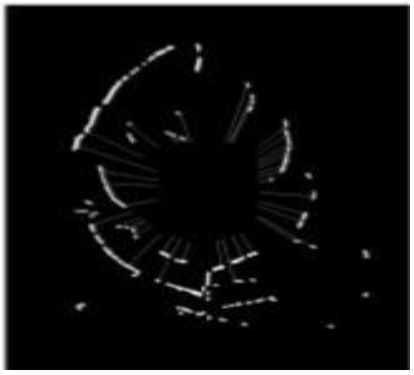

Fig: Feature Extracted image

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IMAGE CLASSIFICATION

Convolution neural classifier is used to categorise these photos. To analyse the acceptable features and identify distinguishing traits forcrack identification, a combination of many features is used.

PERFORMANCE ANALYSIS

From the earlier articles, we can see that both the front and back of the leaves were photographed. When tested over 10 plants, the recognition rates of the leaves were up to 98%
Precision, Recall & Accuracy

The Comparative Analysis Of Detection Using Various Classifiers Is Observable. The Precision Of A Classification Model Is Its Ability To Isolate The Pertinent Class.

Recall Is The Ability Of A Classification Model To Find All The Relevant Cases Within A Dataset.The Quality Or State Of Being Correct Or Precise Called Accuracy.

TABLE I COMPARISON MATRIX

Figures of Merit	CNN	KNN	SVM
Precision	95.67%	90%	91.37%
Recall	97.02%	96.12%	95.28%
Accuracy	97.80%	89.56%	96.66%

IV. CONCLUSION

Images of the front and back of the leaf have been used in a novel way to identify Ayurvedic medicinal herbs the project is built on a collection of images of medicinal plant leaves that the authors created. The recognition rate of green leaves is increased by particular configurations of morphological, colour, and texture traits.

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