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Diagnosis of Plant Diseases using Artificial Neural Network

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Abstract: ***Pomegranate is one of India's most commonly cultivated fruit crops. manual expert observations are being used to detect leaf diseases that take longer time for further prevention. Fruit diseases are causing devastating disadvantages in worldwide agricultural business economic losses in production .in this journal, the answer is proposed and valid by experiment for the identification and classification of fruit disorders. The objective of proposed work is to analyze the illness utilizing picture preparing and artificial intelligence techniques on pictures of pomegranate plant leaf. In the proposed framework, pomegranate leaf picture with complex foundation is taken as input. Then pomegranate leaf ailment division is finished utilizing K-means clustering. The infected segment from portioned pictures is recognized. Best results have been seen when neural networks with a RBFN is used for a classification.***

Index Terms: segmentation , image processing, k-means clustering and feature extraction.

I. INTRODUCTION

Research in agribusiness is pointed towards increment of profitability and nourishment quality at decreased use and with expanded benefit. In the previous couple of years new patterns have developed in the agrarian division. The targets of exactness horticulture are benefit boost, agrarian information defense and ecological harm decrease, by changing the farming practices to the site requests. Plant malady is one of the vital causes that lessens amount and debases nature of the rural items. Plant ailments are generally brought about by growths, microbes and infections. Additionally there are different ailments which are brought about by antagonistic natural conditions. There are various attributes and practices of such plant maladies in which a large number of them are simply recognizable.

The requirements for lower production costs, organic farming needs and disease prevalence were the driving forces for improving food production quality and quantity. Thus, most study concentrated on treating and controlling plants in the field of disease control, and few studies concentrated on instant disease detection. Automatic inspection of plant disease detection can be of excellent advantage to those customers who have little or no data about the crop they grow. It is therefore feasible to identify and classify the diseases using this technique.

II. DIFFERENT DISEASES PRESENT AT POMEGRANATE PLANT

a. Bacterial Blight: The manifestations can be at first found on trunk part which slowly impregnate to leaf and later to natural products. On natural products darker dark spots show up on peri-top with breaks going through those spots.

b. Anthracnose: the growth causes a wide scope of side effects, depending the tissue assaulted and the climate .minute depressed spots of different hues show up on leaves, stem, blossom or natural product. Regularly encompassed by a pretty much checked yellow corona .on leaves, the spots later augment to shape injuries and can cover a noteworthy piece of the cutting edges. They turn yellow and can shed rashly prompting defoliation.

c. Alternaria Alternata: Alternaria alternata is a fungus that has been reported on more than 380 host plant species producing leaf spot and other illnesses. On various vectors it is an opportunistic pathogen that causes leaf spots, rots and blights on many parts of the plant.

III. METHODOLOGY

Plant Image Detection System

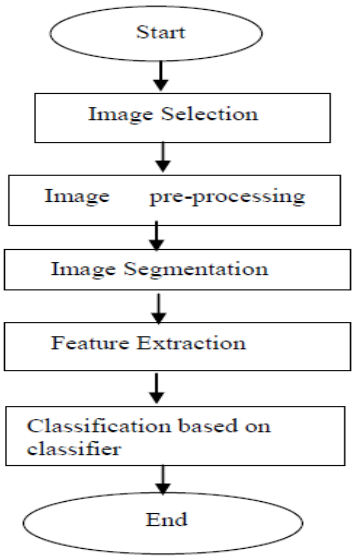

Fig 1 Flow Chart of Plant Image Diagnosis using Neural Network

The Block Diagram is given in the Fig. 1 The strategy suggested step by step includes collecting the image library, preprocessing these images, extracting features from these images using the technique of clustering, extracting features by using the GLCM method and lastly training by ANN and RBFN as activation function.

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Firstly, In order to train a neural network some images are used, and other images are used for test images to monitor the results accurately.

a. Image Acquisition-

In this progression the example pictures are gathered .Some pictures are utilized for the preparation calculation with the goal that classification and identification can be made conceivable and the rest of the pictures are which are required to prepare the framework, utilized as test pictures.

B. Preprocessing-

Preprocessing of the picture is performed on collected pictures to improve the performance of the picture. It removes the noise from the background and suppresses the undesirable distortion. First, this image is resized to 300x300 sizes. The noise is removed by using Gaussian filtering technique.

C. Segmentation-

It is the method of partitioning the image with regard to certain characteristics into distinct regions. K-means clustering is being utilized in present work to segment an image into groups.

K-means Clustering Technique

In the clustering method of k-means, pictures are divided into three groups where one group includes most of the diseased portion of the picture. MacQueen (1967) created the k-means clustering algorithm. Algorithms for K-means divides items (images) into ' k ' groups according to their characteristics. The range is evaluated in Euclidean square distance and is determined by formula (1).

$$J(V) = \sum_{I=1}^{C} \sum_{j=1}^{Ci} (||A_i - B_j||)^2 \quad (1)$$

Where ,

$||A_i - B_j||$ - Euclidean distance between A_i and B_j.

'c_i' - number of data points in i^{th} cluster.

'c' - number of cluster centers.

D. Feature extraction-

Extraction of features is used to obtain the data that can be used to obtain the image's significance. Shape, texture and colour are the main kinds of characteristics mostly used in the method of image processing. Therefore, both color and texture features are extracted in this system to improve accuracy.

The GLCM is developed with statistic texture characteristics. In this study, these texture features are calculated depending on the statistical allocation of measured strength variations in some locations in relation to others. The GLCM co-occurrence matrix and related texture calculations are techniques of image analyzes. Given a pixel-to-intensity image, the GLCM is a table of how much different gray-level combinations happen in the picture or image section. The GLCM co-occurrence matrix and related texture calculations are techniques of image analyzes. Given a pixel-to-intensity image, the GLCM is a table of how much different gray-level combinations happen in the picture or image section.

Calculations of texture features use GLCM properties to evaluate strength variations (such as image texture) with an attention pixel.

Table 1 statistical texture features using GLCM matrix

Sr. No.	statistical texture features	Explanation
1	Contrast	Measure the intensity of the pixel-neighbor comparison across the whole image
2	Correlation	The extent to which a pixel is linked with its neighbor over the entire image.
3	Homogeneity	Measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal
4	Entropy	This statistic measure of randomness, used to characterize the texture of an image
5	Variance	This statistical measurement of heterogeneity is heavily linked to the statistical first order variable, like variance.
6	Energy	Sum of squared elements in the GLCM

Table 2 Formulas to calculate feature of the selected Cluster -

Sr.	GLCM Feature	Formulae
1	Contrast	$\sum_{i,j=0}^{N-1} p_{i,j}(i-j)^2$
2	Correlation	$\sum_{i,j=0}^{N-1} p_{i,j} \frac{(i-\mu_i)(j-\mu_j)}{\sigma_i^2 \sigma_j^2}$
3	Energy	$\sum_{i,j=0}^{N-1} p^2_{i,j}$
4	Entropy	$\sum_{i,j=0}^{N-1} p_{i,j}(-\ln p_{i,j})$
5	Homogeneity	$\sum_{i,j=0}^{N-1} \frac{p_{i,j}}{1+(i-j)^2}$
6	Mean	$\mu_i = \sum_{i,j=0}^{N-1} i(p_{i,j})$, $\mu_j = \sum_{i,j=0}^{N-1} j(p_{i,j})$
7	Variance	$\sigma_i^2 = \sum_{i,j=0}^{N-1} p_{i,j}(i-\mu_i)^2$, $\sigma_j^2 = \sum_{i,j=0}^{N-1} p_{i,j}(j-\mu_i)^2$

P_{ij} = Element i, j of the normalized symmetrical GLCM

N = Number of gray levels.

M = the GLCM mean calculated as

$$\mu = \sum_{i,j=0}^{N-1} i p_{ij} \quad (2)$$

Texture characteristics are calculated in statistical texture analysis from the statistical distribution of measured ratios of intensities at specific position compared to each other in the picture.

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d. NEURAL NETWOK

Radial basis Neural Network (RBFN) in artificial neural Network (ANN) that operates as an activation function. The outcome of the ANN could be a linear combination of the cell parameter radial basis function and input functions. RBFN is intuitive more than the MLP's approach. An RBFN classifies the similarity of the input to images from the training array by activity. Each RBFN nerve cell stores a "prototype," which is just one of the coaching set's examples. Each neuron calculates the euclidean distance between the origin and its prototype if a new entry is to be classified. In general it is classified as class A if many of the inputs are tightly like examples of category A, as compared to examples of category B.

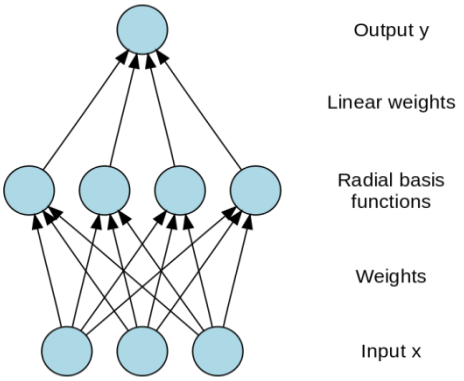

Fig. 3: Architecture Of the of an RBFN Network

In the architecture of a radial base feature network the input vector is used as an entry for all radial baseline features, each of which has its own distinct parameters.

IV .RESULTS

In the classification stage, a classifier shall be educated with the properties and the corresponding feature values and this trained classifier used in the classificational stage to identify test images.

Fig 2 captured image with its clusters

Fig 2 shows captured image with its clusters. Segmentation relates to the method of clustering the pixels in salient areas with certain characteristics and these areas conform to individual surfaces, items or real object components.

Table 3 statistical texture features of segmented image using GLCM

Sr. No.	Statistics properties of GLCM	Values for the Anthracnose
1	Contrast	0.6319
2	Correlation	0.7722
3	Energy	0.7302
4	Entropy	1.4892
5	Homogeneity	0.9459
6	Mean	13.5216
7	Variance	1.5162e+03

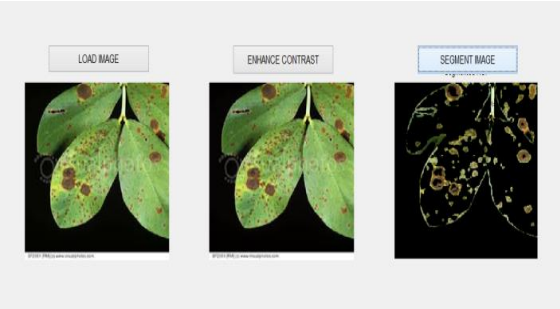

Fig 3 segmentation of the captured image by kmeans clustering technique

Fig 3 shows segmentation of the captured image by kmeans clustering technique. A value of K is selected as 3 for the current work.

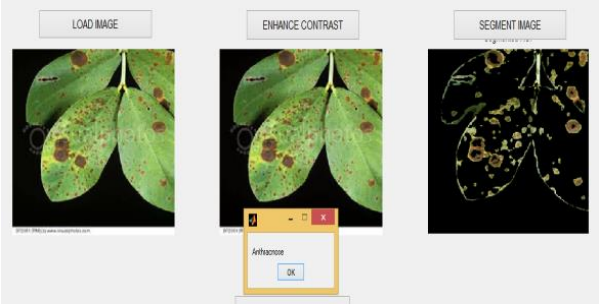

Fig 4 Using the toolbox manual GUI has been created. Anthracnose is recognized by the system

Statistical values are feed to the neural network .depending upon specific values neural network determine type of the diseases .as shown in Fig 4 after all processing system detect captured image is affected of anthracnose.

IV. CONCLUSION

Using Digital Image Processing and ANN methods, primarily three pomegranate plant diseases are categorized and identified from this proposed task. The diagnosis of diseases such as Bacterial Blight, Alternia Alternata and Anthracnose is made using the above method. The experiment results show that nearly all of the samples offer the greatest category discrimination. Once the disease is identified, proper treatment can be advised.

The system is designed to preprocess, segment, extract and classify elements. Experts need the existing system that provides the solution, and farmers cannot recognize disease just by observing the necked eyes. This scheme will provide peasants with instant solutions. It is moment to save and decrease fruit consumption owing to illness. This system's primary aim is to enhance the effectiveness of the system for instant fruit disease identification.

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