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Ayurvedic Plant Leaf Classification using Image Processing Techniques and SVM

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Abstract - *This paper proposes machine learning approaches for identification of Ayurvedic leaf types. Every image has a signature associated with it. The signature can be shape, color and texture with which two images could be compared. The color based segmentation method that uses k means clustering technique. It is an iterative technique used to partition an image into k clusters in order to identify the leaves. As the days passes it is very difficult to identify the existence of the medicinal herbs and to remember the names of every medicinal herb. Thus it is required to construct system of an automatic recognition and classification for greater advantage. The reason for this proposed strategy is to provide accurate knowledge to people and farmers, which serves to develop the culture of medicinal herbs. Plant species belonging to different classes such as Ajwain, Betal, Curry, Methi, Milkweed, Neem and Tulsi are considered in this work.*

***Key Words*: Ayurvedic leaf, k means clustering technique, automatic recognition, classification,** etc

1. INTRODUCTION

In the domain of Indian Science Medicinal Herbs are treated as one of the extent assets called Ayurveda. The herbs are utilized in a variety of industrial appliances, for example herbs, ingredients in biofuels, biomass, pharmaceuticals etc. Individuals have been utilizing some plant as a conventional medicine. These medicinal herbs are regularly develop in our backyards or the ones that available along roadsides. As the days passes it is hard for the individual to identify existence of the medicinal herbs and to remember the names of every medicinal herb. Thus it is required to construct system of an automatic recognition and classification for greater advantage. The reason for this proposed strategy is to provide accurate knowledge to people and farmers, which serves to develop the culture of medicinal herbs. This proposed system also provides details of medicinal herbs and database to suppliers, pharmacy students, research students, agents, pharmaceutical companies.

Medicinal herbs are identified depends on their leaves, bark, blooms, seeds, roots, fruits, stem and parameters like region of its growth, height, and environmental factors. To recognize the medicinal herb we have to group the plant by considering its leaves because these are two dimensional in nature and also available at all the time.

We can classify Ayurvedic medicinal leaf using image segmentation. Image segmentation is the process of dividing images into different parts based on similarity. Clustering is the analysis aimed to classify the objects into categories on the basis of their similarities. Leaf are classified relies on the numerous features such as color, leaf texture, shape and venation of leaf. It is difficult to recognize the medicinal herbs using fruits/seeds and flower because they are three-dimensional in nature and available only in specific seasons.

Leaf recognition technology plays an important role in plant classification and its key issue lies in whether selected features are stable and have good ability to discriminate different kinds of leaves. This paper introduces identification of Ayurvedic leaf using support vector machine (SVM).

2. SYSTEM DESIGN

System design is the process of defining the architecture, components, modules, interfaces and data for a system to satisfy specified requirements. The system design process partitions the system into subsystem based on the requirements. It establishes overall system architecture and is concerned with identifying various components, specifying relationship among components, specifying software structure, maintain a record of design decisions, and providing a blue print for the implementation phase.

3. ARCHITECTURE

Fig.1 shows block diagram of classification and identification of Ayurvedic leaf using image processing techniques and support vector machine (SVM)

This approach is based on mainly 4 steps: Image Acquisition, Preprocessing and segmentation, Feature extraction and Classification in which Ayurvedic leaf is predicted.

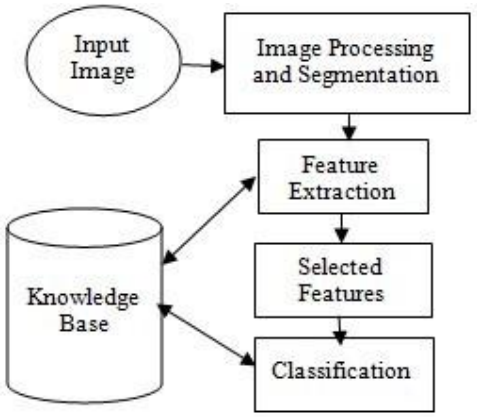


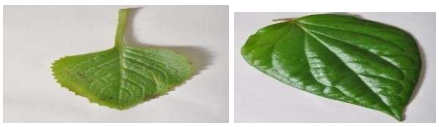
Fig-1: Block diagram of classification of Ayurvedic leaf

The starting point of this paper is the creation of a database with all the images that are used for training and testing. The image database have different formats such as *.bmp,*.jpg etc. In this images are used, as they are the most realistic approach. Images can be read with the help of digital camera. Initially the images are preprocessed for better and clear image. Segmentation is applied on the image to mark and extract the region of interest from the input image. The output of the segmentation phase is fed as input to the feature extraction and the feature set obtained is fed as input to Classification stage for training and classification in order to recognize the leaf.

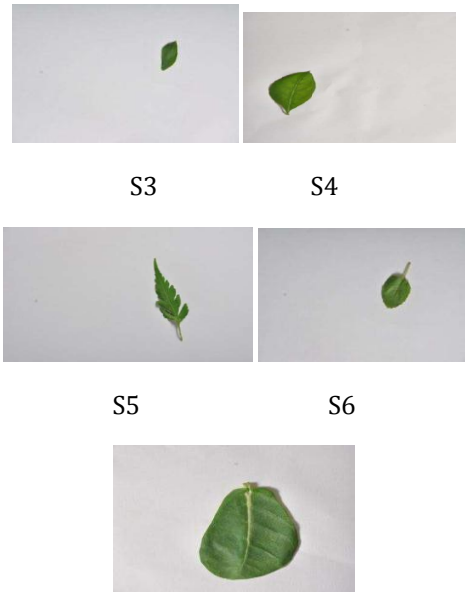
A. Acquisition of input image

Every system needs some precise and concise dataset that will perform the required function with increasing the system complexity. For experimentation purpose dataset is created of 7 samples of Ayurvedic medicinal leaf and 210 images. Images of Ayurvedic medicinal leaf are acquired using Nikon D3300 digital camera of 24.2mp DX format DSLR using 18 to 55mm range lenses. This database is very attractive since at least 30 images of the same category are present, which is essential for a good recognition at a large scale.

There are different types of various Ayurvedic leaf shown below.



S1 S2



S3 S4

S5 S6

S7

Fig-2: Sample Images of medicinal plant (S1)Ajwain, (S2)Betal, (S3)Curry, (S4)Methi, (S5)Neem, (S6)Tulsi,(S7)Milkweed

B. Image Pre-processing

Image pre-processing aims to remove unwanted areas from image or image features improve which are helpful for processing of remaining steps and to perform analysis task. The leaves are considered as a dominant feature for identifying a plant type. The digital image of the leaf part of any plant is given as an input data. This image undergoes preprocessing steps in order to remove any kind of external noises present in an image. The main idea of preprocessing is to enhance the image details so that features are clearly found for further processing. This step involves image enhancement and RGB to Gray scale conversion.

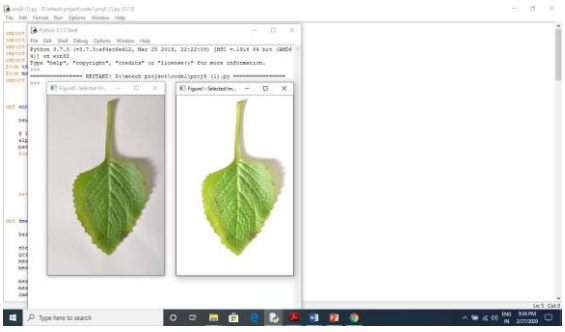


Fig-3: Result of image enhancement

RGB to Gray

The noise removed leaves are then converted from color to grayscale image which will be easy for

feature extraction process. The contour of the leaf is then detected using the edge detectors.

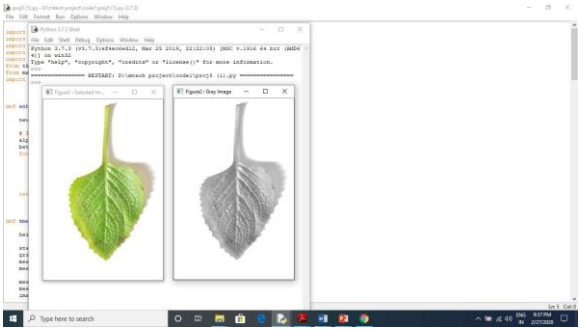
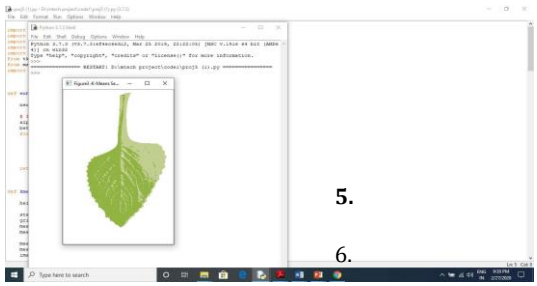


Fig-4: Result of RGB to Gray scale conversion

C. Segmentation

Image segmentation assembles homogeneous pixels in a regions depending on common similarities. Basic similarities may be in terms of pixel colors, texture etc. It's significant and must to rearrange the image so that, the analysis of image becomes easier and efficient, and this is done by making use of segmentation process. Segmentation makes indirectly separating objects and recognizing edges of objects in given image. The main idea of the image segmentation is to group pixels in homogeneous regions and the usual approach to do this is by common feature. The goal is to segment colour image in an automated fashion using clustering. A cluster is therefore a collection of objects which are "similar" between them and are "dissimilar" to the objects belonging to other clusters. In this paper we can use K-mens clustering it is one of the essential algorithms that solve the well-known clustering problem.



5.

6.

Fig-5: Result of K-Means segmentation

D. Feature Extraction

The features are extracted from segmented image. To classify an image adequately and distinctively texture features must be extracted out of any images. Determining the eminent and important features of image data is very crucial. When the input data to an algorithm is too large to be processed and it is suspected to be redundant (much data, but not much information) then the input data will be transformed into a reduced representation set of features. Transforming the input data into the set of features is called feature extraction. The extraction of efficient features is the fundamental step for image classification.

The images feature scan be classified as texture, shape features, statistical features of pixels, and transform coefficient features. In proposed system we can extracted shape feature, color feature and texture feature of leaf.

E. Classification

The classification technique is used to detect the type of leaf disease. Classification deals with associating a given input pattern with one of the distinct class. Features are utilized to describe objects. They are put away in vector called feature vector. A classifier is a learning algorithm that produces a recognition decision according to the weights of these features. As indicated before, these learning algorithms involve training operation and then prediction involves testing phase. During the training phase, training dataset is constructed, which is composed of training patterns from feature values and their corresponding class labels. In the testing phase, given an unlabeled query sample (or feature value), the classifier decides to which class the sample belongs. In this paper Support Vector Machine (SVM) is used for leaf classification.

4. RESULTS AND DISCUSSION

In this system, we used 140 leaf samples for training and 70 samples for testing. This training and testing are based on the features namely Area, Perimeter, Aspect Ratio, Aspect Ratio, Extent, Solidity, Standard Deviation, Kurtosis, Skewness which are obtained from the images. This combination of as well as SVM classifier provides an accuracy of 96.4%.

5. CONCLUSION

The proposed method is tested with different 210 samples of Ayurvedic leaf images of 7 different species and in most cases positive response can be observed. The proposed system implemented by considering leaf features that can be extracted using shape, colour and texture approaches. These approaches have been used for the identification of leaf. SVM is used as a classifier to identify Ayurvedic leaf. The 96.4% accuracy of is obtained from the SVM classifier from the result it is clearly seen that SVM classification model has good classification performance. Through this work, time needed and manual labor required to perform Ayurvedic species recognition can be reduced.

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