Image Segmentation For Plant Leaf Disease Detection Based on ANN

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Abstract—India is a country where Agronomic production is approximately on which economy extremely depends. This is the one of the reasons that infection identification in flowers, vegetable, crop, leaf plays an important role in agriculture field, as having infection in land & Field are relatively usual. If appropriate action can take to care in this field then it foundations thoughtful properties on plants and due to which particular production quality percentage, quantity or efficiency of production is affected. For the proposed work we try to explain the type of disease detection with the help of Artificial Neural Network approach in this method we have a very huge amount of dataset which either save in the system or save in the server if this work can be implanted over worldwide. For implantation of the work MATLAB software is used with the help of ANN the infected sample is selected or online we can take any sample by on site clicking the photograph of any leaf, flower, crop, vegetable and call this sample by MTALAB GUI and then enhance the contrast of sample image then we segment the image by clustering approach we can separate the image in different cluster and each cluster can be properly examined by the simulation tools. There are various parameter that can be calculated by the software like Mean, Standard image. This proposed algorithm which help us to Analyse the sample of any of the agricultural product either it can use on site or by the help of any of the communication method to collect the sample real time implementation of the proposed algorithm is also possible.

KEYWORDS: Image Processing, Genetic Algorithm, Plant disease Detection, Segmentation, Bacterial Blight, Alternaria.

I. INTRODUCTION

The agricultural land mass is something other than being a nourishing sourcing in this day and age. Indian economy is profoundly reliant of horticultural efficiency. Consequently, in field of agribusiness, location of infection in plants assumes an imperative part. To identify a plant ailment in extremely introductory stage, utilization of programmed malady recognition system is gainful. For example, an illness named little leaf infection is an unsafe malady found in pine trees in United States. The current strategy for plant sickness recognition is essentially bare eye perception by specialists through which recognizable proof and identification of plant infections is finished. For doing as such, an expansive group of specialists and in addition consistent checking of plant is required, which costs high when we do with extensive ranches. In the meantime, in a few nations, ranchers don't have legitimate offices or even thought that they can contact to specialists. Because of which counseling specialists even cost high and also tedious as well. In such conditions, the proposed method turns out to be gainful in observing substantial fields of yields. Programmed location of the ailments by simply observing the indications on the plant leaves makes it simpler and in addition less expensive. This additionally underpins machine vision to provide image based automatic process control, inspection, and robot guidance [2][4][5].

India has been gifted with a wide range of physio-geographical conditions and climate. This environment is suitable for horticulture crops like vegetable, fruits, flowers, nuts and plantation crops. The horticulture sector showed the 30% growth in last five years and contributes 28% of agriculture GDP. During 2010-11 India was the second largest producer of horticulture products, even though the productivity is lower than other countries. Indian contribution was 12 % and 14 % for fruits and vegetables respectively [3].

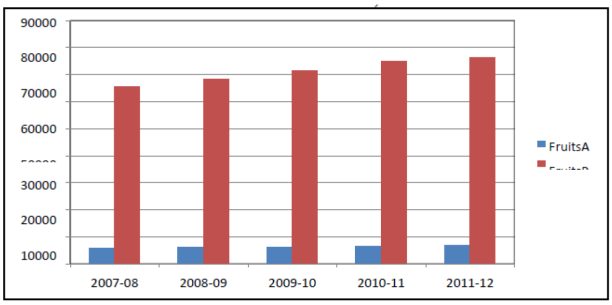


Figure 1.1: Fruit Area and Production in India

1.2 Digital Image Processing -Advanced picture handling is essential field of outlining and development. In current period each field relies upon the employments of modernized picture dealing with, in cutting edge picture getting ready, automated depiction of pictures for the most part require a generous number of bits. In various applications, it is basic to examine approach for suggesting a photo, or the information contained in the photo, with less bits.

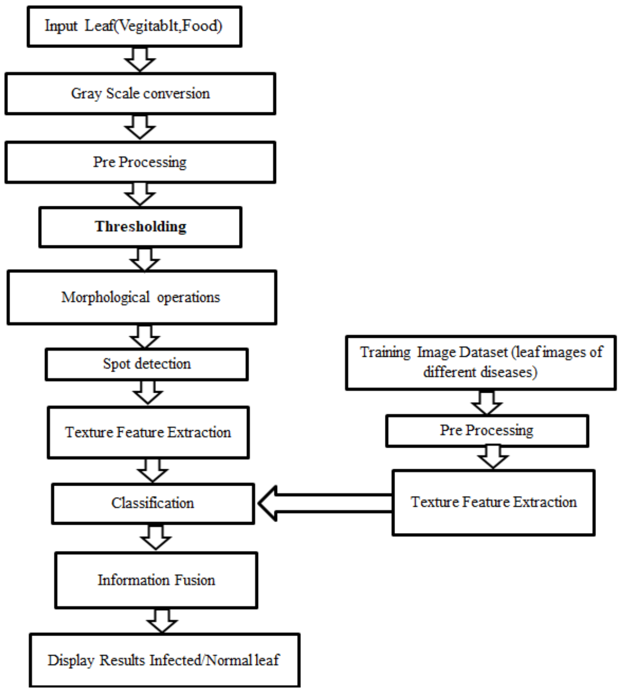
1.2.1 Image Compression - Picture pressure is essential term for successful transmission and picture stockpiling. Necessity of picture pressure is in correspondence framework for the information and picture change, it is need of telecom industry, in the field of sight and sound information in the broadcast communications system and ring the mixed media information through Internet. Some other necessity of picture pressure is as in the field of advanced cameras, prerequisites for information stockpiling, control, and exchanges of computerized pictures, has grown violently [22]. These picture records can be huge and can involve expansive memory. A dim scale picture of 256 x 256 pixels has 65, 536 components to store, and a downloading and transferring of these pictures are exceptionally tedious undertaking. Picture information involve a profound bit of the sight and sound information and they possess the real segment of the correspondence transfer speed for media correspondence [23].

1.3 Feature Extraction - By feature extraction we can diminish the picture into few numbers or gatherings of numbers that depict the material components of the picture [26]. These components fundamental be deliberately chosen such that they create great portrayal of the picture and outline the basic data. Certain cases of elements are mean, standard deviation, angle and edges of picture. More often than not, a gathering of components is utilized to deliver a model for the pictures. By Cross validation on the pictures, we can see which highlights speak to the picture well. Components can be doled out weights to show the significance of that elements. For instance, the mean in a chose picture might be given a weight of 0.9 on the grounds that it is more noteworthy than the standard deviation which may have a weight of 0.3. The scope of weights from 0 to 1, speak to the significance of elements. These elements and their specific weights are utilized to figure significant data of test picture.

1.4 SEGMENTATION OF IMAGE

Image segmentation is generally the first stage in any attempt to analyze or interpret an image automatically. It can also be regarded as a process of grouping together pixels that have similar attributes (Rafael et al 2002). Segmentation partitions an image into distinct regions that are meant to correlate strongly with objects as features of interest in the image. Segmentation is a critical component of computer vision system because errors in this process will be propagated to higher-level analysis processes and increases the complexity of the subsequent tasks. Ideally the segmented regions within the image should have the following characteristics:

1.5 Image Clustering - Cluster by nature are the collection of identical objects. Each set or cluster is homogeneous, i.e., objects relating to the similar set are having equivalent behavior to each other. Also, each set or cluster should be different from other clusters, i.e., objects which are allocated to a cluster should be dissimilar from the objects which are found in different cluster. It is the process of putting together identical objects, and it may be hard or fuzzy. Every element is destined to a particular cluster in the time period of its operation in hard clustering; however, each element has a degree of membership depending on its degree of association to several other clusters in cluster which is created through fuzzy clustering. In the statistics, image retrieval, bioinformatics, data retrieving and machine learning areas, clustering problem for unsupervised data exploration and analysis has investigated for decades.



1.6 SELF-ORGANIZED PARTITIONING

A mechanism to partition the space which adapts to the search space. By self-organizing, we signify that agent will be produced and deleted relying on the supportive optimization process. Agents will divide when points are collected inside a single region (creation), and will be merged when local optima converge (deletion).

1.7 MOVING SUB-REGIONS CENTERS

The way of space partitioning we propose focuses on dynamic the sub-regions‟ centers to different local optima. As a outcome, every agent can select a substitute that is exact just about the local optimum, and the agent can also discover the sub-region in the region of the local optimum. At the start of the process, only one agent exists and is pushed in to the whole search space. Then it starts optimization by selecting a surrogate, dealing with it and optimizing on this surrogate. In outcome the agent computes a latest point $\hat{x}*t-1$. Then, the midpoint of the sub-region is pushed to the "best" point in the sub-region in conditions of feasibility and purpose function value this is done by comparing the center at the final repetition $ct-1$

to the end point referenced by the agent $\hat{x}^{*}_{t-1}$. The center is pushed to the end point referenced by the agent if it is better than the current center. Otherwise, the center remains at the previous center.

1.7.1 MERGE, SPLIT AND CREATE SUB-REGIONS

Once an agent has referenced a latest point in its database and moved its center to the bestpoint, it will check whether to split, or to merge with other ones. joining agents (and their subregions) prohibits agents from crowding the same area, allowing one agent to capture the behavior in a region. Splitting an agent is an approach to search the space as it refines the partitioning of the space in accumulation to the search that every agent can act upon in its sub-region. Divide and merge occurs at the end point of each

iteration. Agents are first combined, the points relating to the merged agent(s) are distributed to the left over agents regarding distance as of the middle of the left over agents‟ sub-regions, and then each remaining agents examines to make your mind up whether to split or not.

1.7.2 MERGE CONVERGING AGENTS

Agents are merged (deleted) if the centers of the agents‟ sub regions are too related as considered by the Euclidean distance among the centers. We measure the minimum Euclidean distance linking two centers as a fraction of the maximum possible Euclidean distance among two points in the design space. When investigating the agents, the agent having the center with the lowest performance is removed. For example, for agents 1 and 2, if $c1 < c2$, agent 2 is removed. Before removal, the deleted agent distributes its internal database points to closest neighbors.

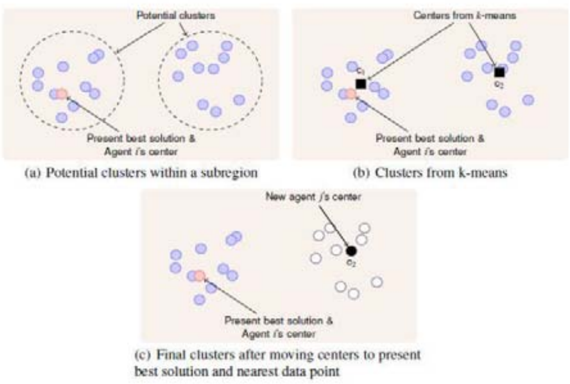


Figure 1.3: Illustration Of Process Used To Establish An Agent j Given Points In A Single Agent i‟s Sub Region.

1.7.3 HIERARCHICAL CLUSTERING

In hierarchical clustering, In a particular step the data does not partition into clusters. Instead, a progression of partitions take place, which may pass from a particular cluster containing all objects to groups each having a single object. This provides grow to a hierarchy of clustering's, also recognized as the cluster dendrogram. A recurrent divisioning of the data into 2, 3, 4 . . . and finally n, clusters is called a hierarchical clustering of n data points. Each mediate clustering is made more fine-grained by dividing one of its clusters. Below Figure shows one promising hierarchical clustering of a five-point data set.

1.8 HIERARCHICAL AGGLOMERATIVE CLUSTERING

Hierarchical agglomerative clustering (HAC) is a bottom-up hierarchical clustering algorithm. In HAC, Singleton clusters allocates points initially, and at every step the "closest" pair of collection of point is combined, where proximity is determined according to a similarity measure among clusters. The algorithm generally come to an end when the specified "convergence criterion" is achieved, which in our matter is when the count of recent clusters becomes equal to the count of clusters preferred by the user. Distinct cluster-level similarity scope are used to distinguish the closeness between clusters to be merged – single-link, complete-link, or group-average. There are distinct HAC schemes which have been just shown to have well specified underlying generative models – single-link HAC conforms to the probabilistic sample of a assortment of branching random walks, complete-link HAC corresponds to consistent equal-radius hyper spheres, while group-average HAC corresponds to equal-variance configurations. So, the HAC process can be classified as productive clustering algorithms.

1.9 MOTIVATION

Weighted clustering well knows method for multi-category data clustering. In weighted cluster is suffered from a selection of k count of cluster for level. The choosing of optimal count of cluster improves the performance of cluster weighted cluster for multi-category data clustering. Machine

II. LITERATURE REVIEW

2.1 INTRODUCTION

Neural network procedures have been effectively pertinent to the conclusion of a few restorative issues. In this study we dissect the diverse neural system strategies for the determination of diabetes. The different information pre-preparing strategies are assessing to enhance the speculating exactness of the neural system calculations. Plant nutrients are essential for the healthy growth of any plant. The plant takes up different nutrients from various sources. It shows visible symptoms on leaves in deficiency as well as toxicity. These symptoms can lead towards a chance for Image processing to play role in nutrient analysis. In this chapter plant nutrient for grapes and its effects in the deficiency and toxicity are discussed. Also review of plant pest or diseases for grapes is discussed along with its symptoms and effects on yield and growth of plant. A detailed review of application of image processing in agriculture is taken into consideration viz. weed detection, food processing, chlorophyll and nitrogen analysis, and pest/ disease detection, etc. Basics of color image processing, i.e. color models are discussed which are near to human perceptions. A review of, discussion and opinions with experts is also discussed.

2.2 Plant Nutrition: Plant growth and metabolism depends on 17 elements or nutrients even though 60 elements are found in the chemical analysis of plant tissues. Nutrients keep plants healthy which leads to less susceptibility to pests. Nutrients are broadly classified into two: Macro and micro nutrients. Macronutrients are those elements which are required in larger quantity whereas micronutrients are required in lesser quantity [5, 6]. Table 2.1 shows the nutrients with their For normal growth and development of grapevines, availability of all plant nutrients in optimum concentration is essential. Deficiency of nutrients affects the growth and yield of grapevines. Toxicity also affects the yield causing excessive growth of plants. Toxicity of nutrients leads to deficiency of other macro or micro nutrients, which is known as antagonism. Each nutrient play a specific role in growth and development of grapevine as discussed in table 2.3 [4, 7]. Table 2.3 also discusses the influence of deficiency and toxicity of each element. Table 2.4: Grape diseases and its effects.

Macronutrients		Micronutrients
From Air	**From Soil solids**	**From Soil solids**
Carbon(C)	Nitrogen (N)	Iron (Fe)
	Phosphorus (P)	Manganese (Mn)
Hydrogen (H)	Potassium (K)	Boron (B)
	Calcium (Ca)	Molybdenum (Mo)
Oxygen (O)	Magnesium (Mg)	Copper (Cu)
	Sulphur (S)	Zinc (Zn)
		Chloride (Cl)

Table 2.1: Classification of nutrients and their sources

2.3 Segmentation and Soft Computing Techniques: -[1] Vijai Singh et all in "Detection of plant leaf diseases using image segmentation and soft computing techniques in INFORMATION PROCESSING IN AGRICULTURE 4 (2017) 41–49" in 2017 Proposed Agricultural productivity is something on which economy highly depends. This is the one of the reasons that disease detection in plants plays an important role in agriculture field, as having disease in plants are quite natural. If proper care is not taken in this area, then it causes serious effects on plants and due to which respective product quality, quantity or productivity is affected. For instance, a disease named little leaf disease is a hazardous disease found in pine trees in United States. Detection of plant disease through some automatic technique is beneficial as it reduces a large work of monitoring in big farms of crops, and at very early stage itself it detects the symptoms of diseases i.e., when they appear on plant leaves. This paper presents an algorithm for image segmentation technique which is used for automatic detection and classification of plant leaf diseases. It also covers survey on different diseases classification techniques that can be used for plant leaf disease detection. Image segmentation, which is an important aspect for disease detection in plant leaf disease, is done by using genetic algorithm. the survey on different diseases classification techniques used for plant leaf disease detection and an algorithm for image segmentation technique that can be used for automatic detection as well as classification of plant leaf diseases later. Banana, beans, jackfruit, lemon, mango, potato, tomato, and spot are some of those ten species on which proposed algorithm is tested. Therefore, related diseases for these plants were taken for identification. With very less computational efforts the optimum results were obtained, which also shows the efficiency of proposed algorithm in recognition and classification of the leaf diseases. Another advantage of using this method is that the plant diseases can be identified at early stage or the initial stage. To improve recognition rate in classification process. Artificial Neural Network, Bayes classifier, Fuzzy Logic and hybrid algorithms can also be used.

2.4 Image Processing Based Leaf Rot Disease, Detection Of Betel Vine (Piper Betlel.):-[2] Amar Kumar Dey et all in "Image Processing Based Leaf Rot Disease, Detection of Betel Vine (Piper BetleL.)" in International Conference on Computational Modeling and Security 2016 Proposed deals with leaf rot disease detection for betel vine (Piper betel L.) based on image processing algorithm. The measurement of plant features is a fundamental element of plant science research and related applications. The information related to plant features is especially useful for its applications in plant growth modeling, agricultural research and on farm production. Few methods have been applied in leaf rot disease detection for betel vine leaf (Piper Betel L.). Traditional direct measurement methods are generally simple and reliable, but they are time consuming, laborious and cumbersome. In contrast, the proposed vision-based methods are efficient in detecting and observing the exterior disease features. In the present investigation, image processing algorithms are developed to detect leaf rot disease by identifying the color feature of the rotted leaf area. Subsequently, the rotted area was segmented and area of rotted leaf portion was deduced from the observed plant feature data. The results showed a promising performance of this automatic vision-based system in practice with easy validation. This paper describes the steps to achieve an efficient and inexpensive system acceptable to the farmers and agricultural researchers as well for studying leaf rot disease in betel vine leaf. In this paper, we have implemented Otsu thresholding-based image processing algorithm for segmentation of leaf rot diseases in betel vine leaf. The proposed method was successfully applied to twelve leaf images with very high precision. The proposed scheme will be helpful in the diagnosis of leaf disease. A leaf disease severity11 scale can be prepared by calculating the total leaf area12, 13and finding the percentage diseased area. Based on the disease severity levels amount and frequency of specific quantities of pesticide application can be regulated, which reduces the cost pesticide used for treatment. Also helpful in reducing environmental pollution due to regulated and controlled application of pesticides. This is an innovative approach ever done for extracting disease features of the leaf. The methodology uses a blend of machine vision and machine intelligence for precision agriculture. In machine vision part, image processing is used where the leaf details, the disease infected area will be extracted. This is a small contribution towards agriculture and growing this medicinally valued precious plant species, to boost up the national economy as well as the national employment generation through proper exploitation of betel vine crop.

III. THEORY OF PROPOSED WORK

3.1 Color Image Processing (CIP):

Color is a powerful descriptor of an object and has an advantage over gray scale. Color information is an important feature like shape, texture which has been successfully used for many image processing applications like object recognition, image matching, CBIR, color image compression. The object in the scene as perceived by human eyes or the camera system is characterized by its radiance R (λ, x, y, t) where λ is the wavelength of the electromagnetic radiation at position (x, y) and at time t for a particular color.

The fundamental difference between color image and gray image is the values assigned. For color images in color space a color vector is assigned to a pixel where as in gray image a gray value is assigned. Thus in Color Image Processing vector valued functions are used. Depending on the principles of processing CIP can be broadly classified into two classes [8].

3.2 Discussion and opinion of Experts

The widely investigated field of image processing, image analysis and important module of early vision problem is image segmentation. Image segmentation is the process of separating an image into some disjoint or distinct regions whose characteristic such as intensity, color, texture etc. are similar. No two such regions are similar with respect to these characteristics [1], [2]. In digital image processing, digital image analysis usually involves a „low-level" and a „high-level" processing. In low-level analysis, the representation of an image is transformed from a numerical array of pixel intensities to a symbolic set of image primitives: edges and regions. In high-level analysis, object labels (or interpretations) are assigned to these primitives, thereby providing a semantic description of the image. Image analysis techniques can be classified into two major groups: 1) Statistical, which uses probability distribution functions of pixels and regions to characterize the image, and 2) Structural, which analyzes the image in terms of organization and relationship of pixels and regions by the specified relations [3]. Image segmentation is a fundamental part of the `low level' aspects of computer vision and has many practical applications such as in medical imaging, industrial automation and satellite imagery. Traditional methods for image segmentation have approached the problem either\ from localization in class space using region information, or from localization in position, using edge or boundary information. Segmentation algorithms for monochrome images generally are based on one of two basic properties of gray-level values: discontinuity and similarity. In the first category, the approach is to partition an image based on abrupt changes in gray level. The principal areas of interest within this category are detection of isolated points and detection of lines and edges in an image. The principal approaches in the first category are based on edge detection, and boundary detection. Basically, the idea underlying most edge-detection techniques is the computation of a local derivative operator. The first derivative of the gray-level profile is positive at the leading edge of a transition, negative at the trailing edge, and zero in areas of constant gray level. Hence the magnitude of the first derivative can be used to detect the presence of an edge in an image.

3.3 Segmentation Techniques

In segmentation phase, the image (such as multi-resolution, multispectral) is divided into its constituent parts as shown in figure (3.1).

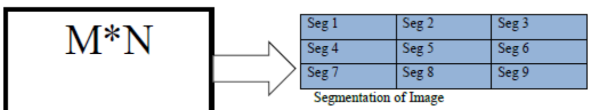


Figure 3.3: Typical Image Segmentation

3.4 Diseases type 1 -Alternaria - The shape Alternaria is a very much perceived sensitivity causing organism. Alternaria spores can be recognized from spring through pre-winter in most calm territories, and can achieve levels of thousands of spores for every cubic meter of air. Alternaria spores can be at their most elevated fixations amid dry, breezy conditions that are perfect for the spores to end up airborne. Alternaria is right now contained around 40-50 species. It is ordinarily disengaged from plants, soil, sustenance, and indoor air. One of the animal categories, Alternaria alternata, has been confined from various sorts of natural materials in soggy circumstances, including materials, put away sustenance, canvas, cardboard and paper, electric links, polyurethane, fly fuel, sewage and effluents. Alternaria alternata causes dark spot in numerous foods grown from the ground far and wide. It is an inactive organism that creates amid the cool stockpiling of natural products, getting to be obvious amid the promoting time frame along these lines causing extensive postharvest misfortunes. With a specific end goal to control Alternaria alternata infections, it is essential to enhance the present methods to recognize this species.

Figure 3.5 Sample Image

IV. PROBOLEM FORMULATION & PARMETER TO BE CALCULATED

By this experimental various parameter is to be calculated according to requirement the no of parameter is to be increased.

4.1 Mean Calculation: - The mean is the average of all numbers and is sometimes called the arithmetic mean. To calculate mean, add together all of the numbers in a set and then divide the sum by the total count of numbers.

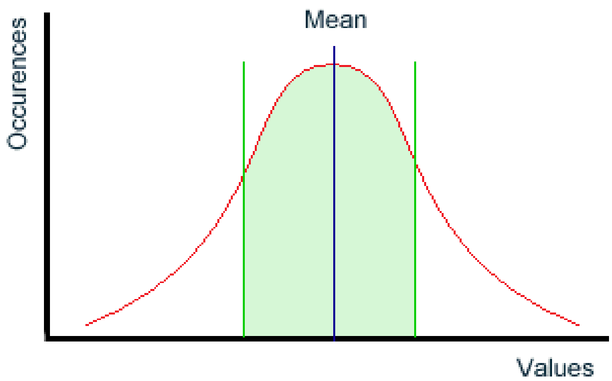


Figure 4.1 Mean Calculation

4.2 Standard Deviation calculation - Standard deviation is a measure of dispersement in statistics. “Dispersement” tells you how much your data is spread out. Specifically, it shows you how much your data is spread out around the mean or average. For example, are all your scores close to the average? Or are lots of score’s way above (or way below) the average score? Standard deviation represented by σ.

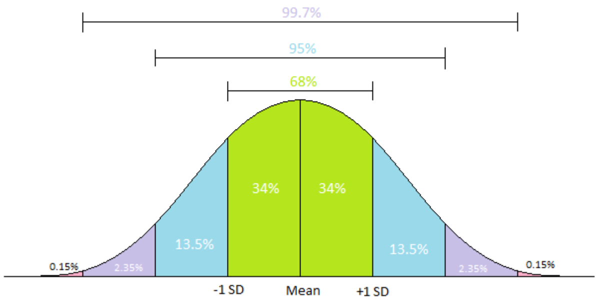


Figure 4.2 Standard Deviation calculation

4.3 Root Mean Square Calculation - For a set of numbers or values of a discrete distribution, ..., , the root-mean-square (abbreviated "RMS" and sometimes called the quadratic mean), is the square root of mean of the values , namely

$$x_{rms} = \sqrt{\frac{x_1^2 + x_2^2 + \dots\dots\dots\dots + x_n^2}{n}}$$

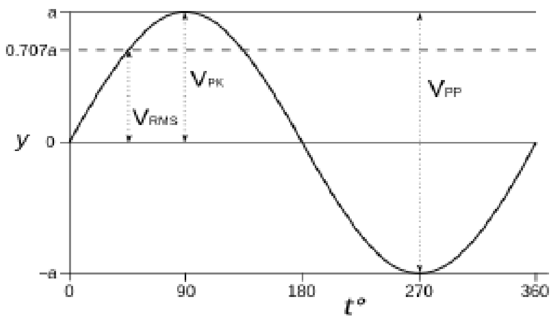


Figure 4.3 Root Mean Square Calculation

4.4 Entropy Calculation - In this situation, **entropy** is defined as the number of ways a system can be arranged. The higher the entropy (meaning the more ways the system can be arranged), the more the system is disordered.

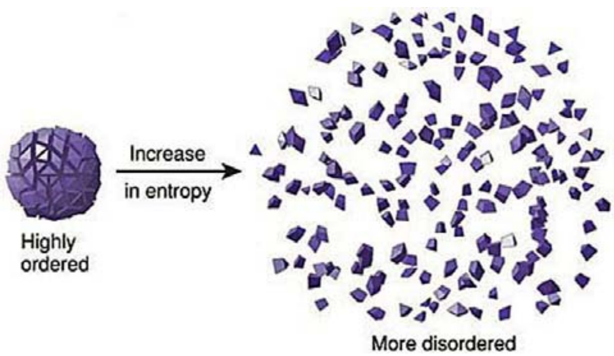


Figure 4.4 Entropy Calculation

4.5 Kurtosis Calculation - kurtosis is a statistical measure that is used to describe the distribution. Whereas skewness differentiates extreme values in one versus the other tail, kurtosis measures extreme values in either tail. Distributions with large kurtosis exhibit tail data exceeding the tails of the normal distribution (e.g., five or more standard deviations from the mean). Distributions with low kurtosis exhibit tail data that is generally less extreme than the tails of the normal distribution.

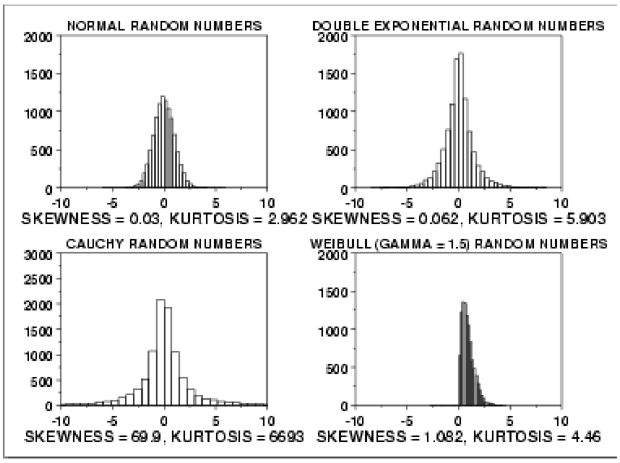


Figure 4.5 Kurtosis Calculation

4.6 Skewness Calculation - Skewness is a term in statistics used to describes asymmetry from the normal distribution in a set of statistical data. Skewness can come in the form of negative skewness or positive skewness, depending on whether data points are skewed to the left and negative, or to the right and positive of the data average. A dataset that shows this characteristic differs from a normal bell curve.

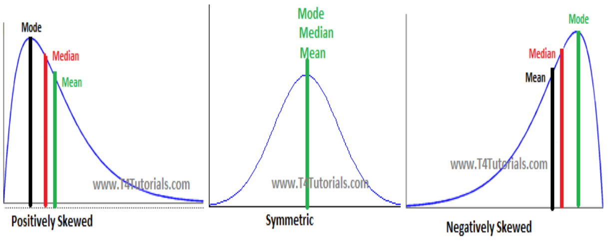


Figure 4.6Skewness Calculation

4.7 Correlation Calculation: - Related. For example, height and weight are related; taller people tend to be heavier than shorter people. The relationship isn't perfect. People of the same height vary in weight, and you can easily think of two people you know where the shorter one is heavier than the taller one. Nonetheless, the average weight of people 5'5'' is less than the average weight of people 5'6'', and their average weight is less than that of people 5'7'', etc. Correlation can tell you just how much of the variation in peoples' weights is related to their heights. Although this correlation is fairly obvious your data may contain unsuspected correlations. You may also suspect there are correlations, but don't know which are the strongest. An intelligent correlation analysis can lead to a greater understanding of your data.

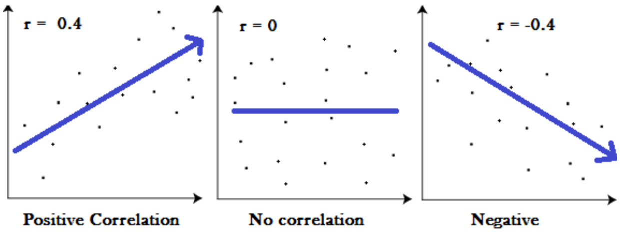


Figure 4.7 Correlation Calculation

4.8 Energy calculation - Leaf is a renewable energy and sustainable technology investment firm providing venture and growth capital across the renewable energy industry to support innovative, well-managed, rapidly-growing companies. Leaf is backed by some of the world's leading institutional investors.

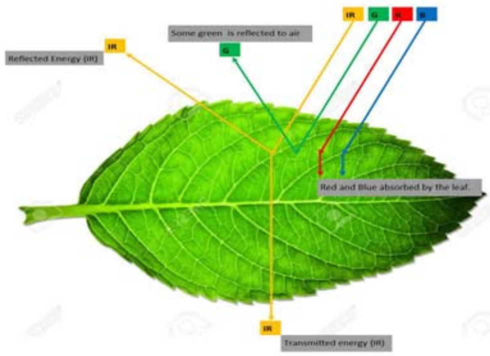


Figure 4.8Energy calculation

4.9 Homogeneity Calculation - In physics, a **homogeneous** material or system has the same properties at every point; it is uniform without irregularities. A uniform electric field (which has the same strength and the same direction at each point) would be compatible with homogeneity (all points experience the same physics). A material constructed with different constituents can be described as effectively homogeneous in the electromagnetic materials domain, when interacting with a directed radiation field (light, microwave frequencies, etc.)

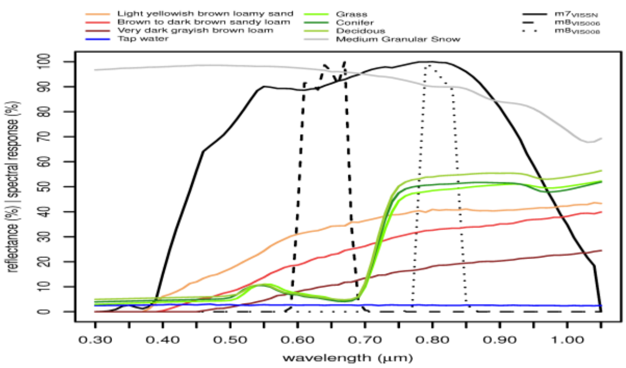


Figure 4.9Homogeneity Calculation

4.10 Variance Calculation- In probability theory and statistics, variance is the expectation of the squared deviation of a random variable from its mean. Informally, it measures how far a set of (random) numbers are spread out from their average value. Variance has a central role in statistics, where some ideas that use it include descriptive statistics, statistical inference, hypothesis testing, goodness of fit, and Monte Carlo sampling. Variance is an important tool in the sciences, where statistical analysis of data is common.

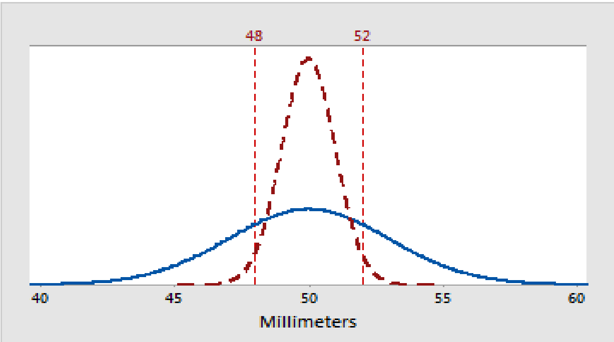


Figure 4.10 Variance Calculatio

4.11 IDM Calculation – IDM stand for Integrated Disease Management The term Integrated Pest Management was first based on the concept of „integrated control" given by the entomologists from University of California, who defined it as "applied pest control which combines and integrates biological and chemical control. Chemical control was used only if necessary and in a way which was least disruptive to biological control". Entomologists initiated the work on the concept of IPM following the problems faced with pest resistance to insecticides and the ecological damage identified with the widespread use of insecticides in the late 1950s and early 1960s. The concept got further importance due to the programs emphasizing sustainable agriculture, growing public concern regarding pesticides and food safety, greater difficulty in registering new pesticides and mounting pressure from growers and practitioners for IPM tactics. IPM does not seek to eliminate the use of pesticides, but aims to utilize the least disruptive options and to reduce the use of pesticides for pest control to the lowest practical levels. Food and Agriculture Organisation (FAO) survey showed that over 50% of the developing countries neither had legal means to limit pesticide use nor any code of practice.

V. SIMULATION RESULTS

5.1 Introduction of MATLAB Software: - MATLAB is a commercial "Matrix Laboratory" package which operates as an interactive programming environment. It is a backbone of the Mathematics Department programming lineup and is additionally accessible for PC's and Macintoshes and might be found on the CIRCA VAXes. MATLAB is all around adjusted to numerical analyses since the hidden calculations for MATLAB's worked in capacities and provided m-records depend on the standard libraries LINPACK and EISPACK.

MATLAB program and content records dependably have filenames finishing with ".m"; the programming dialect is extraordinarily direct since relatively every information protest is thought to be an exhibit. Graphical yield is accessible to supplement numerical outcomes. MATLAB (lattice lab) is numerical processing condition and fourth-age programming dialect. Made by Math Works, MATLAB grants framework controls, plotting of limits and data, use of computations, making of UIs, and interfacing with programs written in various lingos, including C, C++, Java, and Fortran.

Figure 5.1 Graphical User Interfaces for proposed work

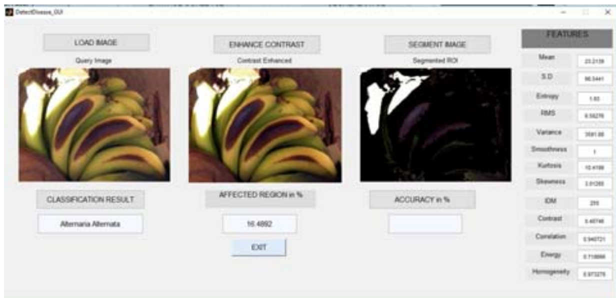


Figure 5.2 Image Graphical User Interfaces for proposed work

5.2 Simulation Result of Object One & Two: - Cucurbits and Cherrey object we can take for result simulation we can calculate various parameter**.**

Figure 5.3 (a) Original Banana image (b) Enhance contrast Image

Figure 5.4 (a) Banana cluster 1 (b) Banana cluster 2 (c) Banana cluster 3

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Figure 5.5 (a) Original Tomato image (b) Enhance contrast Image

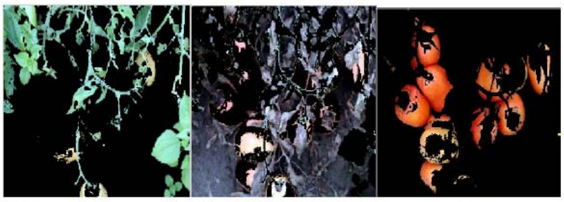


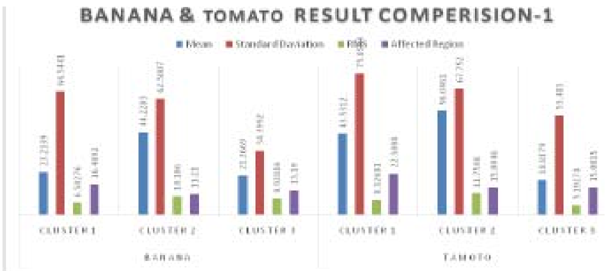
Figure 5.6 (a) Tomato cluster 1 (b) Tomato cluster 2 (c) Tomato cluster

5.2.1 Various Parameter Representation of Object One & Two- Object One and Object Two various result represent in the table.

Parameter	Banana			Tomato		
	Cluster 1	Cluster 2	Cluster 3	Cluster 1	Cluster 2	Cluster 3
Mean	23.2139	44.2283	21.2669	43.5312	56.0461	18.8179
Standard Daviation	66.5441	62.5007	34.3992	75.8584	67.752	53.483
RMS	6.58276	10.106	8.92816	8.12681	11.7598	5.19274
Affected Region	16.4892	11.21	13.19	22.3008	15.0046	15.0015
Entropy	1.93	4.38655	3.27084	2.88409	5.33461	1.78971
Kutosis	10.4199	3.69662	4.93272	3.30907	3.22933	11.0254
Contrast	0.40746	0.508824	1.54856	1.6706	1.92381	0.576072
Smoothness	1	1	1	1	1	1
Correlation	0.940721	0.919914	0.845914	0.833524	0.732962	0.845276
Energy	0.718666	0.319507	0.456883	0.489647	0.216789	0.686281
Homogeneity	0.973278	0.935685	0.952956	0.900646	0.817553	0.954567
Variance	3591.88	3213.28	841.182	5286.29	4391.17	2227.97
Skewness	3.01285	1.29476	1.57327	1.38143	1.08424	2.9975
IDM	255	255	255	255	255	255
Accuracy in %	98.3871	96.7742	98.3871	98.3871	98.3871	96.7742
Classification Result	Alternaria Alternata	Healthy Leaf	Healthy Leaf	Cercospora Leaf Spot	Cercospora Leaf Spot	Alternaria Alternata

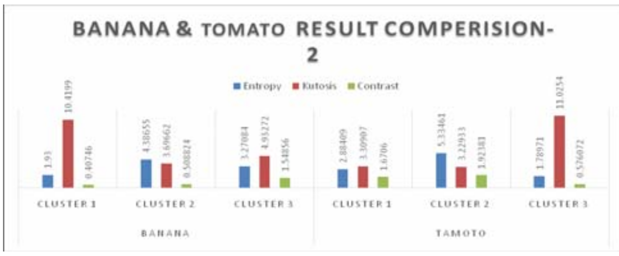
Table 5.1 Result Representation of Cucurbits & Cherry

5.2.2 Graph Representation of Mean, Standard Deviation, RMS and Affected Region- In this section we can do the comparative study analysis of Mean, Standard Deviation, RMS and Affected Region.



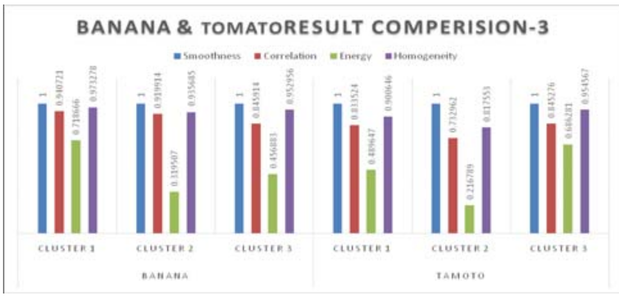
Graph 5.1 Mean, Standard Deviation, RMS and Affected Region(Banana &Tomato)

5.2.3 Graph Representation of Skewness, Entropy, Kutosis, Contrast and Smoothness- In this section we can do the comparative study analysis of Entropy, Kutosis, Contrast and Smoothness.



Graph 5.2 Entropy, Kutosis, Contrast and Smoothness (Banana &Tomato)

5.2.4 Graph Representation of Correlation, Energy & Homogeneity- In this section we can do the comparative study analysis of Correlation, Energy & Homogeneity.



Graph 5.3 Correlation, Energy & Homogeneity (Banana &Tomato)

5.2.5 Graph Representation of IDM, Variance, Accuracy - In this section we can do the comparative study analysis of IDM, Variance, Accuracy.

Graph 5.4 IDM, Variance, Accuracy. (Banana &Tomato)

5.3 Simulation Result of Object Three & Four: - Sample Image-3 and 4object we can take for result simulation we 78 can calculate various parameter**.**

Figure 5.7 (a) Sample Image-3 (b) Enhance Sample Image-3

Figure 5.8 (a) Sample-III cluster 1 (b) Sample-III cluster 2 (c) Sample-III cluster 3

Figure 5.9 (a) Original Tomato image (b) Enhance contrast Image

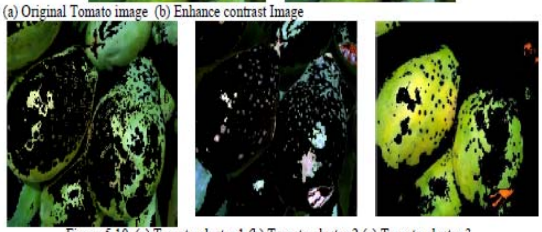


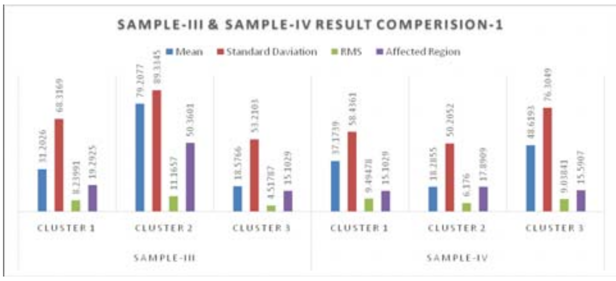
Figure 5.10 (a) Tomato cluster 1 (b) Tomato cluster 2 (c) Tomato cluster 3

5.3.1 Various Parameter Representation of Object Three & Four - Object Three and Object Four various result represent in the table.

Parameter	Sample-III			Sample-IV		
	Cluster 1	Cluster 2	Cluster 3	Cluster 1	Cluster 2	Cluster 3
Mean	31.2026	79.2077	18.5766	37.1739	18.2855	48.6193
Standard Daviation	68.3169	89.3345	53.2103	58.4361	50.2052	76.3049
RMS	8.23991	11.1657	4.51787	9.49478	6.176	9.03841
Affected Region	19.2925	50.3601	15.1029	15.1029	17.8909	15.5907
Entropy	3.36339	4.88679	1.57573	3.88398	2.38192	3.76916
Kutosis	6.28899	1.51576	9.8206	4.14353	11.121	2.97509
Contrast	1.1627	2.08658	2.55255	1.60432	0.811351	1.06837
Smoothness	1	1	1	1	1	1
Correlation	0.8544	0.851963	0.838476	0.741051	0.79567	0.90113
Energy	0.665498	0.253792	0.723652	0.33425	0.710206	0.387145
Homogeneity	0.958314	0.89423	0.951409	0.889226	0.938088	0.930789
Variance	4364.23	7120.32	2401.28	2890.79	2329.11	4453.53
Skewness	2.19764	0.469221	2.84279	1.47105	2.98181	1.24382
IDM	255	255	255	255	255	255
Accuracy in %	98.3871	98.3871	96.7742	96.7742	98.3871	98.3871
Classification Result	Alternaria Alternata	Cercospora Leaf Spot	Alternaria Alternata	Alternaria Alternata	Alternaria Alternata	Cercospora Leaf Spot

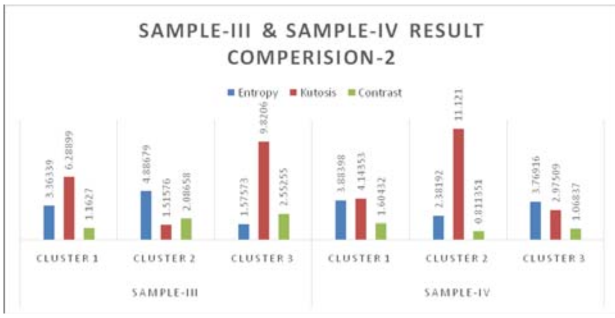
Table 5.2 Result Representation of Sample-III& Sample-IV

5.3.2 Graph Representation of Mean, Standard Deviation, RMS and Affected Region- In this section we can do the comparative study analysis of Mean, Standard Deviation, RMS and Affected Region.



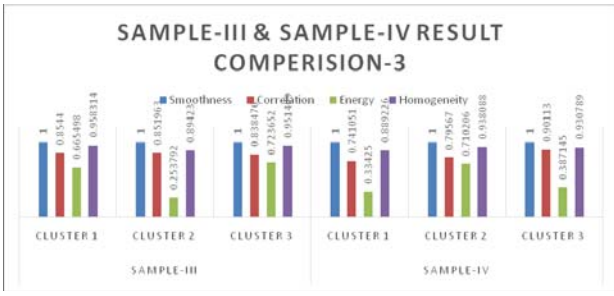
Graph 5.5 Mean, Standard Deviation, RMS and Affected Region (Sample-III & Sample-IV)

5.3.3 Graph Representation of Skewness, Entropy, Kutosis, Contrast and Smoothness- In this section we can do the comparative study analysis of Entropy, Kutosis, Contrast and Smoothness.



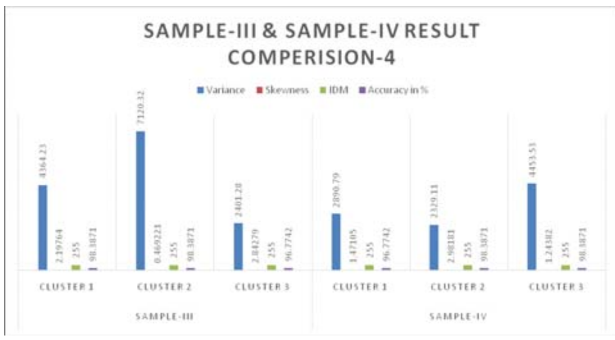
Graph 5.6 Entropy, Kutosis, Contrast and Smoothness (Sample-III & Sample-IV)

5.3.4 Graph Representation of Correlation, Energy & Homogeneity- In this section we can do the comparative study analysis of Correlation, Energy & Homogeneity.



Graph 5.7 Correlation, Energy & Homogeneity (Sample-III & Sample-IV)

5.3.5 Graph Representation of IDM, Variance, Accuracy - In this section we can do the comparative study analysis of IDM, Variance, Accuracy.



Graph 5.8 IDM, Variance, Accuracy (Sample-III & Sample-IV)

5.4 Simulation Result of Object Five & Six: - Leaf Sample-1 and Leaf sample-2 we can take for result simulation we can calculate various parameter

Figure 5.12 (a) Leaf Sample-1 cluster 1 (b) Leaf Sample-1 cluster 2 (c) Leaf Sample-1 cluster 3

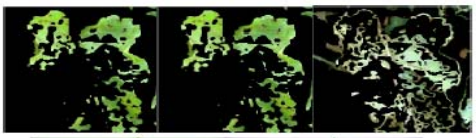
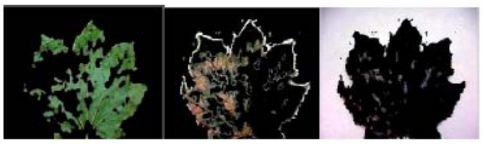


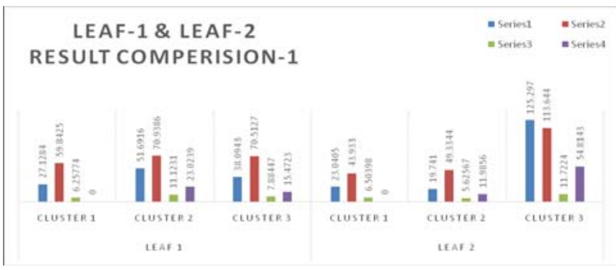
Figure 5.14 (a) Leaf Sample-2 cluster 1 (b) Leaf Sample-2 cluster 2 (c) Leaf Sample-2 cluster



5.4.1 Various Parameter Representation of Leaf Sample-1 and Leaf sample-2 - Leaf Sample-1 and Leaf sample-2 various result represent in the table. Table 5.3 Result

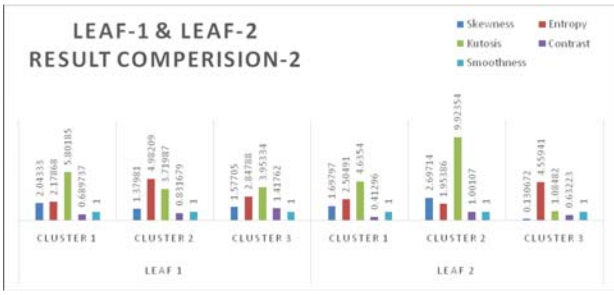
Parameter	Leaf 1			Leaf 2		
	Cluster 1	Cluster 2	Cluster 3	Cluster 1	Cluster 2	Cluster 3
Mean	27.1284	51.6916	38.0943	23.0405	19.741	125.297
Standard Deviation	59.8425	70.9386	70.5127	43.933	49.3344	113.644
RMS	6.25774	11.1231	7.88447	6.50398	5.62567	11.7224
Affected Region	None	23.0239	15.4723	None	11.9856	54.8143
Skewness	2.04333	1.37981	1.57705	1.69797	2.69714	0.130672
Entropy	2.17868	4.98209	2.84788	2.50491	1.95386	4.55941
Kutosis	5.80185	3.71987	3.95334	4.6354	9.92354	1.08482
Contrast	0.689737	0.831679	1.41762	0.41296	1.00107	0.63223
Smoothness	1	1	1	1	1	1
Correlation	0.902025	0.899591	0.842934	0.877485	0.748981	0.970744
Energy	0.629246	0.300285	0.504534	0.557554	0.644755	0.316481
Homogeneity	0.956463	0.915275	0.910164	0.937106	0.919102	0.959639
IDM	255	255	255	255	255	255
Variance	3107.81	4409.05	4535.94	1474.3	2162.61	8577.5
Accuracy in %	98.3871	96.7742	96.7742	98.3871	96.7742	96.7742
Classification Result	Healthy Leaf	Cercospora Leaf Spot	Cercospora Leaf Spot	Healthy Leaf	Anthracnose	Alternaria Alternata

Representation of Leaf Sample-1 and Leaf sample-2



Graph 5.9 Mean, Standard Deviation, RMS and Affected Region (Leaf-1 & Leaf-2)

5.4.3 Graph Representation of Skewness, Entropy, Kutosis, Contrast and Smoothness- In this section we can do the comparative study analysis of Entropy, Kutosis, Contrast and Smoothness.



Graph 5.10 Entropy, Kutosis, Contrast and Smoothness (Leaf-1 & Leaf-2)

VI. CONCLUSION & FUTURE WORK

6.1 CONCLUSION

Image Processing Toolbox™ provides a comprehensive set of reference-standard algorithms and graphical tools for image processing, analysis, visualization, and algorithm development. You can perform image enhancement, image deploring, feature detection, noise reduction, image segmentation, geometric transformations, and image registration. Many toolbox functions are multithreaded to take advantage of multi core and multiprocessor computers. Image Processing Toolbox supports a diverse set of image types, including high dynamic range, Gig pixel resolution, embedded ICC profile, and topographic. Graphical tools let you explore an image, examine a region of pixels, adjust the contrast, create contours or histograms, and manipulate regions of interest (ROIs). With toolbox algorithms you can restore degraded images, detect and measure features, analyze shapes and textures, and adjust color balance [19].

The method reported in the thesis can be used to design a soya bean expert system for farmers for the early detection of plant foliar infection, infection grading and getting the appropriate cure remotely. Through the thesis work, we have tried to highlight the problems associated with the cultivation of soybean and causes of low yield loss in the developing countries like India. It has been taken-up six soya plant foliar diseases, namely; Rust, Bacterial Blight, Sudden Death Syndrome, Brown Spot, Downy Mildew, and Frog Eye, which are mainly responsible for significant yield loss; it has been proposed a fully automatic method for identification and classification by different digital image processing techniques and also to classify the disease severity level using five classes. It has been derived and development various new parameters and indices like DSI, IPR, DLP, which are subsequently used for disease level prediction. The methodology has been implemented successfully and performance tested on a real set of soya leaf data. The result is quite convincing and wide adaptability in developing countries, where such information plays an important role for improvement in yield. The proposed method uses mobile cams for capturing the diseased images and does not require any kind of special training and sophisticated capturing devices. The proposed method is (i) fully automatic for ROI calculation, background separation and parameter

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