Detection of Bacterial Blight on Pomegranate Leaf

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***Abstract*—** In India, agricultural field plays vital role in the development of India. Smart farming is about empowering today's farmers with the decision tools and automation technologies that seamlessly integrate products, knowledge and services for better productivity, quality and profit. In this paper, a solution for the detection of pomegranate leaf disease and also the solution for that disease after detection are proposed. The proposed system mainly consist image preprocessing, feature extraction, clustering and classification. The first steps consists image preprocessing in which images are resized. In second step, feature extraction is carried out. Color, morphology and color coherence vector features are used for the purpose of feature extraction . K-means clustering technique is used for partitioning training dataset into desired number of clusters according the features that has been extracted from the fruit images. Then the next step includes training and classification. Support Vector Machine approach is used for classification.

Keywords- *color; morphology; color coherence vector; support vector machine;*

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I. INTRODUCTION

India is the agricultural country. The role of the agriculture field is very important in the development of the country. To increase the production of crops and preventing the losses due to pests, there is need of implementation of smart farming which helps the farmer's use of advanced technology for farming.

In India, at present the crop disease detection is done by some domain expert and this disease detection is done manually. So it may be time consuming to detect disease on crop and provide proper treatment to prevent economical loss. We have proposed automatic fruit disease detection system.

We have selected pomegranate leaf for automatic disease detection. This fruit is mainly affected now days by the attack of Bacterial blight disease which lead to the major loss for the farmers. The production of pomegranate fruit is taken in the low rain region and which gives the more profit to the farmers. The disease can be widely spread in rainy and winter season. This disease affects steam, leaf and fruits, but major distractive part is on fruits. The leaf disease in the form of dark brown surrounded by dark yellow, infected leaves turn in yellow color. There is need to identify this diseases at the primary stage to prevent farmers loss.

In the proposed approach, system take input as image of pomegranate leaf and identify it is affected by bacterial blight or not.

II. RELATED WORK

The author Monica Jhuria[1], provided an approach for fruit disease detection based on image processing. The purpose of research work is to observe disease on fruit and suggest solutions. Grapes, Apple and mangoes are selected for conducting experiments. Morphology, color and texture feature vectors are choosen for feature extraction. For disease detection and weight calculation of fruit image processing techniques are used. Back propagation is used for weight adjustment of images that are stored in learning database. On the basis of disease spreading, the grading of fruit has been decided.

The author Shiv Ram Dubey[2], suggested an image processing based way for detection and identification of fruit disease. The fruit selected is apple and diseases considered are namely apple rot, apple blotch for conducting the experiments. For image segmentation, K-means clustering is used. Color coherence vector, Histogram, Local Binary patterns, Complete local binary patterns are used for extracting the features. For fruit disease detection, multiclass support vector machine is used.

The author Ilaria Pertot[3], suggested multilingual web based tool. The web based tool provided for plant disease detection. Strawberry fruit is considered as case study. The farmer in the farm will observe symptoms and these symptoms will compare with images provided in the system. The outcome will be identification of fruit disease. The web based system consists user and super user. Super user have authority to add / modify / delete images and diseases. And user can user disease detection method /tool for disease detection.

The author Tejas Deshpande[4], provided a system that is useful for plant pathologist for disease detection on plant leaves of pomegranate fruit. The bacterial blight disease has been selected to carried out experiments. For image segmentation and fruit disease detection, K-means clustering algorithm is used. After segmentation, diseased area has been calculated and disease grading has been done.

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The author Jagdeesh D. Pujari[5], proposed the statistical methods for fruit fungal disease detection. Pomegranate, grapes and mangoes are selected to carried out the experiments. Block wise feature extraction is used. The phases namely image pre-processing, image thinning and bounding box generation are used for image pre-processing. Grey level co-occrance matrix is used for textual feature extraction.

III. PROPOSED FRAMEWORK

Fig. 1 represents framework for proposed system. It consist two phases namely, training phase and testing phase. In training phase, pre-processing, feature extraction and classification are perform on image dataset. In testing phase, query image is uploaded by user, then pre-processing, feature extraction and classification is performed. finally the image will be classified as diseased or non-diseased.And intent search option is also provided.

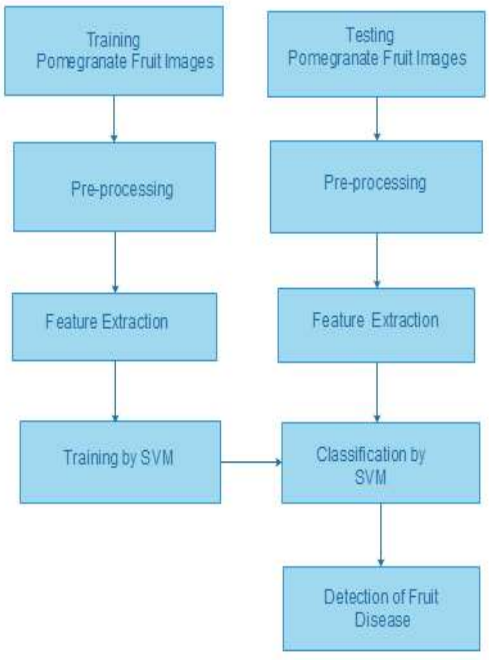

Figure1. Proposed Framework

A. *Image Preprocessing:*

The images are captured by digital camera, so image size is very large. In image pre-processing module, image resizing is done. All images are resized to 300 *300 px.

B. *Feature Extraction:*

It is the process of generating the features to be used in classification. Color , morphology and color coherence vector feature vectors are used for feature extraction.

1) Color: A color feature is widely used visual feature. A color histogram represents the distribution of color in image. Here, we will compute color histogram for all images in dataset and save in database which will be used for comparison of query image with dataset image.

Algorithm for Image comparison based on Histogram

Input: img1:image1
img2:image2
Output: Image similarity in percentage
1.hist1=compute hist(img1).
2.hist2=compute hist(img2).
3.For each colour code R,G,B follow step 4
4.dist=$\sqrt{(hist1 - color) - (hist2 - color)^2}$
5.agg_dist=agg_dist+dist.
6.return(agg dist).

Computation of Histogram

Input: img: image
Output: hist: Three bin histogram for three color code.
1.hist ← Ø
2.for each pixel in img follow step 3.
3.For each color in pixel follow step 4.
4.if(color value <86)
hist color bin1 + + ;
elseif (color value <171)
hist color bin2 + + ;
else
hist color bin3 + + ;
5. return(hist).

2) Morphology: Morphology is tool used for extracting image components. These image components are useful in description and representation of region shape such as boundaries. By using morphology, we will extract disease shape vector from healthy fruit and leaf. We are using erosionconcept which is fundamental operation of morphology for obtaining the boundaries of images.

Algorithm for Image Morphology

Input: img:image1
Output: borderedImage:image
1.erroded=errod image(img).
2.borderedImage ← Ø
3.For each pixel p in img and p2 in erroded perform step 3.
4.bordered image pixel = p1 - p2;
5.return(borderedImage).

Computation of errod image

Input: img:image
Output: errodedImage.
1.erroded ← Ø
2.r from 1 to number of rows.
3.c from 1 to number of columns.

4.erroded pixelat [r][c]= min(img[r-1][c-1],img[r-1][c] ,img[r-1][c+1],img[r][c+1],img[r][c-1],img[r+1][c-1], img[r+1][c],img[r+1][c+1])
5.return (erroded)

3) Color coherence vector: It is a histogram-based method for comparing images that incorporates spatial information. In this technique, each pixel in a given color bucket is classified as either coherent pixel or incoherent pixel. Classification of each pixels is based on whether or not it is part of a large similarly-colored region. Coherent pixels are part of some sizable contiguous region, whereas incoherent pixels are not belongs to some sizable region.

C. *Clustering:*

K-means clustering technique for partitioning the training dataset according to their features.

D. *Training and classification:*

Support vector machine approach is used for training and classification. After applying SVM, clusters will classify into two classes that is diseased and non-diseased.

IV. EXPERIMENTAL RESULTS

A. *Dataset Preparation:*

We have used a dataset of diseased and non-diseased Pomegranate leaf images. We have used 60 Non-diseased images and 190 diseased images.

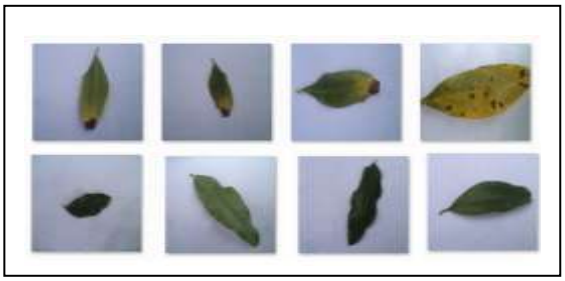

Figure 2. Sample images of diseased and non-diseased leaf

B. *Results Discussion:*

TABLE I. DISEASE DETECTION PERRCENTAGE

Input image category	***Detection percentage***
Infected	81%
Non-infected	86%

As given in the above table we have given image as input to system and the detection percentage is obtained. The non-infected category of image refers to a normal pomegranate leaf without any infection from bacterial blight and in healthy condition and infected category refers to leaf having dark brown spots surrounded by yellow color.

1) Image Pre-processing Module :

User will upload dataset directory. In this module, pre-proceesing takes place. All images will be resize to 300*300 px.

Figure 3. Image preprocessing module

2) Feature Extraction Module:

In this module, Color, morphology and color coherence vector features are extracted.

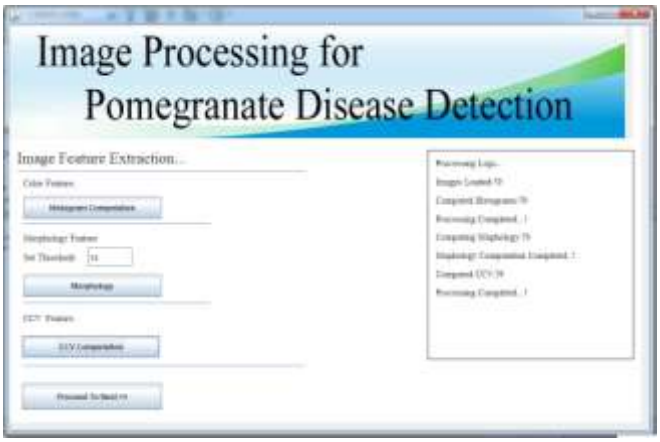

Figure 4. Feature Extraction module

3) Clustering and classification module:

K-means clustering technique is used for partitioning training dataset into desired no. of clusters. Support vector machine algorithm is used training and classification.

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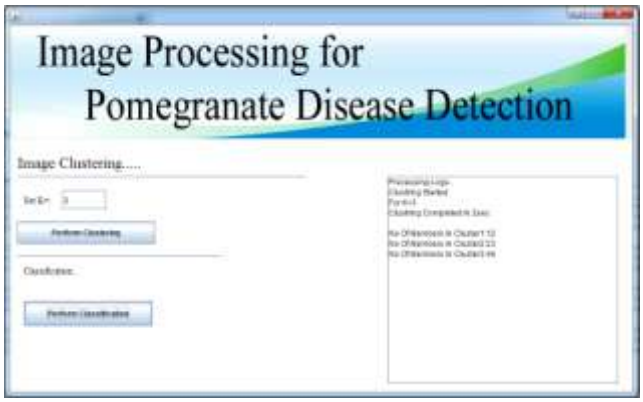

Figure 5. Clustering and classification module

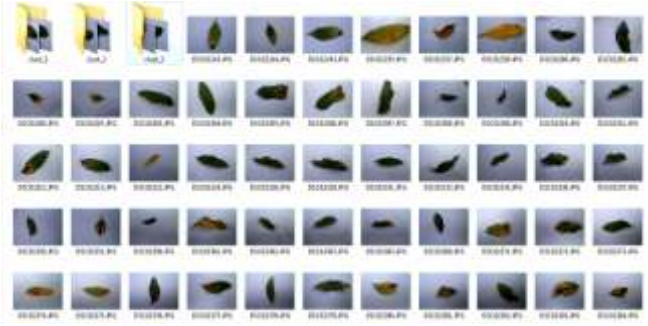

Figure 6. Clusters generated after clusteing module

4) Disease detection module:

In testing phase, user upload query image. Then image pre-processing , feature extraction, classification will perform and finally leaf image will classify as diseased or non-diseased.

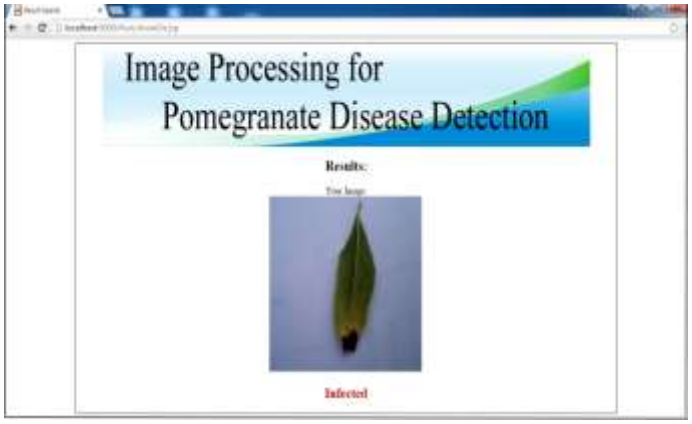

Figure 6. Fruit disease detection module

V. CONCLUSION

The image processing based approach is proposed for automated disease detection system. The proposed approach majorly consists phases namely image pre processing, feature extraction, clustering, training and classification. Color, morphology and Color coherence vector features are used for feature extraction. Morphology gives best results. The disease considered for the research work is the bacterial blight of the pomegranate leaf. Once the disease is detected proper treatment can be suggested.

The results obtained by the automated disease detection system significantly support the automatic detection system. This is the one step towards to promote the farmers to do the smart farming and allows them to take decisions for a better production of fruits and crops.

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