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THE MACROSCOPIC ANALYSIS OF PEEPAL LEAF BY USING THE TECHNIQUES OF IMAGE PROCESSING

Prof.Dr.P.K.Srimani
drsrimanipk@gmail.com
Director, R&D Division
B.U., DSI, Bangalore, Karnataka, India.

Mr. K.Nithiyanandhan
nithiya_r@yahoo.com
Department of Computer Science & Applications,
The Oxford College of Science
Bangalore, Karnataka, India.

Research Scholar
Rayalaseema University
Kurnool, Andhra Pradesh , India.

Abstrac-**The present study deals with the macroscopic analysis of medicinal plants specifically peepal leaf by using the techniques of Image Processing. The leaves of Peepal are highly effective in treating heart disorders. It helps to control the palpitation of heart and thereby combat the cardiac weakness. Ayurveda makes an extensive use of the leaves of peepal due to the numerous benefits it provides.**

Key Words: Image Processing, Peepal tree, macroscopic structure, medicinal.

I.INTRODUCTION

Image processing is a physical process used to convert an image signal into a physical image. The image signal can be either digital or analog. The actual output itself can be an actual physical image or the characteristics of an image.

ASPECTS OF IMAGE PROCESSING

Image Enhancement: Processing an image so that the result is more suitable for a particular application. (Sharpening or deblurring an out of focus image, highlighting edges, improving image contrast, or brightening an image, removing noise).

Image Restoration: This may be considered as reversing the damage done to an image by a known cause. (Removing of blur caused by linear motion, removal of optical distortions).

Image Segmentation: This involves subdividing an image into constituent parts, or isolating certain aspects of an image. (finding lines, circles, or particular shapes in an image, in an aerial photograph, identifying cars, trees, buildings, or roads

The knowledge of the medicinal plants extends to any part of the world where man has traditionally needed these plants to cure his diseases, Thus, mixture of magic and religion , mixture of necessity and chance, test and error, the passage of different cultures has created a knowledge of vegetal remedies that has formed the base of the modern medicine. This rich knowledge should be preserved and extensive research in this direction is absolutely necessary. Therapeutic properties of medicinal plants are conditioned by the presence in their organs of active substances, such as alkaloids, flavonoids, glycosides, vitamins, tannins, and coumarin compounds, which physiologically affect the bodies of humans and animals or which are biologically active in relation to the causative agents of various diseases. A Special group of medicinal plants is antibiotics. In fact, there is no plant in this Universe which is non medicinal and which cannot be made use for many purposes and by many modes. This definition rightly suggests that in principle"All plants have potential medicinal value".

Medicinal plants have been considered as important therapeutic aid for alleviating ailments of humankind. Search for eternal health and longevity and to seek remedy to relieve pain and discomfort prompted the early man in ancient time to explore his immediate natural surroundings to develop a variety of therapeutic agents using natural resources.

The Indian systems of medicine have been a part of the culture and tradition of India down the centuries. Vedas, the ancient Indian epics have devoted important sections to Ayurveda, the science to life. The basic concept in the Indian systems of medicine, namely, Ayurveda, Sidda and Unani relates to maintaining balance in the body between different elements of human of which the body is made of. Any disturbance in the balance leads to disease and the therapy

lies in restoring the balance through the use of medicines of natural origin such as herbs and minerals. India is endowed with a rich variety of medicinal plants. Eastern Himalayas and the Western Ghats are among the 18 crucial regions of bio-diversity in the world. The practice of using medicinal plants as medicines has been existing since pre historic times and flourished today as the primary form of medicine for perhaps as much as 80% of the world population.

There are three ways in which plants have been found useful in medicine. First, they may be used directly as teas or in other extracted forms for their natural chemical constituents. Second, they may be used as agents in the synthesis of drugs. Finally, the organic molecules found in plants may be used as models for synthetic drugs. Historically, the medicinal value of plants was tested by trial and error. Hundreds if not thousands of indigenous plants have been used by man from prehistoric times in all continents for relieving suffering and curing ailments.

The All – Union Scientific Research Institute of Medicinal Plants, a number of institutes of the Academy of sciences of the USSR and the Academies of Sciences of the Soviet Republics, pharmaceutical institutes (Pharmaceutical Department), Botanical gardens, other scientific research and educational institutions are searching for new preparations of plant origin and are cultivating medicinal plants and studying their natural properties, and creating a rational regime for their use.

MEDICINAL PLANTS AND THEIR USES IN PRESENT AGE

The WHO estimates that 80% of people living in developing countries rely almost exclusively on traditional medicine for their primary health care needs. Medicinal plants form the back bone of traditional medicine and hence more than 3300 million people utilize medicinal plants on a regular basis. Demand for medicinal plants is increasing due to growing recognisation of natural products which are non toxic. In spite of rapid development in methods of organic synthesis in laboratories, medicinal plants continue to play a significant role in modern medicine due to their inherent distinct chemical and biological properties. Roughly one third of the known medicinal plants are trees and equal proportion is shrubs and the remaining one third comprises of herbs epiphytes, grasses and climbers. The industrial uses of medicinal plants are many ranging from traditional medicines, herbal teas and health foods as nutriceuticals to galenicals, phytopharmaceuticals and industrially produced pharmaceuticals. Medicinal plants also constitute a source of valuable foreign exchange for most developing countries as they are a ready source of drugs such as quinine and reserpine, of galenicals like tincture and of intermediates in the production of semi synthetic drugs.

INDIA AND ITS MEDICINAL WEALTH

India is well known as an Emporium of medicinal plants. Knowledge of medicinal use of plants in India is amassed over millennia by tribals. For thousands of years Indian plants have been attracting attention of foreign countries. People from countries like China, Cambodia, Indonesia and Baghdad used to come to ancient universities of India likeTakshila (700BC) and Nalanda (500BC) to learn health science of India. Varied climatic and topographical conditions prevailing in India has bestowed upon it a rich and diverse flora which is responsible for the richness and uniqueness of medicinal plants. Numerous wild plants growing in Indian forest are used as folklore medicines to prevent or cure several diseases. Medicinal plants have a potential in today's synthetic era, as a number of synthetic drugs are becoming resistant. A number of novel plant derived substances have entered into Western drug market.

The peepal is one of the longest living tress, which is elaborated by the fact the Shri Maha Bodhi tree, located in Bodh Gaya in the Indian state of Bihar, has a known planting date of 288 B.C. This is the oldest, verified age of any angiosperm of flowering plant. As claimed by many, it was this very tree, in Gaya, under which Siddhartha Gautama. The founder of Buddhism achieved enlightenment or bodhi, and came to be known as Gautham Buddha or more commonly as the Budda.

The peepal Sacred Fig tree is scientifically known as Ficus religiosa. The peepal tree is a species of the banyan fig. native to the region extending from the Indian subcontinent to Indochina and Southwest China. The peepal leaves are cordate or heart-shaped, with a distinctly extended tip. It is an average-sized tree and sports a large crown with branches that spread wide spectacularly. The papal tree is a deciduous tree growing up to 100ft tall, with a trunk which is almost 10ft in diameter. The tree sheds its leaves in the months of March and April, which sums up the spring season in and around the Indian subcontinent. The peepal bears a fruit a small fig which ripens in the month of May. These figs grow in pairs. Just below the leaves and look purple berries. The bark of this tree is light gray. Smooth and peels off in paths.

RELATED WORK

In [1] a review article on Evaluation of In-Vitro Antioxidant Activity in Ficus religiosa (L.) Leaves are presented. Medicinal plants have been used in traditional medicine for the treatment of several diseases. In India, medicines based on herbal origin have been the basis of treatment and cure for various diseases and physiological abnormalities under practice such as Ayurveda, Siddha and Unani. Research in herbal medicine has recently been revolutionized with the identification of several botanical plants with established physiological effect and efficacy for clinical condition either alone or combination with pharmaceuticals. Ayurveda is a comprehensive natural health care system that organized in India more than 5000 year ago. Plant antioxidants are composed of a broad variety of different substances like ascorbic acid and tocopherols, polyphenolic compounds, or terpenoids. They perform several important functions in plants and humans. In this study, antioxidant activity of ethanolic extract of Ficus religiosa Linn. (EEFR) leaf was investigated for its free radical scavenging activity by adopting various in vitro models. The extract was investigated for its antioxidant activity by 1,1--diphenyl, 2-picryl hydrazyl (DPPH) radical scavenging activity, hydroxyl radical scavenging activity, reducing capacity, hydrogen peroxide activity, determination of total phenolic content using Folin-Ciocalteu's phenolic reagent. EEFR showed maximum scavenging of DDPH radical 91.20% at 250 µg/ml concentration and hydrogen peroxide and reducing power were also dose dependent. The IC50 values were found to be 71.10µg/ml and 22.5 µg/ml of EEFR and ascorbic acid respectively. The total phenolic content evaluated that 1 mg of extract contained 3.2µg Gallic acid equivalents of phenols respectively. The extract showed significant results when compared with standard groups.

In [2] a review article on Phytochemistry and Pharmacological properties of *Ficus religiosa.* is dicussed Ficus religiosa Linn is a large evergreen tree found throughout India, wild as well as cultivated. It is popular indigenous system of medicine like Ayurveda, Siddha, Unani and Homeopathy. In traditional system of medicine, various parts such as stem bark, root bark aerial roots, vegetative buds, leaves, fruits and latex are used in diabetes, vomiting, burns, gynaecological problems, dysentery, diarrhea, nervous disorders, tonic and astringent. Phytochemical investigation of plant barks, showed the presence tannins, saponins, flavonoids, steroids, terpenoids and cardiac glycosides. According to Ayurvedic system of medicine, F. religiosa (Peepal tree) is well known to be useful in diabetes. The present work is an attempt to compile an up-to-date and comprehensive review of F. religiosa that covers its ethno botanical, natural product chemistry, and pharmacological data.

Some of the other works include (3] to [11])

PROBLEM SPECIFICATION

The main objectives of the present study is to make a detailed analysis of the macroscopic structure of veins in Indian Medicinal leaves in particular Peepal Leaf by using the techniques of image processing methodologies . Different samples are taken and the experiments are conducted.

II. METHODOLOGY

TYPES OF DIGITAL IMAGES

Binary: Each pixel is just black or white. Since there are only two possible values for each pixel (0, 1), we only need one bit per pixel.

Grayscale: Each pixel is a shade of gray, normally from 0 (black) to 255 (white). This range means that each pixel can be represented by eight bits, or exactly one byte. Other grayscale ranges are used, but generally they are a power of 2.

True Color or RGB: Each pixel has a particular color; that color is described by the amount of red, green and blue in it. If each of these components has a range 0–255, this gives a total of 2563 different possible colors. Such an image is a "stack" of three matrices; representing the red, green and blue values for each pixel. This means that for every pixel there correspond 3 values.

The main goal of preprocessing is to identify the leaf in an image and discarding all other information other than the leaf shape. This can be done with a little help from the user. The user can help identify the base-point and some reference points of the leaf.

Then the system uses the reference points and finds out the pixels that have similar value and connected to the reference points/pixels. Then the leaf is extracted from the background and a binary image is produced where the background pixels are set to 0 or black and the pixels within the leaf is set to 1 or white. Then the remaining black pixels within the leaf blade are removed to produce an enhanced binary image. Next, the tip of the leaf is located. This is done by finding out the furthest point (which is, in most cases, the tip of the leaf) from the base-point (selected by the user). Then the slope of the line connecting the base-point and the tip of the leaf is calculated. Finally the enhanced binary image is rotated according to the angle of inclination to make the leaf horizontally aligned

In order to make a detailed analysis of the macroscopic structure of veins in Betel Leaf and also to predict the other

character tics like Areole and Area characteristics of the leaves, the following steps are performed and the codes are written in Mat lab 7.0/7.4 Version.

ALGORITHM

Step 1: Read the image
Step 2: Setting the scale.
Step 3: Image cropping (Which crops away the unwanted noise around the leaf image)
Step 4: Convert the RGB or grayscale images into binary images.
Step 5: Image storage and Area mask.
Step6: Cleaning the binary image (involves several steps)
Step 7: Image segmentation transforms the leaf vein image by using standard statistical algorithms.
Step 8: Results of vein statistics etc.

The methods currently employed for leaf measurement and contour extraction (Viz. direct and graphical) are highly expensive and time consuming. Therefore, the present investigation is carried out to throw more light on the subject.

The leaf area is determined by using digital photographs and Mat lab tool which has an excellent image processing library. The code will be written in Mat lab 7.0/7.4 version and provides (i) the descriptive statistics on the dimensions and positions of leaf veins and i.e. the areoles they surround by a series of thresholding, cleaning and segmentation algorithms. For this purpose, the veins of the leaves are enhanced relative to the background.

III.EXPERIMENTS AND RESULTS

LEAF GUI is an interactive software program built in MATLAB. The purpose of the software is to dramatically increase the speed and accuracy of the extraction and processing of vascular and areole structure from digital images of leaves. The program incorporates many image processing and analysis tools into a single graphical user interface. The software is modular in construction, including preprocessing, image cleanup, and leaf network extraction steps. The overall process that a user might take to process a leaf image and measure structure within the leaf network can be broken down into five major steps: (1) setting the scale of the leaf image, (2) initial image cropping, (3) image thresholding, (4) binary image cleaning and processing, and (5) extracting leaf network features. In this study and in the software, we refer to the vessel bundles in a leaf as edges and the point where two or more edges intersect as a node. A single individual edge is defined as the vessel bundle segment occurring between nodes. Thus, for example, the primary or mid vein of a leaf would be viewed as a series of connected edges, rather than a single vein. Assuming edges can be approximated as cylinders, the geometry of each individual edge can be described using only its length and diameter. From these two measures, the surface area and volume of a leaf vein network are easily approximated.

AREA STATISTICS

Area Statistics (Table 1) returns the area, perimeter, and records the scale of the image. These measures are computed for the entire leaf. Six samples are taken.

Fig. 1 RGB Leaf RGB to Gray Leaf Black & White

Table 1 AREA STATISTICS

Sl. No	No. of leaf	Area (mm^2)	Perimeter (mm)	Scale (pixels per mm)
1	Leaf1	354.51	137.70	50
2	Leaf2	296.63	158.71	50
3	Leaf3	339.70	145.45	50
4	Leaf4	310.41	147.65	50
5	Leaf5	421.03	148.69	50
6	Leaf6	365.88	146.09	50

AREOLE STATISTICS

Areole Statistics (Table 2) returns the area, convex area (area of the convex hull that just encloses the region), solidity (the ratio of areole area to convex area), eccentricity (the ratio of the major and minor axis of the ellipse that just encloses the region), equivalent diameter (the diameter of a circle with the same area as the region), length of the major and minor axes of the ellipse that just encloses the region, centroid position (x and y coordinates of the region's center of density), mean distance to the nearest vein, and its variance for each areole in the leaf . Six samples are taken.

Table 2 AREOLE STATISTICS

Sl. No	No. of leaf	Average	Count	Sum
1	Leaf1	80.71	7488	604383.08
2	Leaf2	242.93	63362	15392920.74
3	Leaf3	150.03	27703	4156516.08
4	Leaf4	82.44	1170	96456.19
5	Leaf5	364.25	96980	35325177.01
6	Leaf6	356.48	95589	34075694.58

VEIN STATISTICS

Vein Statistics returns the table (Table 3), the first (see sheet titled Vein Stats in the Excel output option) containing a connectivity matrix, which is a NE 3 3 matrix (NE is the number of edges) showing which sand 3) are connected by which labeled edges (column 1). The Table also contains the length, width, and spatial position (centroid) of every edge and node of the vein network. In addition the software returns the two-dimensional (2D) area occupied by each edge and estimates for the surface area and volume based on the assumption and each edge is approximately cylindrical. The Table 3 (see sheet titled Sum option) includes the total number of nodes and edges, the total length of the network, the total 2D area occupied by the network and the mean edge length, width, 2D area, three-dimensional surface area, and volume. Six samples are taken.ary Stats in the Excel output

Table 3 VEIN STATISTICS

Sl. No	No. of leaf	Number of Edges	Number of Nodes	Total Network Length (mm)	Total Network Area (mm^2)	Mean Edge Length (mm)	Mean Width (mm)	Mean 2D Area (mm^2)	Mean 3D Surface Area (mm^2)	Mean Volume (mm^3)
1	Leaf1	46831	29128	6399.71	374.42	0.05357	0.03145	0.00331	0.01039	0.00123
2	Leaf2	43688	27976	5885.01	315.61	0.05450	0.02815	0.00291	0.00915	0.00128
3	Leaf3	47203	29271	6425.08	359.55	0.05479	0.02984	0.00320	0.01008	0.00120
4	Leaf4	46721	28866	6285.06	328.84	0.05302	0.02823	0.00277	0.00870	0.00109
5	Leaf5	61102	38123	8269.25	446.55	0.05465	0.02895	0.00264	0.00830	0.00064
6	Leaf6	53539	33732	7219.84	387.73	0.05388	0.02895	0.00279	0.00877	0.00095

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IV. CONCLUSION

Medicinal plants have a potential in today's synthetic era, as a number of synthetic drugs are becoming resistant. Peepal leaf is the only tree which is honoured as the state tree of three Indian states, Bihar, Haryana and Orissa. The results of the present research work include the macroscopic structure of Veins Statistics, Areole characteristics and Area characteristics. The results are presented and discussed

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