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# Pomegranate Leaf Disease Detection Using Image Processing with SVM Classifier

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*Abstract* - **India is an agricultural country where most peoples in the India are farmers. Economically agricultural field is very much important. The crops are affected by uneven climatic conditions, Because of that diseases on plant is increased and agriculture yield is decreased. Which restrict the growth of plant and quality and quantity of plant also reduces. Now days, the conditions become worst because of bacterial diseases. Detection of diseases and prevention is much more needed for that modern agriculture techniques and systems are designed. The studies of the pomegranate plant diseases mean the studies of visually observable patterns seen on the plant. It is very difficult to monitor the pomegranate plant diseases manually. Hence, image processing is used for the detection of pomegranate plant diseases. Image processing is best way for detecting and diagnosis the diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. K-means clustering algorithm is used for segmentation and support vector machine is used for classification of disease.**

**Index Terms— Image Processing, K-means Clustering, Segmentation, SVM (Support Vector Machine), Classification, Disease Detection, feature extraction.**

## INTRODUCTION

In India farmers are depend on the agriculture. Agriculture is an important part of our country as about 70% of the population depends on the farming for their living. Due to loss in the production, many farmers attempt suicides which is a serious issue. So this issue can be controlled to some extent by using new technologies. Image processing is a best technique for agricultural application. Image processing is the study of any algorithm that takes an image as input and returns an image as output. Image processing can detect a pest's attack from the image of plant. It includes image display and printing, image editing and manipulation, image enhancement, feature detection and image compression.

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics or features associated with that image. There are several ways to detect plant diseases. Some diseases cannot be detected with naked eyes, or those appear only when it is too late to act upon them. Traditional methods to identify and detect plant disease are lengthier and time consuming. The detection and classification of plant diseases are important task to increase plant productivity. In such cases, automation of disease detection is essential. Since these activities are done manually and are very labor intensive, automation of the disease detection is a necessary task.

This paper focuses on Pomegranates plant diseases detection and classification using image processing techniques. Pomegranates plant is one of largely produced crops in India. Improving the productivity of pomegranates can significantly reduce the food deficiency and can contribute towards improvement in health care. pomegranates are crops that are susceptible to many diseases such as Bacterial blight and Wilt of pomegranate etc. These diseases are caused by fungi which attack on pomegranate leaves as well as fruit. Bacterial blight is mostly observed on pomegranate leaves and appears as a one to several small water soaked, dark coloured irregular spot on leaves whereas Wilt shows yellowing of leaves in some twigs or branches, followed by drooping and drying of leaves. Automatic detection of plant diseases is a forthcoming research area as it proves helpful in monitoring large fields, and automatically detects the plant diseases based on the symptoms that are visible on the plant leaves. Therefore, the objective of this paper is to develop image processing technique that can accurately analyze the disease of the grape plants based on images of the leaves, since leaf is a good indicator of the plant health and offer a solution to major national issue of increasing agriculture productivity.

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## II.PREVIOUS WORK

S. S. Sannakki, V. S. Rajpurohit [1] presents a study of Back Propagation Neural Network (BPNN) classifier for detection of plant diseases based on visual symptoms occurring on leaves. Shivaputra S. Panchal, Rutuja Sonar [2] Used image processing for the detection of pomegranate plant diseases. Amar Kumar Dey & et al. [3] implemented Otsu thresholding based image processing algorithm for segmentation of leaf rot diseases in betel vine leaf. The proposed method was successfully applied to twelve leaf image with very high precision. Jayme Garcia Arnal Barbedo & et al. [4] stated the problem associated with automatic plant disease identification using visible range images has received considerable attention in the last two decades. Manisha Bhange & et al. [5] developed a web based tool that helps farmers for identifying fruit disease by uploading fruit image to the system. Manisha A. Bhange [6] proposed the image processing based approach for Automated disease detection system. The proposed approach majorly consists phases namely image preprocessing, feature extraction, clustering, training and classification. Roberto Oberti & et al. [7] investigated how the detection's sensitivity of powdery mildew on infected grapevine leaves may be improved by adopting appropriate view angles. Jianlun Wang & et al. [8] analyzed the background and foreground images of jujube leaf, and propose a new Adaptive Thresholding algorithm that can segment single leaves in a leaf image extracted randomly from an online system. S. Phadikar, J. Sil, and A. K. Das [9] developed an automated classification system based on the morphological changes caused by brown spot and the leaf blast diseases of rice plant. T. Rumpf & et al. [10] developed a system for the detection and differentiation of sugar beet diseases based on Support Vector Machines and spectral vegetation indices.

## III.OUR APPROACH

The proposed method has training and classification phases. In the training phase, from a given set of training images (segmented) the texture features (GLCM) is extracted. This extracted texture features are used to train the system using a Support Vector Machine.

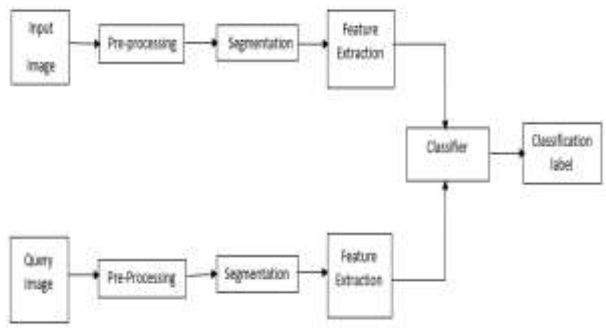


*Fig 1: Block diagram of the proposed work.*

### *Image Acquisition*

In the proposed method collected the images from the database like pomegranate leaf Image Database consortium. The dataset contains two types of images such as disease affected leaf images and unaffected leaf images.

### *Image preprocessing*

Image pre-processing involves removing low frequency background noise, normalizing the intensity of individual particles images, removing reflection and masking portion of images. It is the technique for enhancing data images prior to computational processing. Pre-processing required for shadow removal, image correction. Shadow removal is very important because Shadow may disturb segmentation and feature extraction.

There are two steps of image pre-processing, i.e., Noise removal and Histogram equalization. The image is resized to maintain the uniformity in terms of size of image, and then the resized image converted to gray levels. We convert the input RGB image into grayscale format called the colour transformation using rgb2gray command. After this transformation we consider Median filter for noise removal. In histogram, before performing histogram equalization, you must know two important concepts used in equalizing histograms. These two concepts are known as PMF and CDF. Histogram equalization is used to enhance contrast. image contrast has been enhanced and its histogram has also been equalized. There is also one important thing overall shape of the histogram changes, where as in histogram stretching the overall shape of histogram remains same.

Following figure shows the result of noise removal and histogram equalization.

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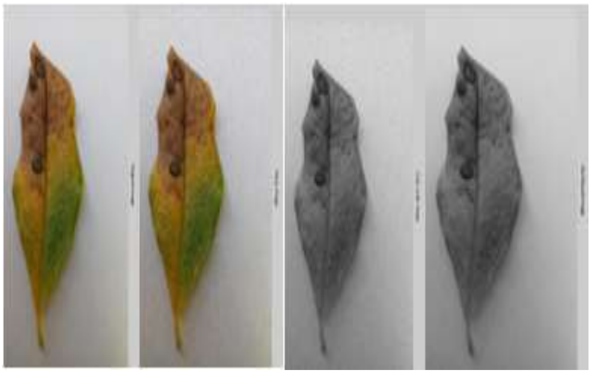


***Fig.2 a) Noise removal***

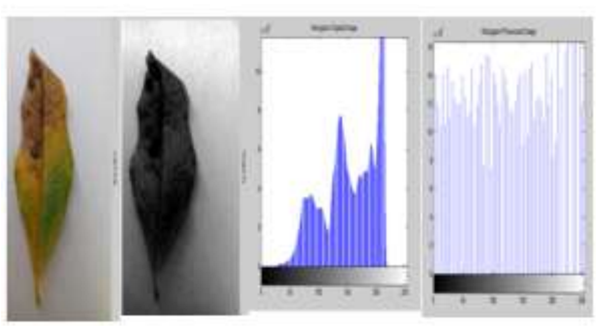


***Fig.2 b) Histogram Equalization***

***Fig. 2 Pre-processing result (a) Noise Removal and (b) Histogram equalization.***

***III. Image segmentation:***

Image segmentation is one of the most important precursors for disease detection and has a crucial impact on the overall performance of the developed systems. The K-Means clustering technique is a well-known approach that has been applied to solve low-level image segmentation tasks. This clustering algorithm is convergent and its aim is to optimize the partitioning decisions based on a user-defined initial set of clusters. Paper proposed k-means segmentation method to segment target areas. The area affected by the disease is the target area.

The segmentation based on K-means technique is a partition clustering technique used to partition n number of observations into k clusters. In this technique, k is the number of clusters in the segmented image and colours present in an image are used for the clustering. The main advantage of segmentation based K-means clustering technique is that it works on local information and global information of image. K-means clustering algorithm is easy to implement and fast, robust and flexible.

The below algorithm represents the flow of process of segmentation using K-means.

***Algorithm:*** Segmentation by k-means clustering operation

***Input:*** Grape leaf image.

***Output:*** Segmented clusters of grape leaf image.

Start

Step 1. Read input image.

Step2. Input images is converted to gray scale image.

Step3. Apply enhancement.

Step4. Resize the image.

Step 5. Apply k-means clustering operation

Step 6. Find the centroid of the pixels.

Step 7. Divide the pixels into cluster.

Step 8. Represent the clustered image.

Step 9. Segmented output.

Stop

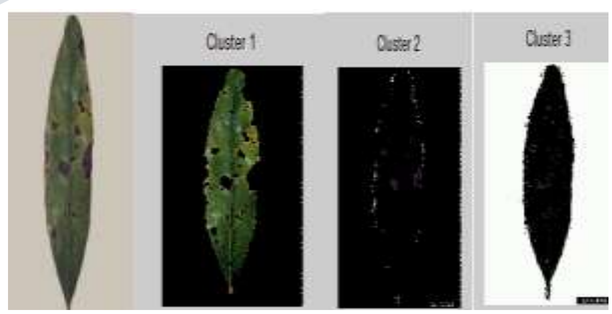



***Fig.3 Segmentation Results: (1) Segmentation of leaf (2) Infected part of leaf removed (3) Only infected part shown (4) Background part removed***

In the classification phase first all the leaf is segmented from test image set and then texture features are extracted. These features are queried to the Support Vector Machine to know the Pomegranate leaf disease.

The block diagram of the proposed method is given in Fig. 1.
The first step in disease detection is to segment the leaf image. In this step from leaf image remove the unwanted noise and create histogram of image. Fig. 2 shows the results of noise removal and histogram equalization of image. To segment the leaf image, we use a k-means clustering segmentation algorithm. Fig. 3 shows the results of leaf segmentation using k-means clustering segmentation on a pomegranate leaf images.

## IV. FEATURE EXTRACTION:

After segmentation of leaf image, features are extracted from the image and classified as healthy or diseased image. Edge, texture, shape, color, etc. are some of the features used for classification. Broken edges, patches in leaf image, roughness or smoothness of leaf texture, etc. can be used for leaf disease detection and identification.

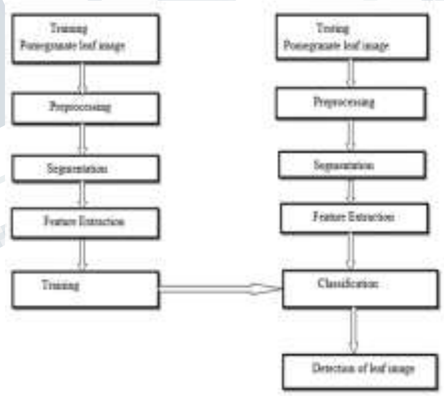
### *1.1 GLCM*

The GLCM is an N × N square matrix, where N is the number of different gray levels in an image. An element p (i, j, d, θ) of a GLCM of an image represents the relative frequency, where i is the gray level of pixel p at location (x, y) and j is the gray level of a pixel located at a distance d from p in the orientation θ. While GLCMs provide a quantitative description of a spatial pattern, they are too unwieldy for practical image analysis. Haralick et al. thus proposed a set of scalar quantities for summarizing the information contained in a GLCM. They originally proposed a total of 14 quantities, or features; however, typically only subsets of these are used. The thirteenth GLCM-derived features Contrast, Correlation, Energy, Homogeneity, Mean, Std_Deviation, Entropy, RMS, Variance, Smoothness, Kurtosis, Skewness, IDM is extracted and used in this work.
For each samples of different class image, above features are computed and stored in the data base feature vector as GLCM features. Therefore, these13 features are used at the time of classification stage.

## V. CLASSIFICATION

Classification comprises of training and testing processes, where features extracted from training leaves are compared with those extracted from testing leaves. The image is then classified based on the matched features. Image acquisition, segmentation and feature extraction comes under the training process and classification comes under the testing process. Image classification is the final step in this paper which results in classifying the Pomegranate leaves into different disease classes. There are usually three diseases which effect on the plants; they are: Bacterial blight, Anthracnose and Wilt. There are number of techniques that are used for classification viz artificial neural network (ANN), fuzzy logic, neuro-fuzzy interference system, K-nearest neighbor (KNN), principal component analysis (PCA), support vector machine (SVM) etc. The classifier used in this project work is SVM multi-class classifier. The images of the leaves are first classified into two classes as either healthy or diseased. If the image is diseased, it is further classified into one of the three diseases as Bacterial blight, Anthracnose and Wilt.
Following figure shows the process for leaf disease detection.

***Fig. 5 Process for leaf disease detection.***




### *SUPPORT VECTOR MACHINE CLASSIFICATION (SVM):*

The SVM classifier is used to identify the classes, which are closely connected to the known classes. The Support vector machine creates the optimal separating hyper plane between the classes using the training data.
The optimal hyper plane increases the margin of the closed data points. If hyper plane is having the largest distance to the nearest training features of any class is considered as good separation. Margins and Maximum margin hyper plane for SVM classifier with from different samples present in two classes. The SVM samples present on the margin are called as support vector. SVM divides the given data into decision

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surface. Decision surface is further divided the data into hyper plane of two classes. Training points defines the supporting vector which defines the hyper plane. The basic idea of SVM is used to increase the margins between the hyper planes of two classes. Basically, SVM can only resolve problems which are related to binary classification. Now they have been enlarged to process multi class problem. It uses the one after one method to fit all binary sub classifiers and also to find the correct class by electing mechanism to grant the multi class classification.

## VI. RESULT

For the experimental work, a database of 400 images is created. The RGB image is pre-processed with color transformation and background subtraction and then segmented with k-means clustering algorithm which segments the image into 4 clusters. From the image color, shape and texture features were extracted. From these features support vector machine (SVM) is trained and it helps to differentiate the images into different classes as healthy and diseased which further categories as Bacterial blight, Anthracnose and Wilt. For experimentation purpose, the database is arranged into two sets: the training and the testing set. Different training testing ratios are taken into consideration to find out the accuracy of classifier. The classifiers used for comparison are artificial neural network (ANN), K-nearest neighbor (KNN) and support vector machine (SVM). The final results are evaluated based on the performance of the four types of classifiers used in this work. The average accuracy of the proposed method comes to be around 90%.

| **Classes** | **Bacterial blight** | **Wilt** | **Normal** | **Accuracy** |
|---|---|---|---|---|
| **Bacterial blight** | 23 | 0 | 1 | 92 |
| **Wilt** | 0 | 22 | 0 | 88 |
| **Normal** | 0 | 0 | 24 | 96 |

## CONCLUSION

Image processing technique plays an important role in the classification. The use of a support vector machine classifier for leaf disease detection and classification using GLCM has been demonstrated. The support vector machine is trained. Own database of leaf of 2 classes, each containing 10 leaf images has been created. It has been found that SVM offers accuracy 92% with GLCM features.

## FUTURE SCOPE

The future work includes incorporating stem, fruit and root based image processing analysis. The proposed work can be extended to various agricultural crops. Every year the loss due to various diseases is challenging part in agriculture production. Although work is carried out till time on detection of diseases but proper segmentation of affected part based on type of plant family is still an open problem as a research area. One other future implementation could be the system could be made real time operating system.

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