

# 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 be 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 dilation. 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.

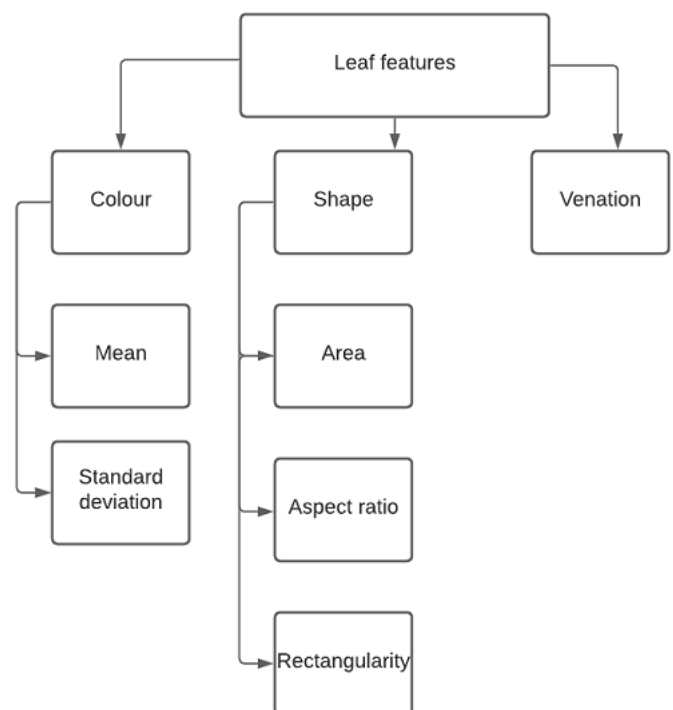


Fig -1: Leaf features

### 2.3 Methodology

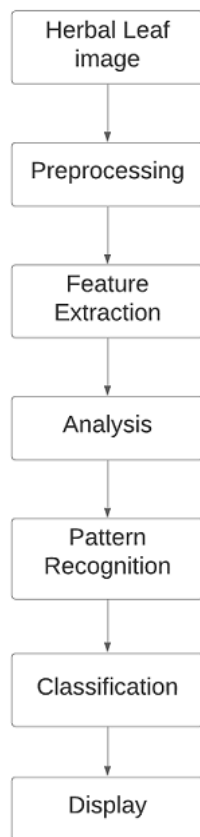


Fig -2: Methodology flow chart

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 preprocessing 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.

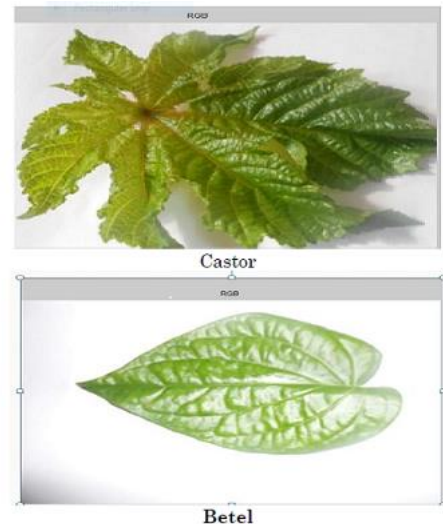


Fig -3: Input color Image

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.

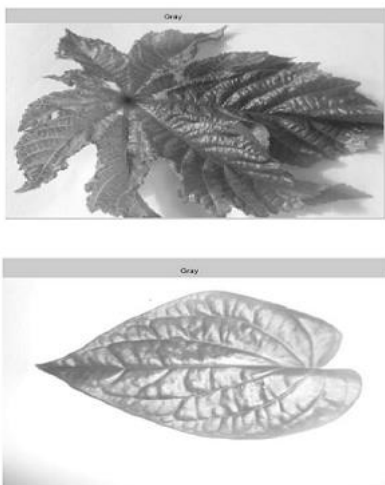


Fig -4: Grayscale Image

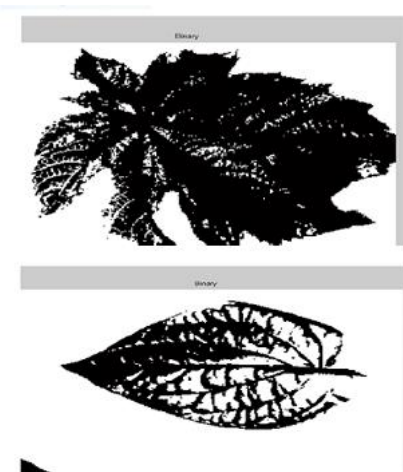
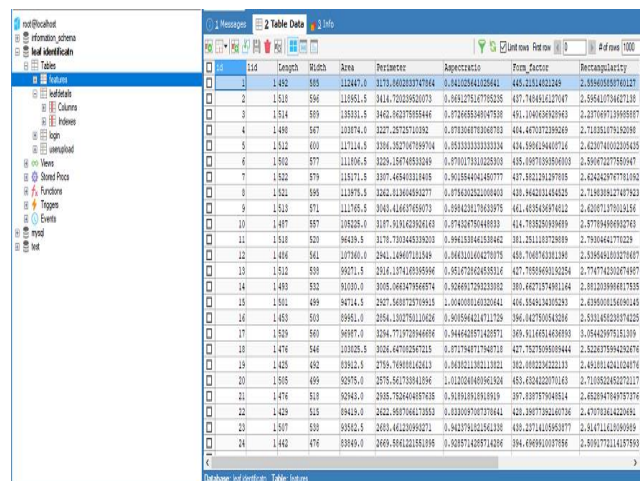


Fig -5: Black and White image

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.



id	laid	length	width	area	perimeter	Aspectratio	Perim_Area	Perim_Area
1	1492	856	11247.0	1375.161233747564	0.4612564433564	435.2114432246	0.58846816746127	
2	1510	856	11692.1	1414.72039292070	0.4612564433564	437.749414217047	0.58641146211136	
3	1514	859	11631.1	1462.16237593446	0.472083649497538	451.194639209463	0.237169713993887	
4	1449	847	11074.0	1327.28727101932	0.4715248793406793	454.447072392569	0.712155115162586	
5	1512	400	11714.5	1394.16274764974	0.453133333333334	454.559144407124	0.423174010201415	
6	1510	877	11104.6	1328.189748934248	0.471017311222819	455.1987038596919	0.59472127759147	
7	1520	879	11671.1	1397.45943318416	0.4612564433564	457.352129237945	0.424324377471192	
8	1521	895	11397.5	1342.81149459277	0.475432759448833	461.344311434325	0.7184318127471523	
9	1513	871	11174.5	1345.41641659703	0.454231176433975	461.482434917432	0.428171179115156	
10	1487	887	11625.0	1317.91942394143	0.47452759448833	461.7883258194919	0.57784949392163	
11	1518	820	14438.0	1378.33044338030	0.4612564433564	381.251113723819	0.7810441770229	
12	1484	841	10740.0	1241.124907131549	0.464311404270715	461.748742131138	0.538454310274827	
13	1512	838	99271.1	1214.1374181856946	0.45167324838512	457.7581648132254	0.7747742102748497	
14	1489	832	91039.0	1015.0643479546974	0.464681728323042	381.442157491124	0.38120386917355	
15	1501	499	94714.5	1247.168127378915	0.464681728323042	461.5542143102523	0.433610151691145	
16	1485	803	89851.0	1054.130275111026	0.501954214711725	384.142750543236	0.531185210174225	
17	1529	860	98897.0	1024.71372034669	0.444642871428971	381.9114631463899	0.354249191511019	
18	1476	844	101025.0	1014.447025647215	0.471748717949718	427.782709891644	0.528291894262476	
19	1425	492	89312.5	1758.74948142613	0.4810211392113921	382.082420221163	0.48381914241410476	
20	1516	499	82975.0	1075.561783841894	0.4810211392113921	463.632420271043	0.7103824620271117	
21	1476	818	82945.0	1015.752404857168	0.481991819181918	387.838787944854	0.48381914241410476	
22	1429	815	88415.0	1022.461704617353	0.4810211392113921	423.3987382160736	0.471701944224891	
23	1507	838	89312.5	1015.412103954271	0.4810211392113921	438.237141819181918	0.514711611039019	
24	1442	476	83848.0	1069.591221513198	0.502871408714289	384.498191017856	0.5011711141317893	

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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