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ANALYSIS OF FRACTAL DIMENSION OF MEDICINAL LEAVES BY USING TECHNIQUES OF IMAGE PROCESSING

[1] Mr. K.Nithiyanandhan ,[2] Shilpa Mathpati

[1] Department of Master of Computer & Applications, Brindavan College, Bangalore, Karnataka, India and Research Scholar, Rayalaseema University, Kurnool, Andhra Pradesh, India.
[2] Department of Master of Computer & Applications, Brindavan College, Bangalore, Karnataka, India.

Abstract: *The present study deals with the analyzing leaf shapes in terms of Fractal Dimension analysis of different medicinal leaves by using the techniques of Image Processing. The fractal dimension can be used to measure the shape of a natural curve. Curves with similar degrees of irregularity will tend to have the same fractal dimension. The fractal dimension exponent describes the complexity of a medicine leaves shape and characterizes the scale-dependency of the pattern. The results of the present research work are very informative.*

Key Words: Image Processing, fractal, Leaf, medicinal

1. INTRODUCTION

Image processing is composed by a set of techniques aiming at manipulating image using computational algorithm in order to extract information from them.

Applications of Image Processing

- Medical imaging
- Surveillance
- Robotics
- Automotive safety
- Consumer electronics
- Geospatial computing
- Machine vision

Common Image Processing Challenges

- Reading writing to various file formats
- Create and test algorithms with what-if scenarios
- Identifying causes of algorithm failures
- Visualizing images and intermediate results
- Processing large images with limited memory
- Executing algorithms faster

1.1 ABOUT MEDICINAL LEAVES

People in ancient India depended a lot of medicinal leaves for maintaining good health and wealth.

Today, the World Health Organization (WHO) estimates that 80 percent of the world's population still uses traditional remedies, including plants, as their primary health care tools.

Unfortunately, the reverence for the use of medicinal leaves in everyday life has largely been lost . But if you are interested in using natural remedies to support your health, you should know that there are many right at your fingertips.

Medicine is considered as one of the most important necessity to all of us. It is derived from the Latin words are medicina meaning "the art of healing". It is a branch of the health sciences and is the sector of public life concerned with maintaining or restoring human health through the study, diagnosis, treatment and possible prevention of disease, injury and other damage to a body or mind.

1.2 IMPORTANCE OF FRACTAL DIMENSION

A fractal is defined as being derived from the Latin fractus meaning broken, uneven: any of various extremely irregular curves or shape that repeat themselves

The dimensional value of a fractal on a plane is always between one and two.

Challenges in fractal dimension

- Fractal Dimension Based Texture Analysis of Digital Images.
- Calculating Fractal dimension from vector images.
- The use of fractal dimension engineering Geology.
- Fractal Dimension Calculation for CORINE Land-Cover Evaluation in GIS.

Box Method

In order to create "square" boxes, the image was resized to a square dimension such that the length, measured in number of pixels, was of a power of 2. This allows for the square image to be equally divided into four quadrants and each subsequent quadrant can be divided into four
quadrants, and so on. After the color image was converted into grayscale, the intensity of grayness for each pixel was determined to be greater than a specified threshold or not, creating the binary, black and white, image. The number of boxes containing "black" pixels was noted as a function of the box-size, length of "box". The natural log of all these points were calculated and plotted.

The images were then converted into binary images and the number of "boxes" containing as least one "black" pixel was counted. The *ln*(number of boxes) versus

ln(pixel-size of box) points was plotted and the fractal dimension was determined by finding the slope of the best fit line for the plotted points.

2. RELATED WORK

In [1] a review article on increasing number of applications of fractal theory in the environmental sciences reflects the recognized Importance of spatial and temporal scale to the study of ecological systems and processes. In this paper, we summarize the various algorithms that have been developed for estimating the fractal dimension of such natural phenomena as landscapes, soils, plant root systems, paths of foraging animals, and so forth. We also discuss the potential utility and limitations of a fractal approach, and outline how fractals have been used in ecology.

In [2] a study of recognition of plant leaf images is an important and difficult task. Extracting the texture feature of leaf images becomes the key to solve this problem in recent years. Considering some wavelet methods only focus on low-frequency sub-bands of images and some fractal dimension methods using a single exponent also cannot identify the images well, a novel wavelet fractal feature based approach for plant leaf images recognition is proposed. Firstly, the preprocessed leaf images are pyramid decomposed with 5/3 lifting wavelet transform and sub images are obtained. Then fractal dimensions of each sub images are calculated to be the wavelet fractal feature of leaf images. Finally back propagation artificial neural network is used to classify plant leaf images. The experimental results show that the proposed method can improve the performance for plant image recognition compared with methods using only wavelet or fractal dimension.

In [3] a study of Fractal dimensions of leaves from Cercis canadensis L., Robinia pseudoacacia L., Amelanchier arborea (F.Michx.) Fernald, Prunus persica (L.) Batsch, Quercus alba L., Carpinus caroliniana Walter, Ficus carica L., Morus rubra L., Platanus orientalis L., and Ulmus rubra Muhl. were calculated. The values were then confirmed and compared by those obtained from box-counting method and the exponent values of density correlation function (first time in the literature). It is now proposed for the first time that there is a relationship between a fractal dimension of the leaf and a surface density of the image and was concluded that together with other measures, the fractal dimensions with surface density function could be used as a new approach to taxonomical study of plants.

In [4] discussed on organisms support continual exchange with the environment so that they maintain in a state far from their thermodynamic equilibrium. The plants maintain themselves under low entropy conditions, a necessary prerequisite to life. The concept of fractal dimension to describe structures, which look the same at all length scales, was first proposed by Mandelbrot Objects are usually referred to as self-similar to indicate their scale-invariant structure. The common characteristic of such fractal objects is that their length depends on the length scale used to measure it, and the fractal dimension tells us the precise nature of this dependence. Estimation of fractal dimension of leaf shape was recently performed form various authors. We estimated Fractal Dimension of different kinds of leaves looking at their inner structure until to the cellular nucleus.

In [5] a review discussed an image analysis method based on the box counting algorithm was evaluated for its potential to characterize grapevine leaves. Although vine leaves lack the self-similarity of the theoretical fractals, leaves are candidates for characterization using fractal analysis because of their highly complex structure.

Some of the other works include ([6] to [10]).

3. PROBLEM SPECIFICATION

The main objectives of the present study is to make a detailed analysis of the fractal dimension of different medicinal leaves by using the techniques of image processing. Different samples taken and the experiments are conducted.

3.1 METHODOLOGY

In Order to make detailed analysis of the fractal dimension of different medicinal leaves performed using ImageJ tool.

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.

3.2 ALGORITHM

Step 1: Read the image
Step 2: Image cropping (Which crops away the unwanted noise around the leaf image).
Step 3: Convert to 8 Bit image type
Step 4: Make binary image of leaf,
Step 5: Assign the Number of box count
Step 6: Find the Fractal Dimension of each leaf with Graph of the line shows number of boxes vs. Count the number of pixels.

4.EXPERIMENTS AND RESULTS

The experiments are conducted with different medicinal leaves using ImageJ tool. The results are presented in Table 1 and from Figure 1 to Figure 9.

RGB color Image

Figure 1

Gray scale Image

Figure 2

Binary Image

Figure 3

Determination of Fractal dimension Graph

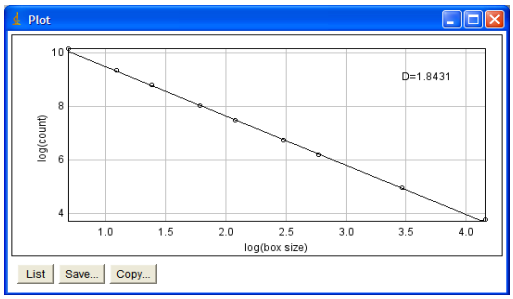

Figure 4

Neem Leaf

Figure 5

Hibicus leaf

Figure 6

Peepal Leaf

Figure 7

Betel Leaf

Figure 8

Cast roil Leaf

Figure 9

Table 1

Number of Boxes	Number of Pixels				
	Neem	Hibiscus	Peepal	Betel	Cast roil
2	1389	26232	10136	99768	2985
3	656	11753	4571	44508	1394
4	387	6664	2609	25139	826
6	189	3012	1194	11259	392
8	119	1720	696	6387	242
12	63	784	329	2882	121
16	40	450	195	1651	77
32	15	125	59	440	25
64	6	38	21	123	9
Fractal Dimension	1.572	1.897	1.799	1.938	1.677

5. CONCLUSION

Our results showed the differences of the five different types of medicinal leaves. The fractal dimension of the value varieties is significantly different from the one another.
On measurements of fractal dimension of medicinal leaves randomly chosen to measure fractal dimension showing different fractal dimension because usually leaf shape and size. This research shown that fractal dimension is much more related to the shape complexity than to the size of leaves.

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Mrs. Shilpa.Madapathi working Brindavan College and done her M.Tech. from VTU. Her research area is on image processing.

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