Pattern Recognition Method for Study of botanical characteristics of Leaf

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ABSTRACT

The feature extraction is important step in pattern recognition. The application of pattern recognition to extract proper features of leaf can lead to through study of botanical characteristics of leaf. The methodological contents of this paper are to describe a novel approach for pattern recognition method for feature extraction from natural image such as plant leaf. This novel method proposed for automated living plant species recognition. This recognition of plant species will be useful for botanical students in their research for plant species identification. A leaf is an aerial and lateral outgrowth of the stem of a usually flat and dorsiventral anatomy. Their pattern, also called leaf venation, is a feature of characterization. The blade margin and the leaf arrangement at the stem are further features of characterization.

Keywords

Pattern Recognition, Feature Extraction, plant leaf.

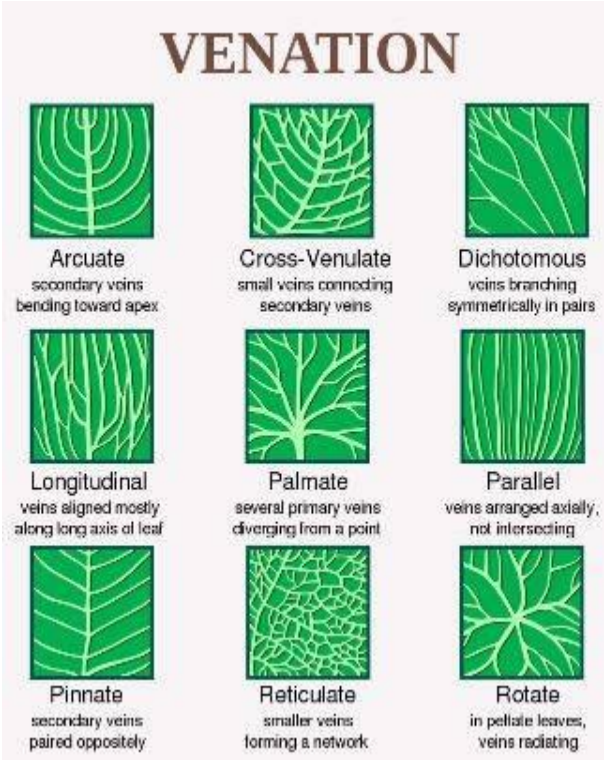
1. INTRODUCTION

India is agriculture based country and it is also endowed with a variety of natural resources. All along the west coast the Western Ghats are sprawling. The entire Western Ghats is known for its biodiversity, richness and endemism of different species. [1] There are various species of plants, some of which can be found generally, while others can only be found in specific areas. These plants are both useful and dangerous. Memorizing and recognizing species of plants are a difficult and important task for people. Plants are also important for their medicinal properties, as alternative energy sources like bio-fuel and for meeting our various domestic requirements like timber, clothing, food and cosmetics. Building a plant database for quick and efficient classification and recognition of various flora diversities is an important step towards their conservation and preservation. The plants are basically identified by their leaves. There are different varieties of trees grown throughout the world. Many leaves are used in medicine, so it increases its value and identification is very important in day to day life. This recognition of plant species will be useful for botanical students in their research for plant species identification. A leaf is an aerial and lateral outgrowth of the stem of a usually flat and dorsiventral anatomy. Their pattern, also called leaf venation, is a feature of characterization. From this perspective the current paper proposes the design of a system which uses feature extraction and shape recognition techniques to recognize the plants based on the shape of their leaves, extracted from digital images

2. RELATED WORK

In recent times computer vision methodologies and pattern recognition techniques have been successfully applied towards automated systems of plant cataloguing. Many methodologies have been proposed to analyze plant leaves in an automated fashion. A large percentage of such works utilize shape recognition techniques to model and represent the contour shapes of leaves, however additionally, colour and texture of leaves have also been taken into consideration to improve recognition accuracies. Plant leaf images corresponding to three plant types, are analyzed using three different shape modelling techniques, the first two based on the Moments-Invariant (M-I)[2] model and the Centroid-Radii (C-R) model and the third based on a proposed technique of Binary-Superposition (B-S).[3] There are more than 2,50,000-2,70,000 plant species that have been named around the world.[4] Therefore, it is difficult for people to recognize all of them. There are a lot of researchers trying to build an automatic system that can recognize plants by using both leaves and flowers. There identification had been studied using various methods [5]. A tree's leaf is also one major botanical marker that helps in keying out and identifying any species of tree that has a leaf. Most trees can be identified by the leaf alone - they are unique! Tree Leaves come in many shapes and sizes, many with similar structures but most with subtle differences. The texture features have been extracted with using the GLCMand the PCA algorithms, on the 390image in dataset and with 65 deformed or new leaf images for test. In addition, different degrees for the GLCM method were used and it was found out to be more efficient in the degree 0° by78.46 % accuracy. Therefore, it was specified that the GLCM is very sensitive in any changes for images such as deforming or giving the new leaf image as a test. In addition, the PCA method comes out to be more efficient compare to the GLCM method by 98.46 % accuracy .Even slight differences can determine exact tree species identification. [6]The way a leaf looks in terms of leaf shape, leaf margin, leaf arrangement and leaf venation is important for identifying plants to include trees. These structures are always species specific and will consistently grow to a genetically determined pattern and shape. Botanists and foresters have developed terms for these patterns and shapes which help in tree identification. A leaf is an aerial and lateral outgrowth of the stem of a usually flat and dorsiventral anatomy. It functions mainly to manufacture food by photosynthesis and consists typically of a stalk also called petiole, a flattened blade, the lamina, and the leaf base. Strands of conducting and strengthening tissues, the veins, run through it. Their pattern, also called leaf venation, is a feature of characterization. Leaves may be simple, i.e. undivided or compound (composed of several parts called leaflets). The blade margin and the leaf arrangement at the stem are further features of characterization. The blade is radiated by leaf veins that contain the fibers. It is distinguished between parallel, arched, pinnated or netlike vein structures. Just as variable as the vein structure is the shape of the leaves. The fundamental difference is that between simple and compound leaves. The compound leaves are built from several small

leaves or from pinnations that sit in a regular organization at the undivided or branched rhachis.



Another feature of recognition is the blade margin that can be shaped very differently. It can be plain, serrated, double serrated, crenated or sinuated. Leaves with deep clefts are called pinnatified, pectinated, palmated or lobed.

During the last four decades, the field of leaf recognition has been receiving significant attention. It is an application of image processing (pattern recognition) in botany. Hence, the leaf recognition is interdisciplinary research. As the world achieves a major enhancement in a digital camera technology, people can take a picture anywhere and anytime. Therefore, the objective of this work is to develop the leave images recognition system that allows humans to differentiate the sorts of plants more precisely. Similarly, many researchers used the neural network to find out pest and diseases, percentage of pest and diseases incidence.[7]

3. METHODOLOGY

Normally, a plant leaf has the green colour. Therefore only the RGB colour feature cannot be used to recognize plants leaves. Researchers use more features and techniques to recognize a plant leaf image. For example, they use shape, size, vein and texture of the leaf to recognize plant species. There are many researchers using a neural network method to recognize a leaf image.

For this work, we have collected the leaf and the capture it's images through modern digital camera and it is the data set of leaf images, after that stores them in the system database. The system chart is shown below.

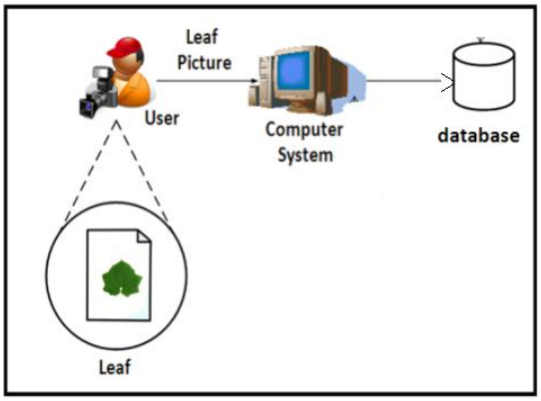


Figure.1 Database of leaf

Figure. 2 Captured Images

4. Proposed Algorithm for Feature extraction

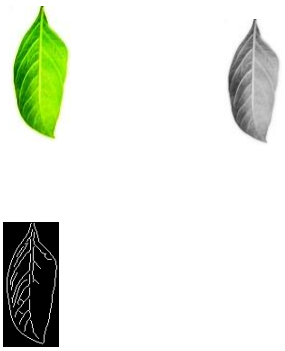
The proposed algorithm is conceptually simple, but may provide better recognition accuracies. er than the database is created by capturing the images of different leaves of different pattern. The leaf images are initially colour images that are converted into gray scale image. Find the edges after smoothing (get connected) the image. We proposed the following algorithm for the recognition of Pattern Recognition Method for Study of botanical characteristics of Leaf.

- Data Acquisition
- Resize the image.
- Convert image into gray scale image.
- Removing _noise_ from an image;
- Removing motion blur from an image
- Obtaining the edges of an image.
- Extract the features
- Match the pattern for recognition.

5. Experimentation

The images captured by 12.1 mp Digital Camera operated with flash in day light. For this work we have collected initially 110 images of 10 different plants, out of which some of the leaves looks like similar but they have different venation pattern. Each image is 50 x 90 pixels in dimensions and in JPEG format. Converting the image into gray scale, remove the noise from the image by using filters which

smooth the image. The stages of images are shown below. Canny edge detector is used to identify its edge pattern.



6. Conclusion and Future Scope

This paper proposes an algorithm of automated system for leaf recognition using shape features of the leaf. From these features, we will get the type of the leaf whether it is single or compound. Further, we can classify from the venation pattern. Like, divergent means moving towards boundary and convergent means moving towards mid vein. Such automated classification system s can prove extremely useful for quick and efficient classification of plant species with the help of leaf. The accuracy of current proposed approach is comparable to those reported in contemporary works.

Future work would involve research along two directions:1) Image acquisition techniques such as by scanning the leaf directly through good quality scanner and, 2) Connecting the discontinue edges and carry it up to the boundary of the leaf for improving recognition accuracies

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