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An Effective Approach for Diagnosis of Plant Disease using ELM

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Abstract:-- **The objective of this paper is to identify the diseases in the leaves of the all plants. The detection of disease is one of the crucial importance to increase the productivity of plants. Plant pathology is the scientific study of plant diseases, based on this study, to identify the pathogen, and classification under different kind of circumstances. In existing, the automatic plant disease detection without training set using only prior knowledge. The proposed method, to use detects the diseases by using the ELM (Extreme Learning Machine) techniques. In the above method, initially the ABC Clustering has approached for segments the affected area. Secondly, using TELP (Transform Encoded Local Pattern), Gradient Features, Color Histogram Techniques for extract the features from that affected area. Finally, these extracted features are given to the ELM classifier to get the exact type of disease affected on a leaves.**

Keywords:-- **Plant Pathology, ABC clustering, TELP, ELM.**

1. INTRODUCTION

Developing countries like India the economy is greatly rely on agriculture. The quantity and quality of agricultural product is reduced as a result of disease. Plant disease is caused by micro-organism like fungi and microorganism .the lifecycle of micro-organism is unable to predict .some disease do not have visibility throughout early stage it solely seem that finish. The prediction of plant sickness by eye is employed in apply however results area unit subjective and disease extent isn't exactly measured. Nowadays automatic detection of plant sickness is a very important analysis topic and therefore mechanically detects the diseases from the symptoms that seem on the plant leaves. Plant disease is one among the necessary issue that causes important reduction within the quality and amount of plant production. Detection and classification of plant diseases are necessary task to increase plant productivity and economic process. Detection and classification are one of the attention-grabbing topics and far a lot of mentioned in engineering and IT fields.

P. R. Rothe and R. V. Kshirsagar [1] proposed associate degree Active Contour model (Snake segmentation) technique for segmenting the pathological region from the cotton leaf. Hu's moments [26] are used as the options for the classification. For training and classification, it uses a set of seven moments and Back Propagation Neural network has been used for classification with an accuracy of eighty five.52%. Back- propagation neural networks are extremely economical for finding multiple category issues. Its weight is updated using Levenberg Marquardt optimisation. The proposed ways will be applied to alternative crops like orange, citrus, wheat, corn and maize etc. Aakanksha Rastogi, Ritika Arora and Shanu Sharma [2] suggested a Fuzzy system for leaf illness detection and grading. K-means clustering technique has been used for segmentation. which teams similar pixels of associate degree image. RGB color area is reborn to L*a*b space, where L is the luminance and a*b square measure the colour area. The reason for this conversion is that luminosity issue isn't necessary for the colour image. GLCM [27] matrix including distinction, correlation, energy and homogeneity has been measured for disease grading. Artificial Neural Networks as been used for training the knowledge. Fuzzy logic is employed for grading the disease. SmitaNakwadi and NiketAmoda[3] recommended a k-means bunch technique for segmentation. RGB has been converted to HIS, where H is the hue, I indicate the intensity and S indicate the saturation value. Color Co-occurrence methodology or CCM method has been used for color feature extraction. Plant disease is detected victimization bar graph matching. The Threshold value for the picture element is computed victimization Otsu's methodology.

S. S. Sannakki and V. S. Rajpurohit [4] suggested a Back-propagation Neural Network based mostly classifier (BPNN) for sleuthing the malady in Pomegranate leaf. Features have been designated as color and texture. BPNN detects and classifies the diseases with a precision of around ninety seven.30 %. Dr. K. Thangadurai and K. Padmavathi [5] recommended pc vision image improvement for leaf malady identification. It includes color conversion and Histogram deed. Histogram deed will increase the image clarity. RGB to Grayscale conversion is used to retain the luminance data instead of Hue and Saturation data. For encoding of linear intensity values, Gamma expansions are used. Cumulative Gaussian distribution operate distributes the intensity worth of the image. Histogram deed provides the higher quality image in Grayscale. YuanTian, Chunjiang Zhao, ShenglianLu ANd XinyuGuo[6] proposed an SVM-based Multiple Classifier System (MCS)[25] for wheat leaf diseases. It uses a stacked generalization structure to join the classification choices obtained from 3 sorts of support vector machines (SVM) based mostly classifiers. The features like color, texture and shape options area unit used as coaching sets for classifiers. Firstly, features area unit classified mistreatment a classifier in low-level of MCS to corresponding mid-level classes, which will part notice the symptom of crop diseases in line with the information of plant pathology. Then the mid-level features area unit generated from these mid-categories generated from low-level classifiers. Finally, high-level SVM has been trained and correct errors made by the colour, texture and shape SVM [24] to improve the performance of detection. Compared with other classifiers, it can offer higher success rate of detection. The classifiers like SVM Artificial Neural Network classifier, k-nearest neighbor (k-NN) classifier's, the MCS can acquire higher recognition accuracy than others classifiers. Color, texture and shape SVMs [24] to improve the performance of detection. Compared with other classifiers, it can offer higher success rate of detection. The classifiers like SVM, Artificial Neural Network classifier, k-nearest neighbor (k-NN) classifier's, the MCS can acquire higher recognition accuracy than others classifiers.

Neetu Chahal and Anuradha[7] proposed a C means that bunch Approach for the identification leaf sickness. Neural Networks are used for the classification. Godliver Owomugisha, John A. Quinn, Ernest Mwebaze and James Lwasa [9] recommended a Machine learning system that converts RGB to HSV, RGB to L*a*b*. The Shape was conjointly taken as property gap [11] that square measure accustomed calculate all the parts in every threshold image. Shape options elect as space of minimum introduction parallelogram, elongation, small compactness, small perimeter and Moment of Inertia. It uses seven classifiers such as Nearest Neighbors [12], Decision tree [13], [14], Random forest [15], [16], Extremely irregular Trees [17], Naive Bayes [18] and support vector classifier (Linear SVM and RBF SVM) [19], [20], [21], [22].The splitting of dataset into coaching and testing was done by the k-fold cross-validation or known as rotation estimation methodology. The dataset was randomly split into reciprocally exclusive subsets (folds) of equal size of ten [23].Comparing the seven classifiers, Extremely irregular Trees yield a terribly high score. Ratih Kartika Dewi and R. V. Hari Ginardi[9] recommended associate image pattern classification techniques to spot the rust sickness in sugarcane leaf. Features have been select as color and Texture. Shape options embody solidity, extent, minor axis length and eccentricity. Texture features square measure extracted from distinction, correlation, energy and homogeneity. It converts RGB to science lab as a result of LAB color channel is consistent in terms of human perception.SVM classifiers are used for the classification of coaching sample in support vector machine is dissociable by a hyperplane. Eccentricity is used to work out whether the sickness form could be a circle or line phase. It is the ratio of the gap between axis length and therefore the foci. An conic whose eccentricity is zero will represent as a circle; but, an conic whose eccentricity is one will represent a line phase. Minor axis length is employed to work out the length of the axis of the diseased region. Extent is {the space|the world|the realm} of the diseased region that's divided by the area of the bounding box. The Extent can be computed because the space divided by the world of the bounding box. Solidity is used to work out the world of the diseased region Divided by the pixels within the planoconvex hull. From Gray-Level Co-occurrence Matrix (GLCM) the texture features [10] will be extracted. Texture features square measure distinction, correlation, energy, and homogeneity. The Otsu-threshold is used to extract the form feature. Mean, skewness and kurtosis square measure used to represent color as options. For this, it transforms RGB to LAB. SVM is the binary classifier because it will classify accurately [6]. There are completely different varieties of kernel perform in SVM classifier.

This work compares identify the fungal diseases in the fruit tree images. In this paper the fungal disease is to identify from the images. Fungal Disease is one of the most serious diseases affected in fruit trees in the world. Once a tree is infected, there is no cure. In existing, to detect the diseases they used the spectroscopic techniques. These techniques are very expensive and can only be utilized by trained persons only. This paper presents the detection of diseases which are detected using ELM(Extreme Learning Machine) technique. First the ABC clustering Approach is applied to the input image to segment the affected area. Then extract the features from the area by using TELP, Gradient Features, and Color Histogram Techniques are used. And then these features are given to the ELM classifier to get the type of disease.

The remainder of the paper is organized as follows: In Section II, the overview of proposed method is presented. In Section III, the proposed method is specifically depicted, including its design idea and practical implementation approach. In Section IV, the performance of the proposed method is evaluated. Finally, conclusions are made in Section V.

II. CROP DISEASE DETECTION FROM LEAF IMAGES

The work flow of proposed method is shown in Fig.1.In the first module, the disease affected part of the input image is segmented. In the second module, the texture features are extracted from the segmented part of the input image. In the last module, the classification approach is used for finding the affected disease in the input image. The further details of these modules are discussed below:

III. CROP DISEASE DETECTION FROM LEAF IMAGES PROCEDURE

The proposed method has three modules. They are
1.Affected Part Segmentation
2.Feature Extraction
3.Classification

A. Affected Part Segmentation

This is the first module of this paper. In this module from the given input image the disease affected part is segmented. Then only find the type of disease and its severity can also be easily measured. To segment the affected part the ABC Clustering Algorithm is used. It is depicted in Fig.2.ABC Clustering is an optimized segmentation algorithm. It is based on the intelligent foraging behavior of the honey bee swarm. The result of this step is shown in below figure.

First get the each subset. Consider the each subsets as the initial food sources.
1.Repeat
2.Send the employee bee onto the food sources and determine their nectar amounts.
3.Calculate the probability value of the sources with which they are preferred by the onlooker bees.
4.Send the onlooker bees onto the food sources and determine their nectar amounts.
5.Stop the exploitation process of the sources exhausted by the bees.
6.Send the scouts into the search area for discovering the new food sources, randomly
7.Save the best food source found so far.
8.Until the requirements are met.

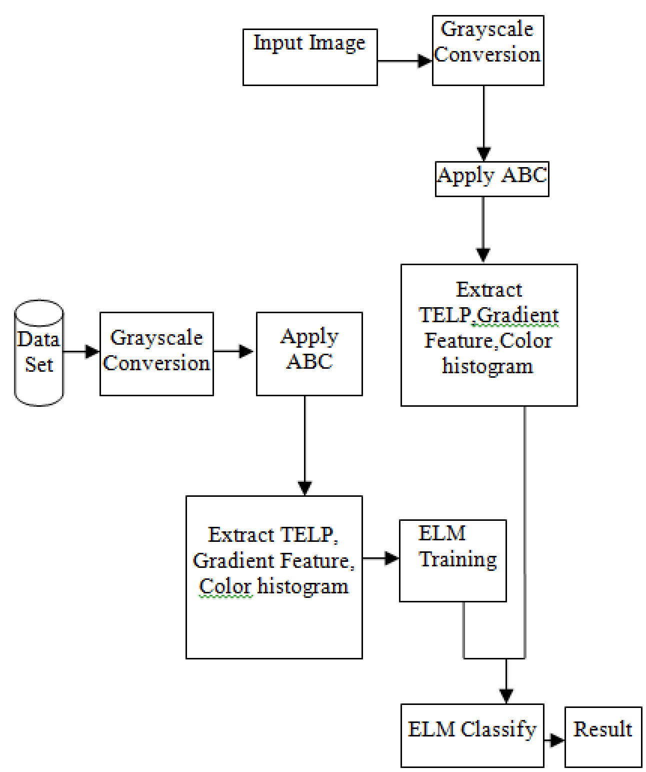

Fig. 1. Overall Block Diagram of Proposed Methods

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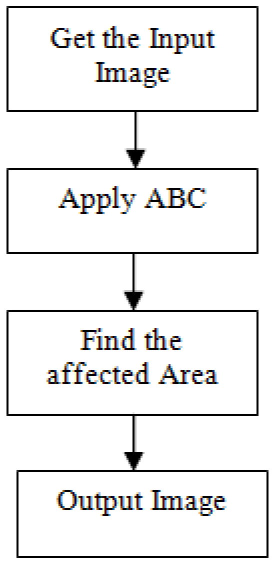

Fig. 2 ..Flow Diagram of Affected Part of Segm

B. Feature Extraction

After segmenting process the next step is to calculate the features from the part. The features are used to uniquely identify the disease name and its severity. To extract the features in this paper uses Transform Encoded Local Pattern (TELP) and Gradient Features are used. It is depicted in Fig.3.

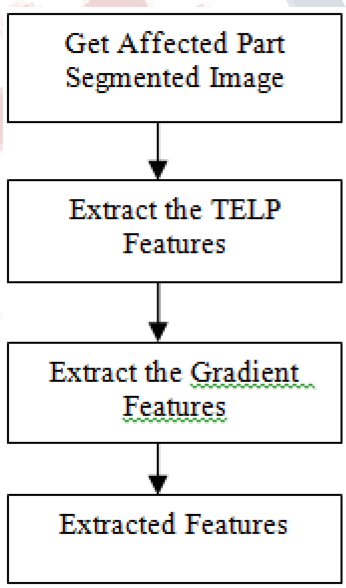

Fig. 3. Flow Diagram of Feature Extraction

Transform Encoded Local Pattern(TELP)
Input: Image I, Current Pixel value , Current X Index, Current Y Index, Pixel Distance P, Total No of Neighbours T
Output: ELBP Pattern, ELBP Description

Algorithm:
Apply the below steps for all pixel in an input image
1.Get the neighbouring pixels Sp of current pixel Sc based on the pixel Distance P.
2.Apply DWT on Sp and Sc to co
3.convert pixel into DWT Coefficient.
4.Then compare the current DWT Coefficient DWTCc with that the neighbouring DWT Coefficient DWT Cp.
5.If the centre pixel DWTCc is greater than the neighbouring pixel DWTCp put the value 1
6.Else put the value 0
7.Then convert these binary number into the decimal value
8.This is called local binary pattern description
9.Then store the description into the array. This array is called bin.

Gradient Feature

An image gradient is a directional change in the intensity or color in an image. The gradient of the image is one of the fundamental building blocks in image processing. For example the Canny edge detector uses image gradient for edge detection. In graphics software for digital image editing, the term gradient or color gradient is also used for a gradual blend of color which can be considered as an even gradation from low to high values, as used from white to black in the images to the right.

Image gradients can be used to extract information from images. Gradient images are created from the original image (generally by convolving with a filter, one of the simplest being the Canny filter) for this purpose. Each pixel of a gradient image measures the change in intensity of that same point in the original image, in a given direction. To get the full range of direction, gradient images in the x and y directions are computed.

One of the most common uses is in edge detection. After gradient images have been computed, pixels with large gradient values become possible edge pixels. The pixels with the largest gradient values in the direction of the gradient become edge pixels, and edges may be traced in the direction

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 12, December 2017

perpendicular to the gradient direction. One example of an edge detection algorithm that uses gradients is the Canny edge detector.

Color Histogram

In image processing and photography, a color histogram represents the distribution of colors in an image. For digital images, a color histogram represents the range of pixels that have colors in each of a fixed list of color ranges that span the image's color space, the set of all possible colors. The color histogram can be built for any kind of color space, although the term is more often used for three-dimensional spaces like RGB or HSV. For monochromatic images, the term intensity histogram may be used instead. For multi-spectral images, where each pixel is characterized by an arbitrary number of measurements (for example, beyond the three measurements in RGB), the color histogram is N-dimensional, with N being the number of measurements taken. Each measurement has its own wavelength range of the light spectrum, some of which may be outside the visible spectrum. If the set of possible color values is sufficiently small, each of those colours may be placed on a range by itself; then the histogram is simply the count of pixels that have each possible color. Most often, the space is divided into an appropriate number of ranges, often arranged as a regular grid, each containing many similar color values. The colour histogram can also be represented and displayed as a smooth function defined over the color space that approximates the pixel counts. Like other kinds of histograms, the color histogram is a statistic that can be viewed as an approximation of an underlying continuous distribution of colors values.

C. Classification

The final process is to classify the disease name and its severity. To do this process the Extreme Learning Machine Classifier is used. It is depicted in Fig.4.

ELM is one of the classification techniques. It has two stages, training and testing phase.

1.Given training set with activation function and a hidden number of nodes
2.Randomly assign input weight and bias.
3.Calculate the hidden layer output matrix.
4.Finally calculate the output weight.

IV. PERFORMANCE ANALYSIS

A.Experimental Images

In this paper the images taken from the real cameras are used. In total 200 images are taken. From that 100 images are used for training and remaining 100 images are used for testing.The sample images are shown in the below Fig.5. The image size is 512 x 512 color images. All of these images are images which are affected by any one of the disease. These images are used for experimental purposes.

B. Performance Analysis

To evaluate the performance of the crop disease detection techniques several performance metrics are available. This paper uses the Classification Accuracy and Error Rate to analyses the performance.

Classification Accuracy

Accuracy is the measurement system, which measure the degree of closeness of measurement between the original disease and the detected disease.

Accuracy = (TP+TN)/(TP+FP+TN+FN)

Where, TP – True Positive (equivalent with hit)
FN – False Negative (equivalent with miss)
TN – True Negative (equivalent with correct rejection)
FP – False Positive (equivalent with false alarm)

Error Rate

Error Rate is the measurement system, which measures the number of falsely identified diseases name form the given input images.

$$\text{Error Rate} = \frac{\text{Number of images of Falsely Identified Diseases}}{\text{Total Number of images}}$$

Precision Rate

The precision is the fraction of retrieved instances that are relevant to the find.

$$\text{Precision} = \frac{TP}{TP+FP}$$

Where TP = True Positive (Equivalent with Hits)
FP = False Positive (Equivalent with False Alarm)

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Vol 2, Issue 12, December 2017

Recall Rate

The recall is the fraction of relevant instances that are retrieved according to the query.

$$\text{Precision} = \frac{TP}{TP + FP}$$

Where TP = True Positive (Equivalent with Hits)
FP = False Negative (Equivalent with Miss)

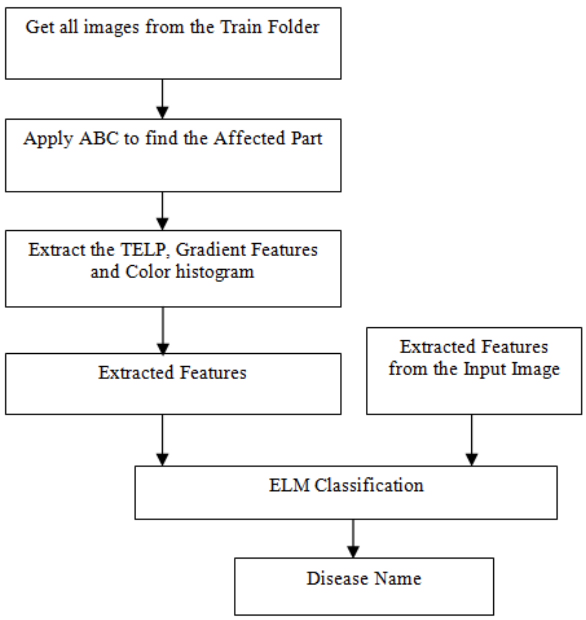


Fig. 4. Overall Flow Diagram of Classification Methods

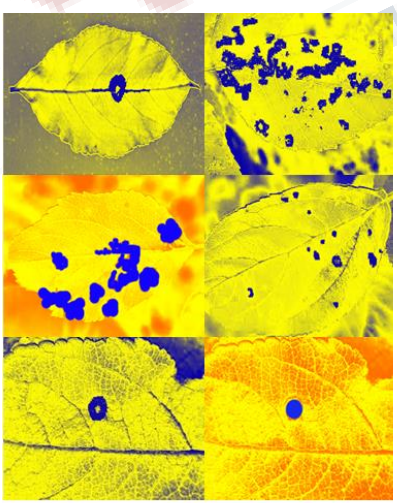


Fig. 5. Experimental Images

Table 1. Classification Accuracy Value

Crop Disease Detection Methods	Classification Accuracy Value
SVM	95%
ELM	97%

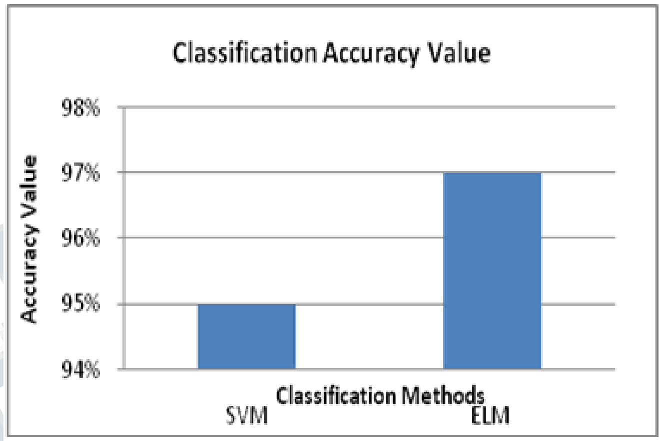
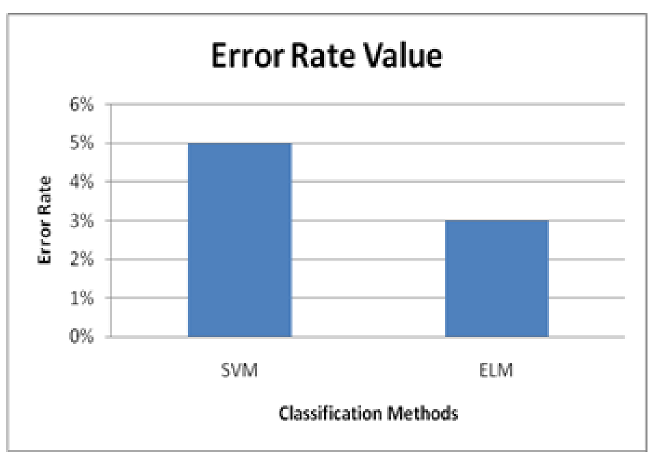


Table 2. Error Rate Value

Crop Disease Detection Methods	Error Rate Value
SVM	5%
ELM	3%



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Vol 2, Issue 12, December 2017

Table 3. Recall Rate Value

Crop Disease Detection Methods	Recall Rate Value
SVM	93%
ELM	96%

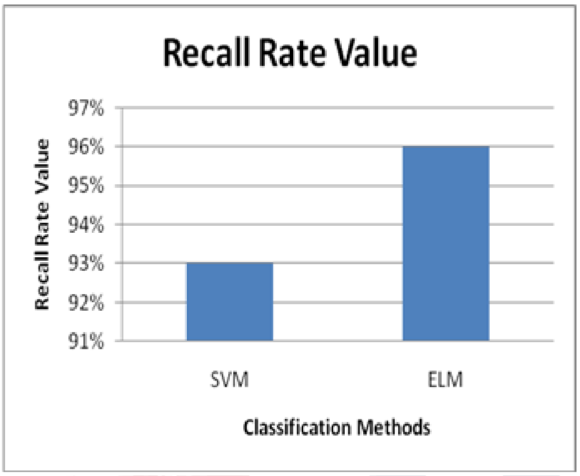
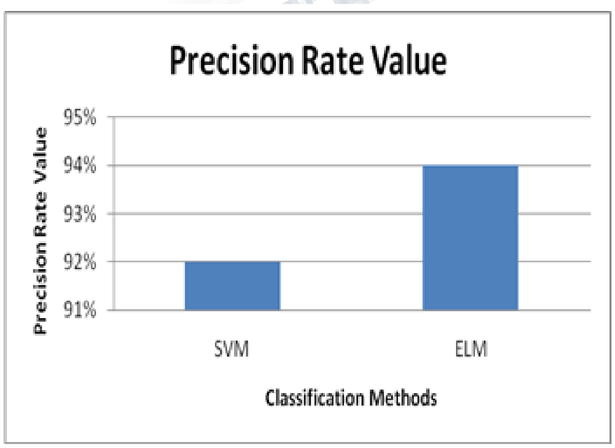


Table 4. Precision Rate Value

Crop Disease Detection Methods	Precision Rate Value
SVM	92%
ELM	94%



V. CONCLUSION

In this paper, a new method is proposed for identify the fungal diseases in the leaves of the fruit trees . Plant pathology is the scientific study of plant diseases caused by pathogens and environmental conditions. Fungal Disease is one of the most serious diseases affected in fruit trees in the world. Once a tree is infected, there is no cure. In existing, to detect the diseases they used the spectroscopic techniques. These techniques are very expensive and can only be utilized by trained persons only.This project presents the detection of diseases which are detected using ELM(Extreme Learning Machine) technique.First the ABC clustering Approach is applied to the input image to segment the affected area. Then extract the features from the area by using TELP, Gradient Features and Color Histogram Techniques are used. And then these features are given to the ELM classifier to get the type of disease.

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