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Leaf Image Authentication using Image Processing Methods

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Abstract - *Medicinal plant materials and herbs are essential components of herbal medicines. In the preparation process of herbal medicines, the authenticity of leaves used is at most important. Leaves with similar features have high chances to mistaken as in same class. Leaves which look alike are authenticated using methods of image processing by considering various parameters of leaves.*

***Key Words*: medicinal plant, leaf image, image processing, leaf features, aspect ratio**

1. INTRODUCTION

Plant species recognition can be easily done by leaf identification. For doing the same the identification system should be efficient and reliable. Reliability and accuracy of test result depends on the database with high quality leaf images. In this work database of leaf images are taken by capturing leaf images with a high-resolution digital camera. Images are stored in the system for further processing. Preprocessing of images is the first step in image processing. In this step colour image is converted into grayscale image. Image enhancement process enhances the image for better clarity with the region of interest. Followed by morphological operation is carried out in preprocessing step. It applies a structuring element to an input image creating an output image of same size. A small binary image (small matrix of pixels) each with a value of zero or one is normally taken as structuring element. The size and shape of a structuring element determines the results of dilation or erosion. The basic operation of morphological operation is dilation and erosion. The process of adding pixels to the boundaries of the object in an image is dialation. The process of removing pixels on boundaries is erosion. For image identification, image processing can play an important role. In this work plants identification as herbal medicinal plants is done using image processing methods.

2. OBJECTIVES AND METHODOLOGY

2.1 Objectives

The aim of this work is to develop an accurate practical application system for easily identifying plant species by authenticating leaf images. In order to popularize Ayurvedic medicines worldwide, accurate identification of medicinal plants is very important.

2.2 Leaf Features

Aspect ratio is one of the features used for leaf image identification. Ratio between length and breadth of leaves is defined as aspect ratio [5]. Other leaf features used in the process are colour, shape and venation pattern. Main leaf features are given in Fig-1.

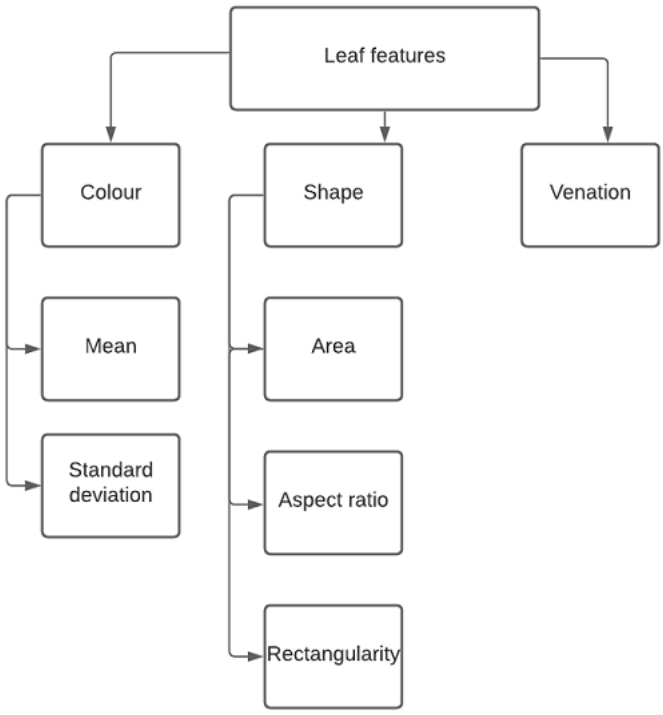

Fig -1: Leaf features

2.3 Methodology

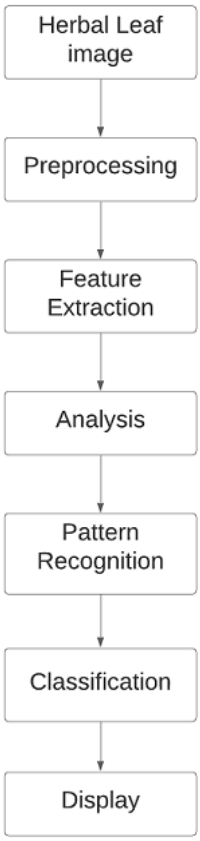

Fig -2: Methodology flow chart

The flowchart shown in Fig-2 gives an overview of how a leaf image is authenticated using image processing methods. Leaf image database is the main part of the identification system. The image of the leaf to be tested is captured by a high-resolution camera and comparison is done against the prestored database. Desired features for comparison purpose are extracted after applying preprocessing techniques. Preprocessing operations cleaning the image by reducing noises. Using mathematical formula feature and pattern of the leaf is calculated. The same operations are already performed corresponding to each leaf prestored in the database. The vector values calculated corresponding to test image is compared against the database. The dissimilarity factor of test image against each database image is calculated. The leaf sample with more similarity is identified as the leaf's class.

3. EXPERIMENTAL SETUP

A high-resolution digital camera is used for image acquisition. Image is saved in JPEG format. The supported file formats are TIF (TIFF), JPG (JPEG), BMP (bitmap) and RAW format. Sharp edges in the leaf image can be detected by converting RGB image format to grayscale format. Reduction of noise or distortion, image enhancement for better view and image sharpening are carried out in prepossessing phase. Colour image used in the experiment is given in Fig-3. Normally leaf image is green in colour. Changes in water, nutrients and climate can affect the leaf colour up to a limit. The colour information from the image may be removed due the low reliability of colour characteristic.

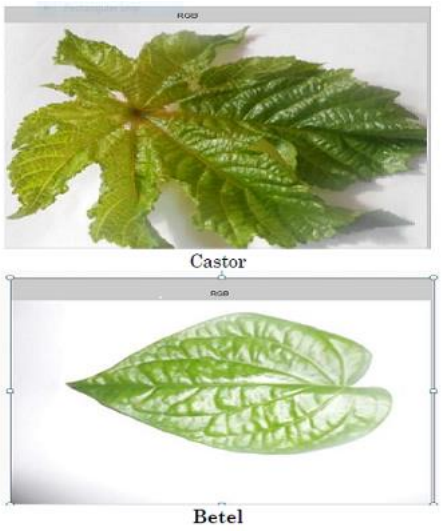

Fig -3: Input color Image

Grayscale image of tested sample is shown in Fig- 4. In the grayscale image only shades of gray or no colour present. Colour images can be converted into black and white or grayscale images. In this process only luminance information of pixels retained after eliminating colour information. Colour images are combination of red, green and blue components. In a colour image each pixel has three different luminance values. In grayscale images, the value of each pixel is related to the number of bits of data used to represent the pixel. The value of the gray image is usually represented by 8 bits, that is, the combination of eight binary numbers represents the pixel value of a pixel. Many shades of gray are present in grayscale images. Since only one colour is present grayscale images are also called monochromatic. Binary image of the tested leaf image is shown in Fig-5. Image contain two values black and white. Black and white images are otherwise known as bilevel or two-level images. In binary images each pixel is 1 or 0. The result of certain operations such as segmentation, thresholding, and dithering results in binary images.

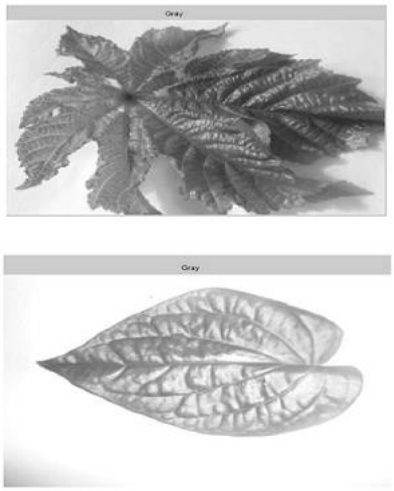

Fig -4: Grayscale Image

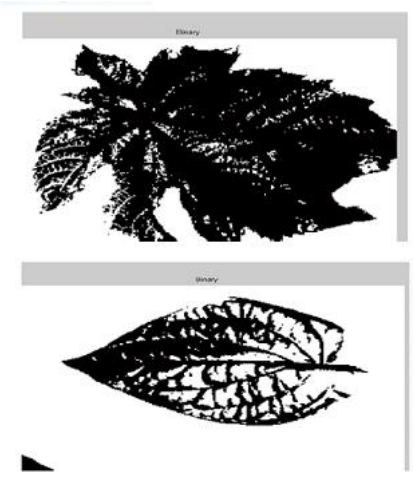

Fig -5: Black and White image

This work is carried out for betel and castor leaves. From different plants 25 leaves are collected and image is captured. Images are converted into JPEG. After preprocessing images are converted into grayscale. The parameters considered are rectangularity, aspect ratio and form factor. MYSQL is used to construct database. Comparison operation and other processing done using python. Test image is compared with the already collected images. By calculating feature parameters, similarity index, identification and classification of leaves carried out. Feature extraction table is shown in Fig-6.

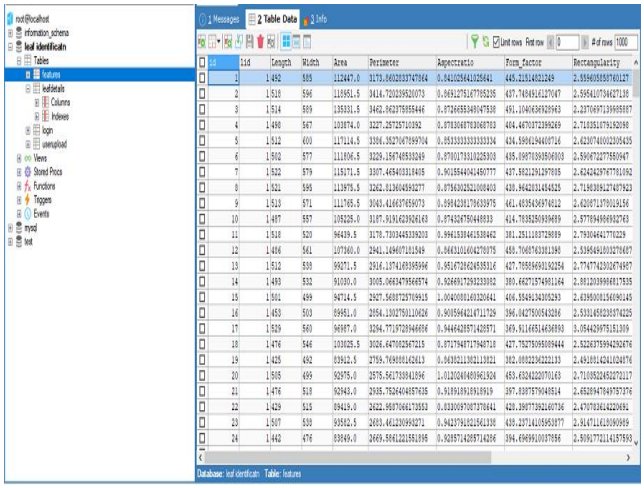

Fig -6: Feature extraction table

4. CONCLUSION

Aim of this work is quick and correct identification of herbal leaf images as medicinal leaf or not. Result obtained will be more accurate if the database size is large and more features are considered. As future work, can be expanded by enhancing database size with more species and thereby make possible the identification process more effective.

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