Leaf Disease Detection and Grading using Image Processing

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Abstract— In agriculture sector automatic leaf disease detection is essential research topic as it may prove benefits in monitoring huge fields of crops, and thus automatically detect disease as soon as grading it. There are the principle ventures for disease discovery of Image Acquisition, Image Preprocessing, Image Segmentation, Feature Extraction and Statistical Analysis. The proposed system is separated into two stages, in first stage the plant is perceived on the premise of the Feature of leaf, it incorporates Preprocessing of leaf pictures, and Feature extraction taken after by Artificial Neural Network based training and classification for acknowledgment of leaf. In second stage the malady show in the leaf is classify, this procedure incorporates K-Means based segmentation of defected area , Feature extraction of abandoned segment and the ANN based classification of disease. At that point the disease grading is done using fuzzy logic on the premise of the amount of disease introduce in the leaf.

Keywords: Horticulture, Leaf, ANN, Yields, Fuzzy Logic

I. INTRODUCTION

In agriculture sector plants or yield development have seen quick advancement in both the quality and amount of nourishment generation, notwithstanding, the nearness of vermin and ailments on trims particularly on leaves has prevented the nature of rural products. In the event that the nearness of irritations on products and clears out is not checked appropriately and the auspicious arrangement is not gave at that point the quality and amount of nourishment creation will be decreased, which results in upsurge in neediness, nourishment frailty also, the death rate. In India near about 60-70% population do farming and they are totally depends on farming. In our country plant observation is done by naked eyes so in this method proper diagnosis is not done and this directly affect on crop production. So we need to produce automatic disease detection technique. Through our system we are going to make a system which will detect and classify leaves diseases using Artificial Neural Network and fuzzy logic technology. The main source for the disease is the leaf of the plant. About 80 to 90 % of disease of plant is on its leaves. So for that our study of interest is the leaf of the tree rather than whole plant. The machine vision system now is normally consists of computer, digital camera etc. Various kinds of algorithms are integrated in the application.

We take an input image of diseased plant leaves and extract the features of leaf. In our project we will consider number of feature. With the help of this feature we will compare our defected plant leaf with the database present there. We will use Artificial Neural Network as our classifier for comparision of plant leaves. An artificial neural network (ANN) is a mathematical model that is inspired by the structure and/or and not functional aspects of biological neural networks. A neural network consists of an connected group of artificial neurons, and it processes data using A connectionist approach to computation. We have created a database of diseased leaf considering four diseases they are bacterial blight, Alternaria Alternata, Anthracnose and Cercospora Leaf Spot. We have extracted the Number of features and compared those features with the features that are extracted from the input test image. We have perform various preprocessing steps on the input test image like resize image, filter image, contrast enhancing for detecting the boundary of the image. We have divided the whole area of interest into parts and the we have compared features of each block with the features of images in the database.

II. LITERATURE REVIEW

The issue of acknowledgment of leaf diseases and the total of afflictions in them has for quite a while been an issue of stress in agribusiness part for yield quality organization. Till date, various investigates have been finished for making different leaf contamination distinguishing proof systems using PC vision and picture taking care of methodologies. Visual ID of infections on leaves is work asking for, less correct and ought to be feasible for little regions in a manner of speaking. In this way, the motorized acknowledgment of ailments in plants is a basic investigation subject as it may give central focuses in managing extensive fields of yields. This field many researcher research some of them

John William ORILLO- In this study, advanced picture handling was fused to take out the subjectiveness of manual examination of infections in rice plant and precisely recognize the three regular infections to Philippine's farmlands: (1) Bacterial leaf scourge, (2) Chestnut spot, and (3) Rice impact. The picture handling segment was assembled utilizing MATLAB capacities and it involves strategies such as picture upgrade, picture division, and highlight extraction, where four components are extricated to investigate the illness: (1) portion secured by the ailment on the leaf; (2) mean values for the R, G, and B of the illness; (3) standard deviation of the R, G, and B of the illness and; (4) mean estimations of the H, S what's more, V of the malady. The Backpropagation Neural Network was utilized as a part of this venture to upgrade the precision and execution of the picture preparing. The database of the system included 134 pictures of ailments and 70% of these were utilized for preparing the arrange, 15% for approval and 15% for testing. After the preparing, the program will give the comparing key alternatives to consider with the sickness identified.

Xu Pengyun et al. - presented a strategy for checking plant contaminations that were brought on by spores. The shaded pictures is firstly changed over into dull scale picture so in demand to analyze and plan however histogram time, the dim level amendment, picture highlight extraction, picture sharpening and so on. Additionally with a particular ultimate objective to clear the parts of the photo having low repeat, the edges of the grayscale picture is enhancing using Middle Channel and attentive edge figuring. In the wake of

thresholding, morphological highlights like extension, breaking down, opening et cetera are associated on the combined picture got .The weaknesses for this framework were that get ready time radiates an impression of being high and there similarly exists assortments in the traverse of spores.

Malvika Ranjan- Plant disease finding is an art as well as science. The diagnosis process (i.e. recognition of symptoms and signs), is inherently visual and requires intuitive management as well as the use of scientific ways. The work begins with capturing the images. Color feature like HSV features are extracted from the result of k-means segmentation and Artificial neural network (ANN) is then trained by choosing the feature values that could differentiate the healthy and diseased samples appropriately. Experimental results showed that classification performance by ANN taking feature set is better with an correctness of 80%. The present work proposes a methodology for detecting cotton leaves diseases early and accurately, using diverse image processing techniques and artificial neural network (ANN).

Stephen Group Wu - put into practice a leaf affirmation estimation using easily expelled parts and extremely capable computations for affirmation reason. A Probabilistic Neural Network (PNN) was used for affirmation of plant takes off. In this, extraordinary components are mined and took care of by which go about as a commitment to PNN. The drawbacks of this technique were that exactness of affirmation viewed was 90% and the components evacuated were not up to the engraving.

III. SYSTEM IMPLEMENTATION

We create a system which helps in detecting the diseases of different leaf which will help the farmers to detect disease and take proper precaution to enhance the production of crop. We take the pictures of diseased leaf and performed various preprocessing techniques on them for visualize the clear leaf. The main target is to identify the disease in the leaf spot of the crops. In this regard, It is discussed that about 80 to 90 percentage disease on the crops are on its leaf spot. We used ANN as the classifier for testing the input test image with the stored image so that proper disease can be detected. The main objective of this system is to detect diseases in leaf. It is very necessary to detect the diseases in leaf. Detection of leaf diseases can be done early and accurately using Artificial neural network.

The proposed system is shown in Figure 1. The proposed system has been classified into two part:-

1) Training Part, this includes Input Image , Image Pre-Processing, Feature Extraction and Artificial Neural Network based training part and
2) Testing Part, this includes Test Input Image , Test Image Pre-processing, Feature Extraction, Segmentation and Classification, Percentage disease area Calculation and Disease Grading using Fuzzy Logic FIS Toolbox.

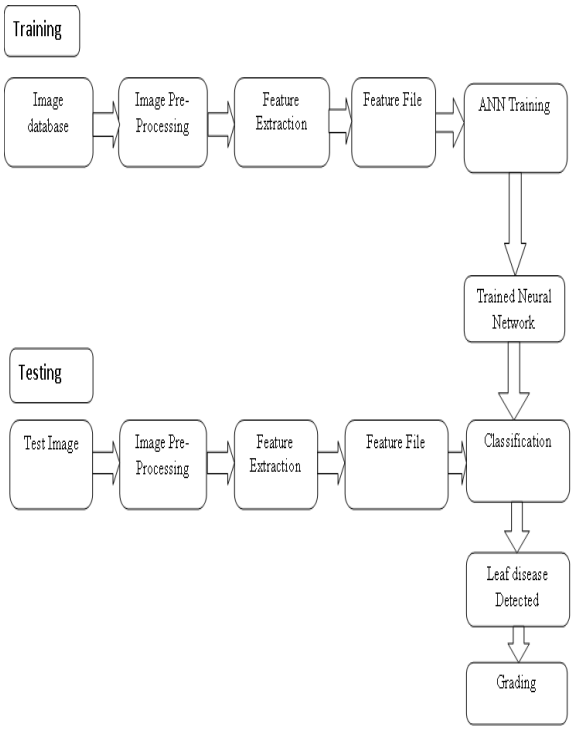

Fig. 1: Methodology of Proposed System

Creating Database: We started our system by creating database used for training part and testing part by ANN. Database contains number of images of the different leaves that would be used for training part and testing part. The image database consists of number of image. The image database is responsible for the better result of the classifier. For each of the disease we are taken some images of the different crop and according to the features that are extracted from those images training of the ANN is done.

A. Input Image:

Input Image means acquiring an image by using of Camera or we also take image from the database. Sample image of leaf is displayed in Fig. 2.

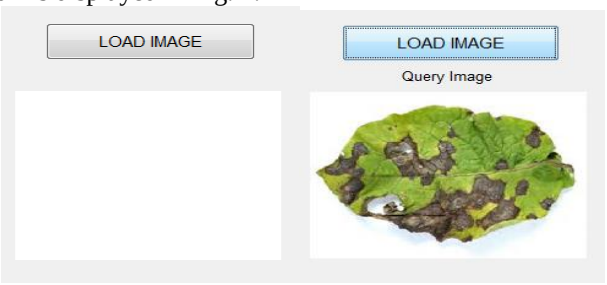

Fig. 2; Load Input Image

B. Image Pre-Processing:

In Image pre-processing input image is converted in to suitable form because it tested effectively by using different technique like resize image, enhance contrast, filter image etc In image processing, computer program are applied to execute image processing on images.

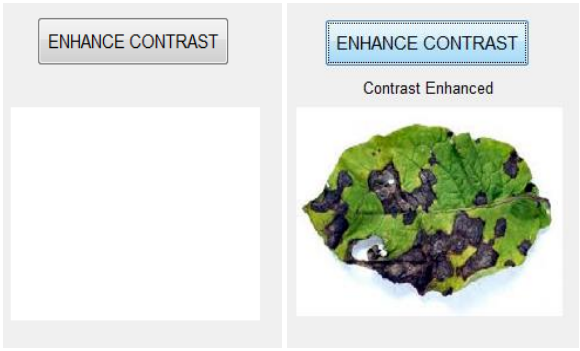

Fig. 3: Image Pre-Processing

C. Segmentation and Feature Extraction:

In segmentation we uses k means segmentation which generate different cluster. K-means is used for grouping similar pixels of an input image. RGB space is converted into L*a*b space where L is Luminosity and a*b are the colour space.

In this system we can extract 13 Feature of input image For recognizing the plant to which the leaf belongs, 13 features have been extracted for 125 leaves. On the other hand, 5 features of the GLCM matrix (including contrast, skewness, energy, homogeneity, correlation) have calculated for detecting the type of disease in the leaf and. As a result, a feature file is being created which is being sent to the ANN toolbox for training of ANN.

The input image is resized and transformed into a binary image. For calculating the total leaf area (AT) and calculating the diseased area (AD), the clusters formed after the color image segmentation containing the diseased spots are considered. After calculation of the total leaf area (AT) as well as the diseased area (AD) of the leaf, the percentage infection (P) is calculated by using the Equation

$$P = (AD / AT) * 100$$

D. Artificial Neural Network Based Training:

After calculating feature create a feature file and by using this feature we train the ANN using the ANN toolbox and using 'nnstart' command. Below fig 4 shows the Flow chart for database creation

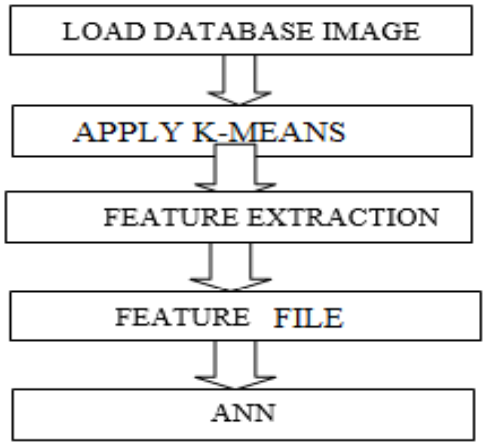

Fig. 4: Flow Chart for Database Creation

E. Grading using Fuzzy Logic Toolbox:

After calculation percentage of infection we can grade stage of disease by using FIS fuzzy logic toolbox. Fuzzy logic toolbox is start using 'fuzzy' command and it show in fig 5

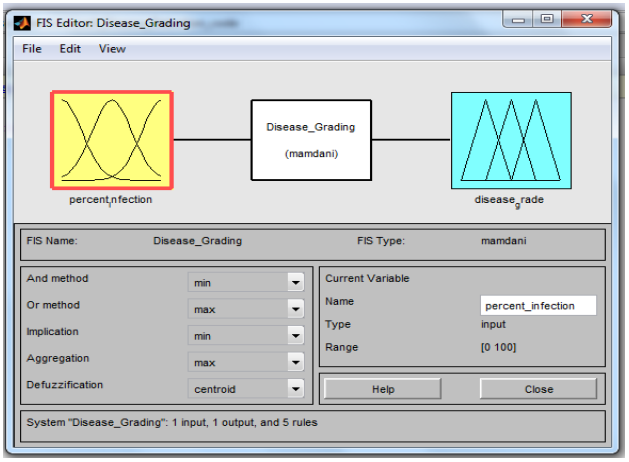

Fig. 5: Fuzzy Logic Toolbox

Grade of disease is decide by using below table 1

Class	Risk	Percentage Infection
A	Very Low	Between 1 to 10%
B	Low Risk	Between 10% - 20%
C	Medium Risk	Between 20% -40%
D	High Risk	Between 30% - 50%
E	Very High Risk	Between 50% -100%

Table 1: Grading Scale for Diseased Leaves

IV. Results and Analysis

The project is developed using GUI file. The results at various stages of the project are discussed as below:-

A. Input Image:

Take image from database and preprocessed it then extract the feature these are shown below fig 6

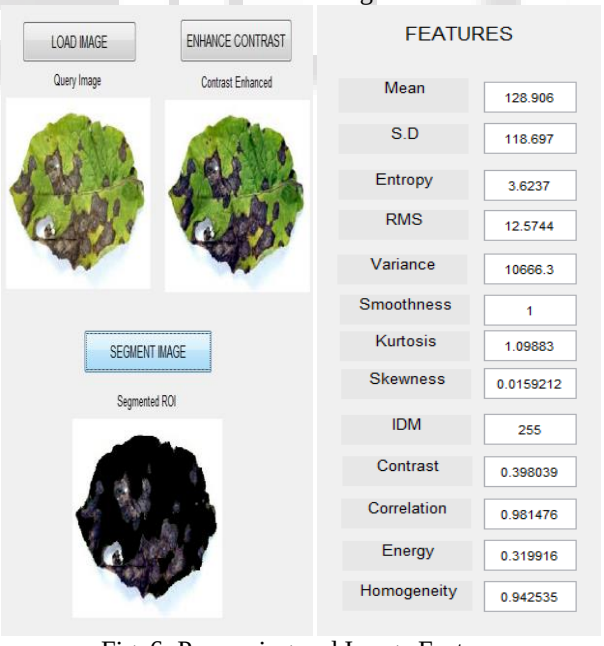

Fig. 6: Processing and Image Feature

B. Generating Clusters in the GUI:

Input image loaded from database in the testing set then GUI window is shows cluster like below fig 7 In this total three cluster produced cluster 1 shows the diseased area of leaf. cluster 2 shows the total leaf area and cluster 3 shows boundary of leaf

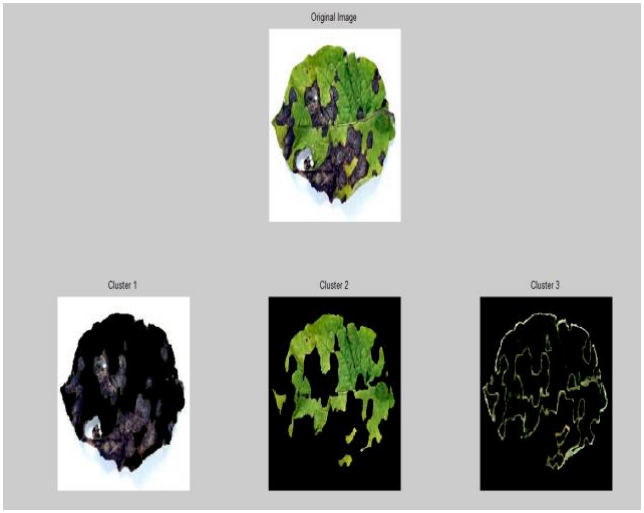

Fig. 7: Image Clusters

Below fig 8 shows total GUI window it consist total system consist take image, image preprocessing, image segmentation, feature extraction, classification and grading

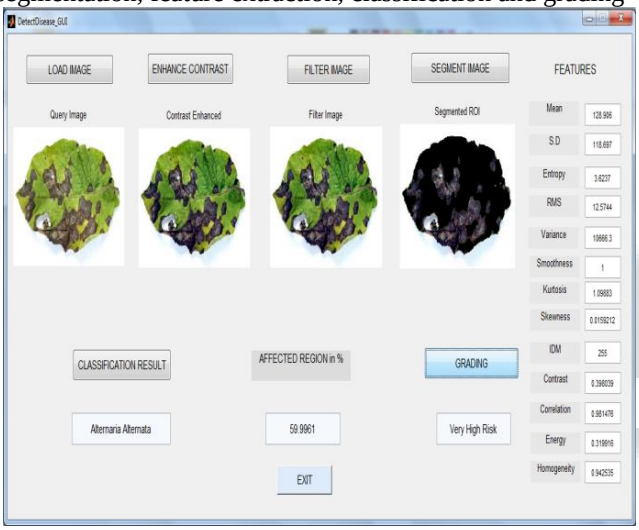

Fig. 8: Total System GUI File

V. CONCLUSION

In the present situation, it is important to find plant leaf disease and grade it automatically. This system is based on image processing, Artificial Neural Network (ANN) and fuzzy logic. Hear Artificial Neural Network (ANN) is used as a classifier to find the disease and fuzzy logic is used for grading of disease. This system is very helpful in agriculture sector to find the disease accurately and grade the disease.

In our system we uses image pre-processing, k-means clustering for segmentation of image to produce different cluster to find total area and disease area to calculate percentage of infection of disease leaf and grade them in various stage. This system gives fast and accurate disease detection and grading them in to different stage as compared to manual method.

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