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Foliage Measurement Using Image Processing Techniques

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Abstract— Automatic detection of fruit and leaf diseases is essential to automatically detect the symptoms of diseases as early as they appear on the growing stage. This system helps to detect the diseases on fruit during farming , right from plan and easily monitoring the diseases of grapes leaf and apple fruit. By using this system we can avoid the economical loss due to various diseases in agriculture production. K-means clustering technique is used for segmentation. The features are extracted from the segmented image and artificial neural network is used for training the image database and classified their performance to the respective disease categories. The experimental results express that what type of disease can be affected in the fruit and leaf .

Keywords: Artificial Neural Network ,Segmentation, Local Binary Pattern, K-Means Clustering.

I. INTRODUCTION

The detection and identification of fruit diseases is the most important in the plant growing period. Because plant diseases are usually caused by environmental conditions, climate changes, fungi and bacteria's. The ability of disease diagnosis in earlier stage is an important task. An intelligent decision support system for prevention and control of plant disease is needed [1].The purpose of this paper is to monitor disease on leaf and fruits of the crop and suggest solutions to them for healthy yield and productivity .Neural Network is used for training the database of diseased images and normal images has been loaded[3].Then the k-means clustering is used for image segmentation and disease detection process.

Then this system will show that the leaf and fruit is infected by the downy mildew, apple scab or not. This system will provide the better performance and accurate results. This image processing based on proposed system uses 14 image databases, one for training and others for testing. The images are classified and mapped to their respective disease categories on basis of feature vectors namely, color, texture and morphology [2].Image processing is used to detect diseased leaf, fruit on apple and grapes.

II. METHODOLOGY

1) Image classification:

Color, morphology and texture are used for feature extraction of image database.

A) Color:

it is the most important properties which is used for object discrimination. It is divided into three areas.

- Color transformation.
- Spatial processing of individual color planes.
- Color vector processing.

Where in [3], [8] RGB color space is affected by light and angle at which image has captured so to avoid this problem HSI color space is used.

Algorithm for color feature vector:

In [3] the nearest matching database images with the query image have the least distance metric. The exact match is the one with zero distance metric. The global color histogram data for all images in database are computed and saved in database in advance which can be used to compare the query image with images in database. Here we have quantized H, S & V planes at 8, 8, 4 levels respectively. This is done in order to give less importance to V plane and have less computational time.

B) Morphology:

In [3] Morphology term is used for extracting image components that are useful in the representation and description of region shape, such as boundaries. By using morphology, we are extracting disease shape feature vector from healthy leaf/fruit. Like color, RGB space is converted into HSI with quantized H, S &I planes.

Algorithm for morphology feature vector:

In each plane, boundaries of all database images are obtained by using erosion concept [3].

C) Texture:

It describes visual patterns, each having properties of homogeneity. Image texture provide information about spatial arrangements of color of an image[2].

Role of ANN in image classification:

After feature extraction, learning data base images are

classified by using neural network. In ANN Back propagation algorithm is used in a recurrent network. Once trained, the network weights are frozen and can be used to compute output values for new query images which are not in learning database.

Testing of query image:

Once the weight of learning database has been calculated then ANN is able to test for any query image which is not already in learning database. K-means clustering algorithm is used to entire training data set. K-nearest neighbor algorithm is proposed for classification .It will classify in two classes that is one class will consist diseased fruit/leaf images and another class will consist non diseased images.

Local binary patterns (LBP):

It is a type of feature used for classification in computer vision. LBP is the case of the Texture Spectrum model .It has been determined that when LBP is combined with the histogram of oriented gradients (HOG) descriptor, it improves the detection performance considerably on some datasets. A local binary pattern is called uniform if the binary pattern contains at most two 0-1 or 1-0 transitions. Using uniform patterns, the length of the feature vector for a 3x3 window reduces from 256 to 59. Concatenate normalized histograms of all cells. This gives the feature vector for the window.

III. RESULTS AND DISCUSSION

Fourteen images are used for learning of the system. Color, morphology and texture features are used for feature extraction. Learning is a process by which the system learns the input parameter and classifies the input images into different classes. This has done by using ANN toolbox in Matlab.

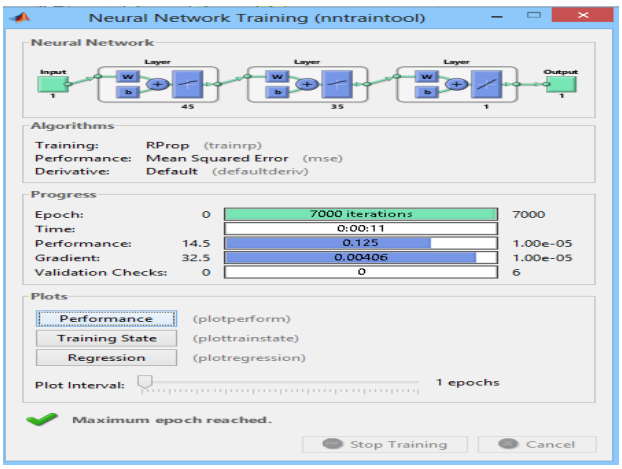

Fig 1Neural Network Training by using NN train tool.

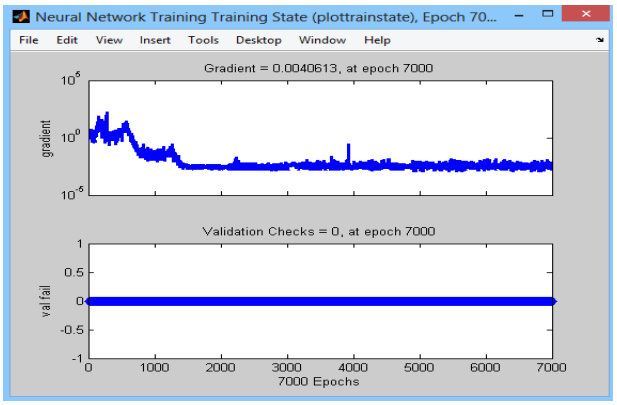

Fig 1(a).Gradient=0.0040613,Validation checks=0 at epoch 7000.

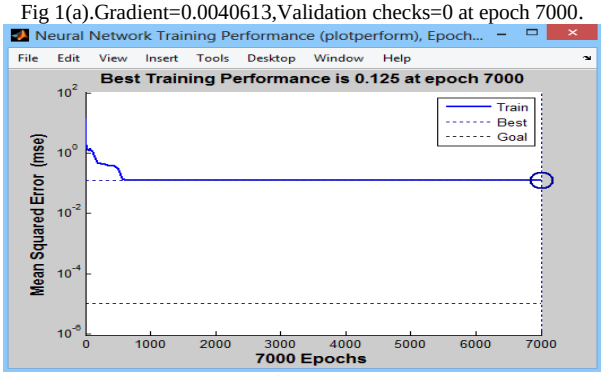

Fig 1(b).Best Training Performance is 0.125 at epoch 7000.

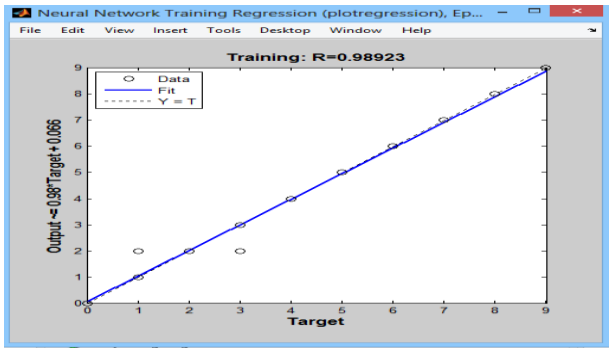

Fig 1(c).Training R=0.98923 using NN training tool.

Plottrainstate(tr) plots the training state from a training record TR returned by TRAIN.

Epoch	7000 iterations	2428 iterations
Best Training Performance	0.125	9.7555e-06
Gradient	0.0040613	0.057145
Validation checks	0	0
Training(R)	0.98923	1

Table 1.Compared output for 7000 and 2428 iterations.

Plotperform(TR) plots the training, validation, and test performances given the training record TR returned by the function train.

Simulation Results:

Simulation results for normal grape leaf , Downy mildew disease affected leaf, and normal apple fruit , apple scab affected fruit.

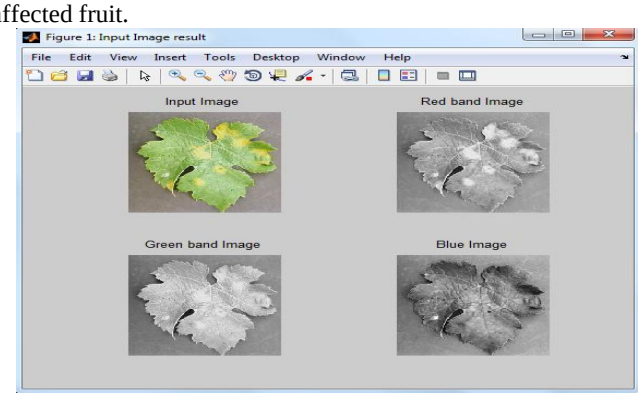

Fig 2.Diseased grape leaf input image is converted to RGB image.

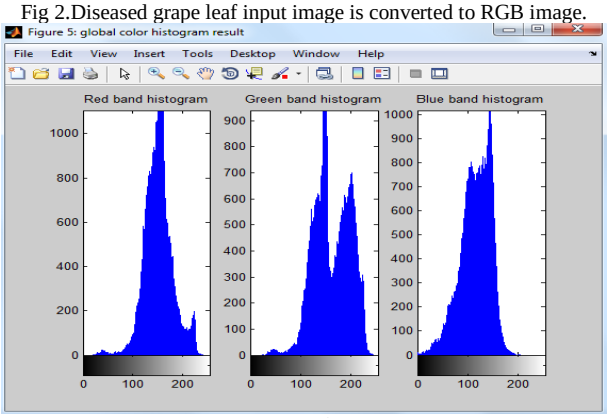

Fig 2(a).Histogram result for RGB input image.

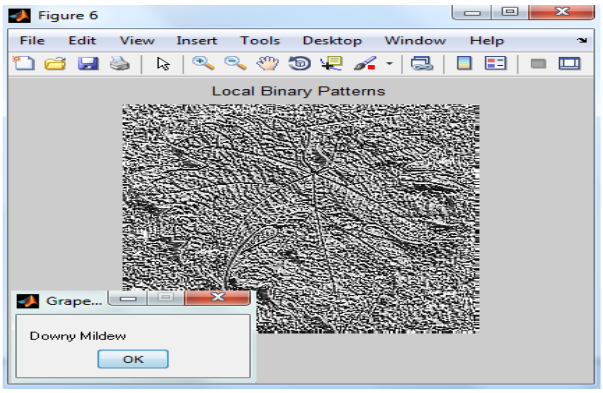

Fig 2(b).Input image is converted to Local Binary Patterns and result.

LBP =131.9095

Y=6

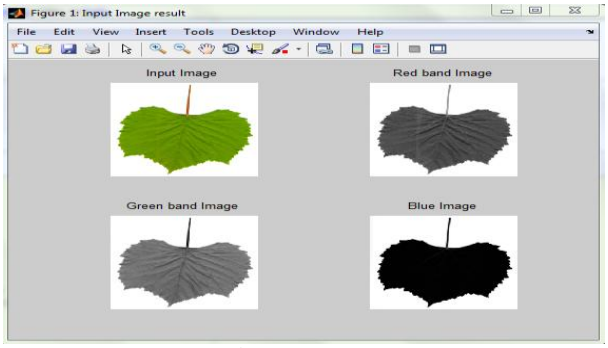

Fig 3. A normal grape leaf input image is converted to RGB image.

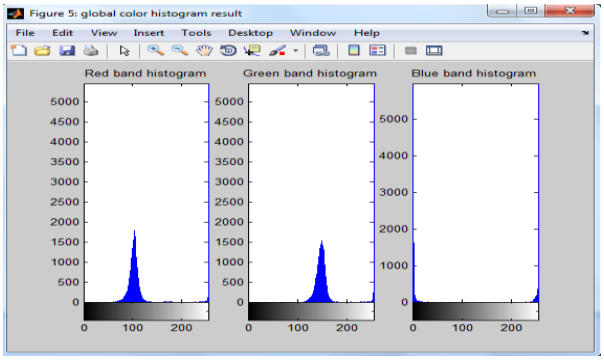

Fig 3(a). Histogram result for normal leaf image.

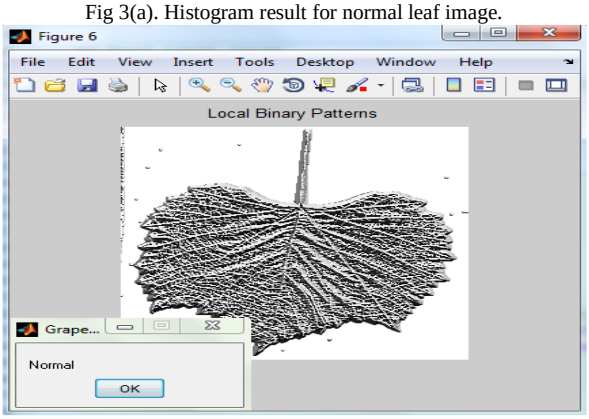

Fig 3(b). Input image is converted to Local Binary Patterns and result

LBP=191.3998

Y=9

	Normal grape leaf	Downy Mildew
Initiated centroid value	35.000000	48.200000
Initiated centroid value	70.000000	96.400000
Initiated centroid value	105.000000	144.600000
Initiated centroid value	140.000000	192.800000
lbp	191.3998	131.9095
y	9	6

Table 2.Compared output for normal and diseased grape leaf.

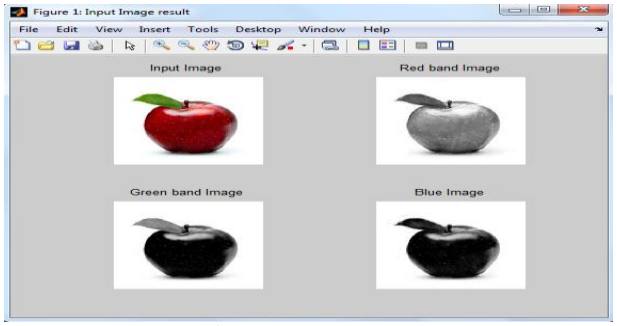

Fig 4. A normal apple fruit input image is converted to RGB image.

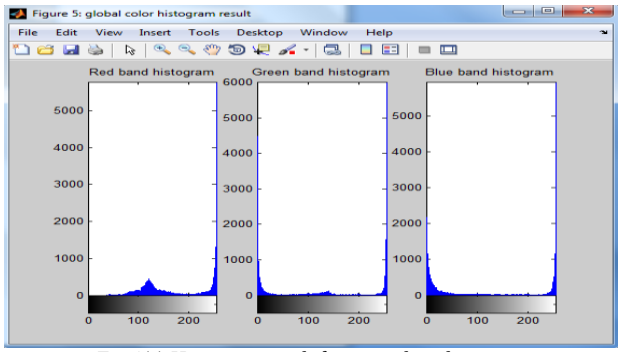

Fig 4(a).Histogram result for normal apple image.

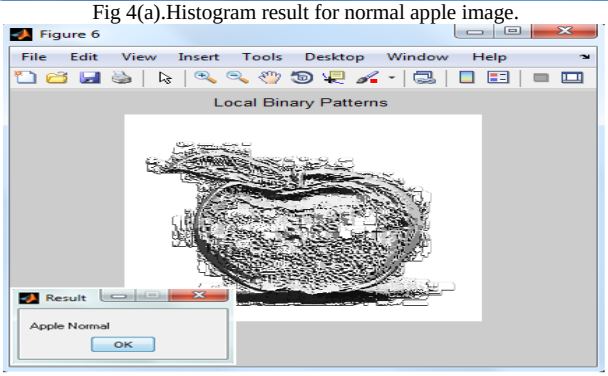

Fig 4(b). Input image is converted to Local Binary Patterns and result.
LBP=205.4011
Y=0

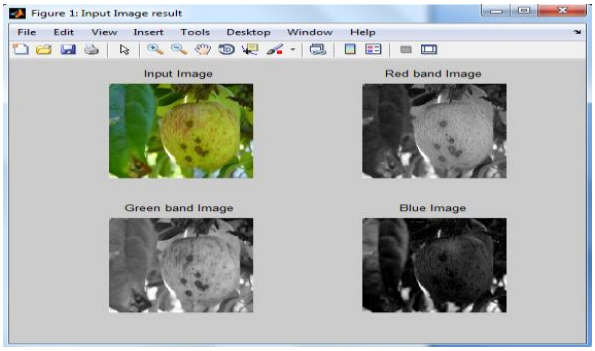

Fig 5.A diseased apple fruit input image is converted to RGB image.

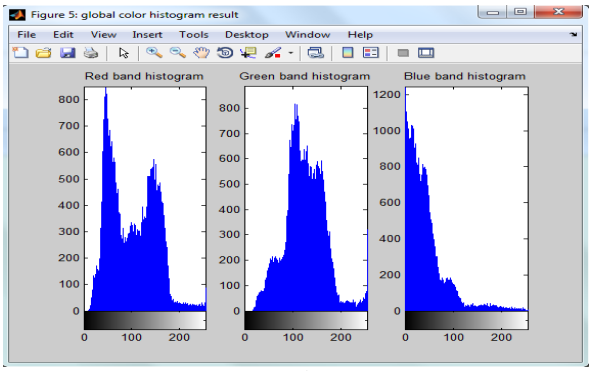

Fig 5(a). Histogram result for diseased apple image.

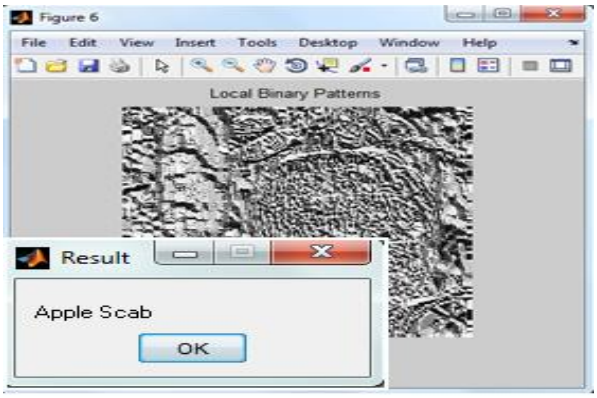

Fig 5(b). Input image is converted to Local Binary Patterns and result.
LBP=136.0406
Y=4

	Normal Apple	Apple Scab
Initiated centroid value	51.400000	49.400000
Initiated centroid value	102.800000	98.800000
Initiated centroid value	154.200000	148.200000
Initiated centroid value	205.600000	197.600000

lbp	205.4011	136.0406
y	0	4

Table 3.Compared output for normal and disease affected apple.

IV. CONCLUSION

The main purpose of this paper is to improve the efficiency of automatic fruit disease detection system. The proposed system the developed neural network can successfully detect and classify the tested disease. We get better results for color and morphology as compared texture. Automatically detect the disease on plant leaves is very much essential. the downy mildew, apple scab is identified on apple ,grape leaf and fruit. Once the disease identified proper treatment can be suggested.

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