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Grape Leaf Disease Detection Using SVM Classifier

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ABSTRACT: Identification of the grape leaf disease is the main goal to prevent the losses and quality of agricultural product. In India grape fruit crop is widely grown. So disease detection and classification of grape leaf is very critical for sustainable agriculture. It's not possible to farmer, to monitor continuously the grape disease manually. It requires the excessive processing time, tremendous amount of work, and some expertise in the grape leaf diseases. To detect and classify the grape disease we need fast automatic process so we use SVM classifier technique. This paper presents mainly five stages, viz image acquisition, pre-processing, segmentation GLCM feature extraction and SVM classification.

This paper is proposed to benefit in the detection and classification of grape leaf disease using support vector machine (SVM) classifier.

KEYWORDS: Image acquisition, pre-processing, Image segmentation, GLCM feature, SVM classifier.

I. INTRODUCTION

In INDIA 70% of population depends on agriculture field. Grapes plant is one of most widely produced crop in agriculture field. Grape leaf disease reduces quality and productivity. There are various image processing techniques proceed to detect and analyse the leaf disease such as thresholding, clustering, watershed, masking etc. adopted in practice. In general the modern agriculture is now aiming at the maximum amount of productivity of yield with the less work and time so we can use modern digital image processing techniques. Agriculture products need proper quality control to gain more products in the yield and best quality of fruits. There are many diseases of grapes such as Downy mildew, powdery mildew, grey mildew, rust, black rot etc which affects on grape leaf and reduce the productivity .Many times there is confusion to diagnosis leaf disease because of some similarities in the grapes leaf. Cultivator cannot be able to detect and analyse the leaf disease, they have to go and meet some expert having superior knowledge about the grapes leaf and its corresponding diseases. Every time appointing such a expert would may more costly. Continuous monitoring with naked-eye observation is not possible to farmer. So we use digital image processing techniques.

Initially the input RGB image is converted into gray scale. After that the output of gray scale is segmented using histogram thresholding method then we can extract the GLCM features of image and last stage is detection of disease using SVM classifier. So the proposed system produces automatic, fast, accurate and less expensive methods to detect and classify the disease.

II. RELATED WORK

In [1] A.Meunkaewjinda, P.Kumsawat and K.Attakitmongcol studied the grape leaf disease detection according to the color imagery using hybrid intelligent system. His system used back propagation neural network (BPNN) to extract grape leaf color, to obtain optimal number of color groups, genetic algorithm (GA) for MSOFM used in this work and multiclass SVMs for classification of grape leaf disease. In [2] Braik and Bani Ahmed used a fast and accurate method in which they use K-mean technique for segmentation of leaf and neural network technique for

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classification of leaf disease. In [3] authors have proposed detection and classification of grape leaf diseases using Neural Networks (NN).From his experiment, grape leaf image is taken as input. Thresholding technique is used to mask green pixels. An anisotropic diffusion is deployed to remove noise. Then segmentation is done by using K-means clustering method. Using Neural Networks the diseased part is recognized.

In [4] Qinghai He et al. proposed the system based on cotton leaf in which three different color models for extracting the injured image. Images are converted into the RGB, HIS, and YcbCr color model. The ratio of damage (γ) was chosen as feature to measure the degree of damage which is caused by diseases. By using different color model comparative results are obtained. Then the comparison of result shows good accuracy in both color models and in YCbCr color space. Out of these two models consider the better color model for extracting the infected leaf images. In [5] P. Revathi, M. Hemalatha developed Image Edge detection Segmentation techniques for Cotton Leaf Spot Disease Detection. Image Edge detection in which, the captured images are processed for enrichment first. Then R, G, B colour Feature image segmentation is carried out to get disease spots. Image features such as boundary, shape, colour and texture are extracted for the disease spots to recognize diseases.

In this proposed work K-means clustering technique is used to partition the leaf image into cluster such as there is one or more clusters used when the leaf is infected by one or more disease. For compare threshold value with boundary value masking is done. Using color co-occurance method feature extraction is done [6]. In [7], they work about automatic detection and classification of diseases. Plant disease spots are different in color but not in intensity. Thus color transform of RGB image is used for better segmentation of disease spots. For image smoothing Median filter is used and Otsu method is deployed to calculate threshold values to detect the disease spot.

III. PROPOSED APPROACH

Our proposed methodology is a five-step process, graphically illustrated in Fig. 1. All these steps are briefly depicted below fig.1:

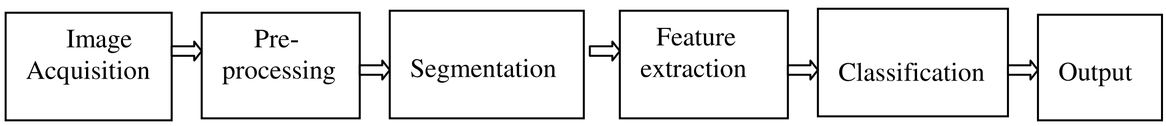

Fig.1 Overview of System

A) Image Acquisition:

The first stage of any vision system is the image acquisition stage. After that sample images are obtained or collected from the farm of grape using different mobile cameras with different resolutions. Which are used to train the system. These sample images are stored in standard jpg format. All sample images are in RGB (Red, Green, and Blue) form. Collected images include the healthy leaf as well as affected leaf by different diseases like powdery mildew, rust, black rot etc. Various methods of processing can be applied to the image to perform the many different vision tasks required.

B) Pre-processing:

An input image has some unwanted noise as well as redundancy present in it. So pre-processing techniques are used for noise removal, contrast enhancement and illumination equalization. To remove the background noise as well as to suppress the undesired distortion which is present in it. These types of variations are occurred due to many reasons such as camera settings, variation in light etc. To overcome such kind of problems, input RGB image is converted to grayscale intensity image. Also it converts RGB to grayscale values by forming a weighted sum of the R, G and B components using following equation (1).

Grayscale= 0.2989 * R + 0.5870* G + 0.1140*B-------- (1)

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Then all images are resized to 500x500 using resizing techniques for accurate result.

C) Segmentation:

The main goal of the segmentation is to be extract meaningful and useful information from the image with respect to certain feature. In present work histogram based method and thresholding is used for segmenting an image. In this technique, a histogram is computed from all of the pixels in the image, Color or intensity can be used as the measure. The histogram can also be applied on a per-pixel basis where the resulting information is used to determine the most frequent color for the pixel location. In this technique, from a grayscale image, thresholding can be used to create binary images. The simplest thresholding methods replace each pixel in an image with a black pixel if the image intensity I{i,j} is less than some fixed constant T { I{i,j}<T}, or a white pixel if the image intensity is greater than that constant.

D) Feature extraction:

Extracting the relevant information from the input image is the process of feature extraction. Also transforming the input data into the set of features is called feature extraction. There are various types of features of leaf images such as color, texture, shape and edges etc. so in this proposed system color and texture features are extracted to get good result and accuracy. Hence the following features are examined.
GLCM Features: Image analysis techniques are the GLCM feature. Using this method texture features are extracted such as contrast, correlation and homogeneity. The following features are considered,
Contrast – To measure of the intensity contrast

$$\sum_i \sum_j |i-j|^2 \, p(i,j,d,\theta) \text{---------} \quad (2)$$

Correlation: To measure correlation between pixel values and its neighborhood.

$$\sum_{i,j=0}^{N-1} \frac{(i-\mu)(j-\mu)}{\sigma^2} \quad \text{--------------} \quad (3)$$

Homogeneity: Measurement of degree of variance.

$$\sum_{i,j=0}^{N-1} \frac{P_{i,j}}{1+(i-j)^2} \quad \text{------------} \quad (4)$$

To calculate the color features following steps are considered,
1) Convert RGB image into HSV color spaces by using following formula.

$$X' = \frac{1}{N} X_i \text{---------------} \quad (5)$$

Where,
X_i = pixel intensity and N =Total number of pixels.
Hence mean is considered as one of the feature
2) Standard deviation - Find standard deviation of input or sequence of inputs

$$S = [\frac{1}{n} \sum_{i=1}^{n} (X_i - X')\ \hat{}\ 2]\ \hat{}\ \frac{1}{2} \text{--------} \quad (6)$$

3) For Holes Extraction Radon transform is used let $f(x, y)$ the input of Radon Transform and $R(\rho,\theta)$ it's Radon Transform which is given by

$$R(\rho,\theta) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f(x,y)\delta(\rho - x\cos\theta - y\sin\theta)dxdy$$

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Where, δ is a dirac delta function,
θ is the orientation off the x-axis and
ρ is the perpendicular distance of a line from the centre.

E) Classification:

The classification technique is used for both training and testing process.This is the last stage of the system. The features extracted from training leaves are compared with features extracted from testing leaves. Then the images are classified based on the matched features. So the Support Vector Machine technique is used for classification of leaf disease.SVM is binary classifier which uses hyper plane this hyper plane is a line dividing a plane in two parts where in each class lay in either side. One class containing the target training vector which is labeled as +1 and other class containing training vector which is labeled as -1.Using this labeled training vector, SVM finds an hyper plane that will then maximizes the margin of separation of two classes as shown in bellows fig.2

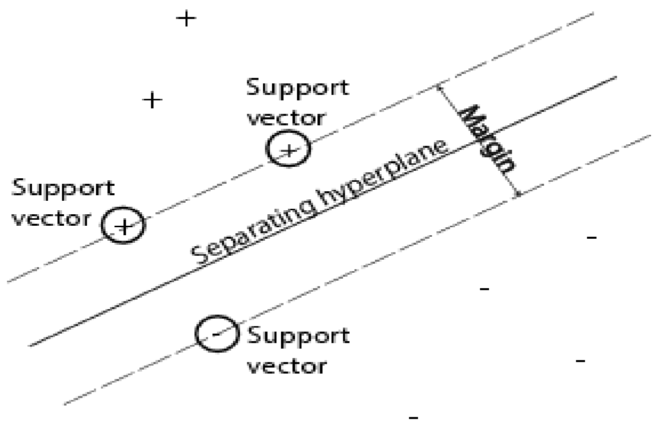

Fig.2 Overview of SVM

IV. EXPERIMENTAL RESULTS

In this work total 90 grape leaf images are used for both training and testing purpose. Out of which 70 are used as training phase and 20 are for testing phase. The given data sample contains both healthy as well as affected (diseased) leafs.
First step is pre-processing the bellows fig.3 Show output of pre-processing

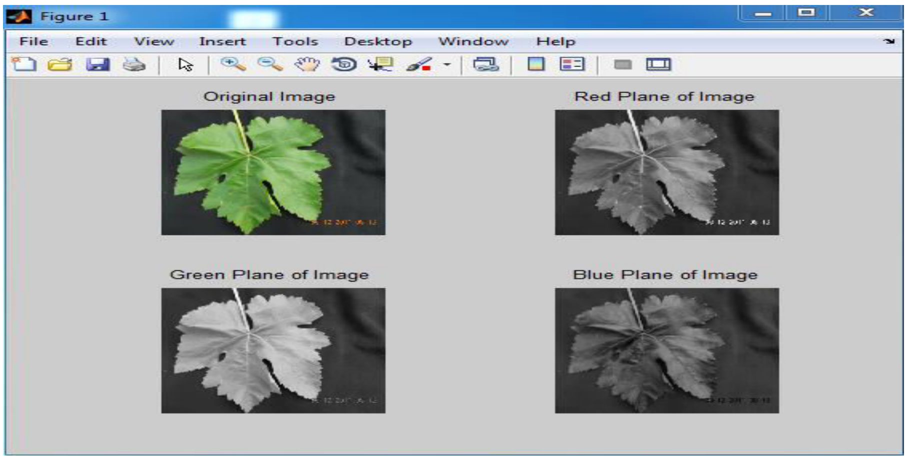

Fig.3 Output of pre-processing

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Then output of pre-processing is segmented using histogram thresholding technique bellows fig.4 Show segmented output

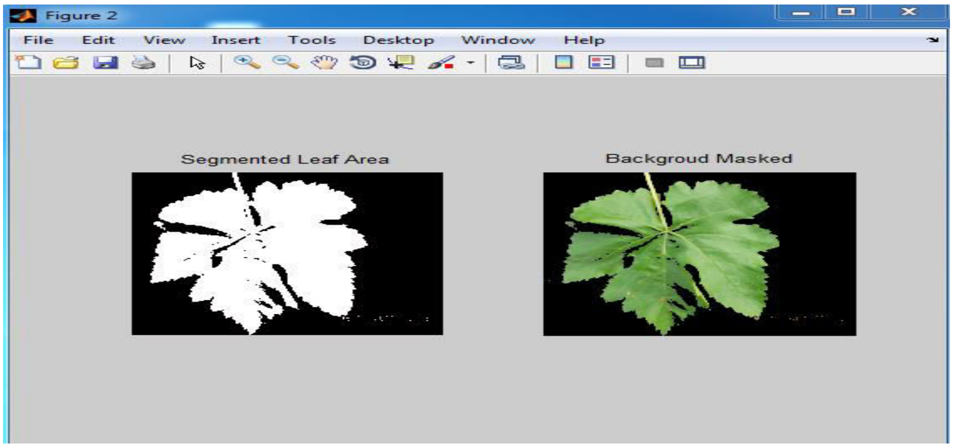

Fig.4 Output of segmentation

The texture and color features of all segmented images are extracted. Then these extracted features are given to SVM classifier. In this proposed work 17 features are calculated .Hence total number of feature values for single leaf image becomes calculated. These feature values is given to trained SVM classifier which classifies the input leaf image into two classes healthy and affected (diseased).So this result is presented into a message box. The GUI output is given bellow fig 5

Fig.5 Output of GUI

The overall performance of SVM classifier is summarized into bellows table.6 So the proposed system is extremely good. It gives good result using SVM classifier.

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Dataset	Total No. Of test Images	Correctly Identified
Healthy	10	10
Affected	10	09

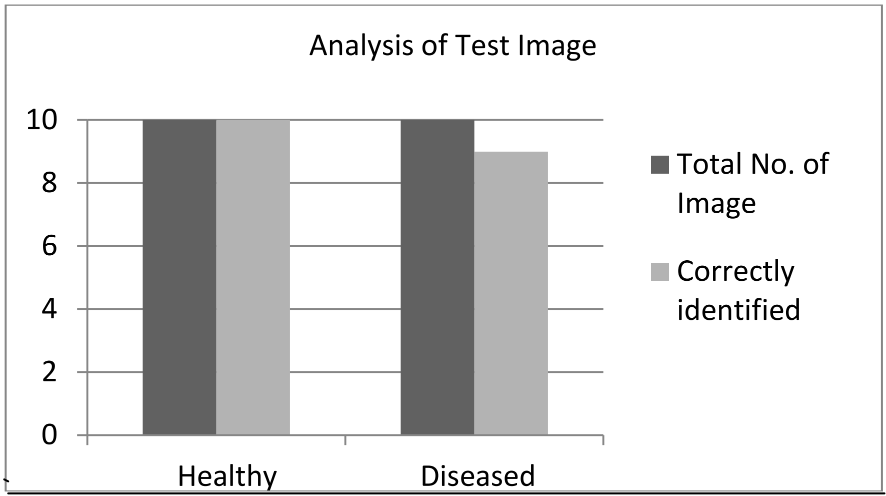

Fig.6 Analysis of test image

V. CONCLUSION

The simulation results showed that the proposed approach will design, develop, and evaluate an automatic system for grape leaf disease detection. It uses standard database images which are collected from farm of grapes. The given system manipulates resizing technique for image pre-processing. To obtain the leaf area, the histogram thresholding is used for segmentation then the feature extraction is done using GLCM and Radon transform technique. Then the final stage SVM classification technique is used to detect the leaf disease. The output of the system resulted in health, affected. An accuracy of 89.90% is obtained.

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