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Diagnosis of Pomegranate Plant Diseases using Neural Network Methadology.

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Abstract : One of the fruits with the highest market earnings is the pomegranate, which is cultivated in several Indian states with a very high yield. However, a variety of factors lead to the plants becoming infected with different diseases, which decimate the entire crop and produce a very low yield. Therefore, the paper suggests using image processing and neural network techniques to address the primary problems in phytopathology, namely the detection and categorization of diseases. Different illnesses that are brought on by fungus, bacteria, and environmental factors damage the pomegranate fruit as well as the leaves. Similar to Bacterial Blight, Fruit Spot, Fruit Rot, and Leaf Spot. The system employs a variety of pictures for testing, training, and other purposes.Pre-processing is done on the colour pictures, and segmentation is done using k-means clustering. Utilizing the GLCM technique, the artificial neural network is provided with the texture characteristics. This approach is 90% accurate overall. In contrast to manual grading, the results have been shown to be accurate and satisfying, and it is hoped that they will gain a solid reputation as one of the most effective methods.

IndexTerms **- disease detection and classification; pomegranate plant diseases; k-means clustering segmentation; GLCM method; artificial neural network.**

- **Introduction**

Numerous trends have emerged in the horticultural sector in the past few years and become a good source of income generation. Varieties of fruits are being exported all over the
world with the development in cold storage facilities and
transportation. It becomes the necessity of maintaining the highest level export quality which is mainly carried out by visual inspection by experts. This is expensive and time consuming due to distant location of farms. Precision Agriculture helps the farmers to equip with sufficient and economical information and control technology due to the development and exposure in various fields. The objectives are profit hike, agricultural input systemization and environmental damage reduction. [3][7]
Pomegranate (Punicagranatum) is a deciduous tree grown inarid and semi arid regions. [13] It grows well in areas with temperatures ranging from 25-35 degrees and an annual rainfall of 500-800 mm. In recent years, diseases have resulted in huge losses in pomegranate produced. These diseases are usually caused by micro-organisms like fungi, bacteria and viruses. The major diseases are Bacterial Blight, Fruit Spot, Fruit Rot and Leaf Spot. These diseases are very severe and destroy the orchards. Business of fruits indeed belongs in the high-risk category [5].An intelligent decision support system uses some high-tech and practical technology to appropriately detect and diagnose the plant diseases for prevention and control of plant diseases.[11] We can used Complete Local Binary Pattern (CLBP) for Apple fruit disease detection. Their proposed approach comprises of k-means clustering

algorithm for feature extraction and images were classified using Multi class support vector machine. DaeGwan Kim et al. [5]classified the grape fruit peel diseases using color-texture feature analysis. The Spatial Gray level Dependence Matrix(SGDM) is used for extracting texture feature while the HSI
model is used for color. The HSI texture feature model gives better accuracy, so it becomes the robust model for classifying the fruits according to the peel conditions. They are used Grading System built by Machine Vision useful for identification of grading of pomegranate plant diseases.
The system uses k-means clustering image based leaves and fruit grading is calculated. Since, the timely diseases detection is essential and to prevent those diseases, we propose a system which detects and classifies various diseases of pomegranate using k-means
clustering segmentation from the image database. Further, the back propagation algorithm is used for training the neural network. The query images are tested using this algorithm, and the accuracy of the work is calculated. The paper is organized
as follows. Section II gives the description of pomegranate plant diseases. Section III gives block diagram and brief description. We provide the results in section IV. Section V concludes the paper.

The system which use edge detection method and color detection method. For this methodology use image segmentation. The input images of orange which are captured at different lighting condition and will use image segmentation to detect color of the image. The implement of this project in MATLAB image processing toolbox. The implemented edge based detection method which will detect edges of objects and color detection method to detect color of object. In this system user will input image of orange. System will convert the image from RGB to grayscale image for further processing. System will apply many filtering techniques, since image is captured under different illumination condition. It implemented many image pre-processing steps in order to extract the object and to implement edge detection and color detection method on object. Finally, system will detect orange color objects and will display as an output.

Block Diagram:

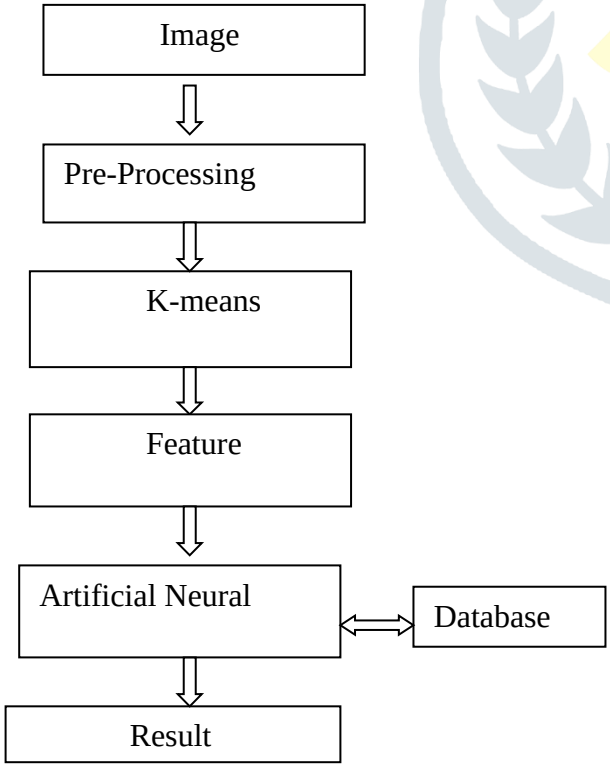


Fig. Block diagram

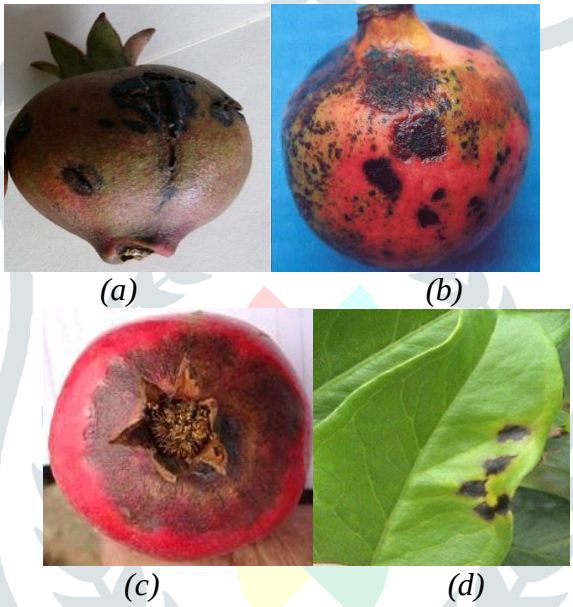
II. DIFFERENT DISEASES OF POMEGRANATE PLANT

A. Bacterial Blight

It is one of the most severe diseases of the pomegranateand caused by the bacteria. It shows up to 100% severity insome orchards. The symptoms can be initially found on stempart, which gradually impregnate to leaves and later to fruits. On fruits, brown-black spots appear on peri-cap with cracks passing through those spots. It spreads as the bacteria surviveon the tree, on the diseased fallen leaves, to the healthy plantsin the area through wind-splashed rains and infected cuttings. High temperature and relative humidity favors the disease. Itis shown in fig. (1) (a)

B. Fruit Spot

Light brown spots on fruit, which enlarge and coalesce to formblack patches on fruit; infection may cause plant death. It iscaused by fungus and its emergence is favored by rainfall and water saturated soil. This disease shows up to 5-60% severity in some orchards. It is shown in fig. (1) (b)



(a) *(b)* *(c)* *(d)*

Fig.1: Different Sample Images of the Pomegranate Plant Diseases

C. Fruit Rot

This disease occurs on flowers and they fail to set fruit. It starts from calyx end and gradually the entire fruit shows black spot. The young fruits may drop pre-maturely and emits foul odor. The disease spreads through the seeds of affected

fruits. Rainy season also favors the spread of disease. It shows up to 13-14% severity. It is shown in the fig. (1) (c).

D. Leaf Spot

Black elliptical spots appear on the twigs and leaves. The twigs become flattened and depressed with a raised margin. Infected twigs dry out and die. As the infection grows, the entire orchard dies. The main cause is fungus and its emergence is favored by rainfall and water saturated soil. This disease shows up to 8-60% severity in some orchards. It is shown in the fig. (1) (d)

III. Methodology

The Block Diagram of the proposed work is given in the below Fig. 2. The step-by-step proposed approach consists of the image database collection, preprocessing of those images, feature extraction from those images using k-means clustering based color segmentation technique, Feature extraction using

GLCM method and finally the training the artificial neural network using Back propagation Algorithm. Firstly, some

images are used to train the neural network and other images are used as test images to check the accuracy from the results. The description of each block is given in the next section.

A. Creation of Database and Image pre-processing

This work consists of images captured from diseased and fresh pomegranate plants directly from the farms. Some images are used for the training algorithm so that classification and detection can be made possible and the remaining images are Fig. 2: The Block Diagram used as test images. Digital images are prone to a various types of noise.

There are numerous types of noise like Gaussian noise, salt and pepper noise, white noise, etc. So, for removing such noise, various filters are used. Filtering of such images is done using masks like (3*3), (5*5), (7*7), etc.

B. Segmentation

Segmentation is used to extract features of particular regions of the image. The proposed work aims at using k means clustering technique to divide the image into its constituent regions or objects. [2][8]

K-means Clustering Technique

In k-means clustering technique, images are partitioned in to four clusters in which one cluster contains the majority of the diseased part of the image. The k-means clustering algorithm [9] was developed by J. MacQueen (1967). The k means

clustering algorithms classify the objects (pixels) into 'k' number of classes based on features set. The classification is carried out by minimizing the sum of distance squares between the data objects and the corresponding cluster.

C. Feature Extraction

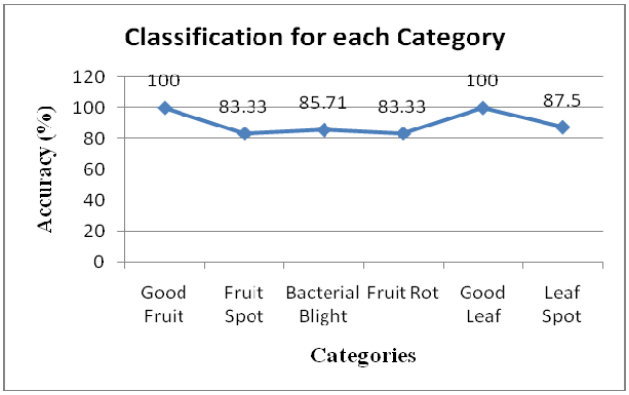
Feature extraction involves simplifying the number of resources required to describe a large data set accurately. Gray level co-occurrence matrix (GLCM) is formulated to obtain statistical texture features. In this analysis, these texture features are calculated from the statistical distribution of observed intensity combinations at specified positions relative to others. According to the number of intensity points in each combination, statistics are categorized into first, second and higher order statistics. Number of gray levels is an important factor in GLCM. Different statistical texture features are extracted namely energy, covariance, sum entropy, difference entropy, entropy, information measure of correlation; inverse difference and contrast.

D. Neural Network

Neural networks provide a rich platform of parallel processing. The application will use Multilayer Perceptrons (MLP) using back-propagation algorithm for the images. MLPs are used to solve some difficult problems by training them in a supervised technique with an algorithm based on error-correction learning rule called as back propagation algorithm. [1]

Back-propagation algorithm

Back-propagation algorithm (BPA) trains a given feed forward neural network for a given input dataset with known classification when each entry of the sample is given to the network and it examines its output response to the sample input pattern. The output response is then compared with the known and desired output and if it is not matched then the error value is generated. According to that error, the connection weights are adjusted. BPA is based on the Wid row-Hoff delta learning rule in which the weights are adjusted through the mean square of the output response to the sample input. The set of these samples are repeatedly given to the network until the error value is reduced to the minimum. The Back Propagation multilayer network is shown in fig. (3)



IV. RESULTS

For the experimental work, a database of 500 images is created. The RGB image is preprocessed with the (3*3) filter mask and then K-means clustering segments the image into 4 clusters. Here, k=4 is considered because it gives proper clusters than k=3 or 5. From these images, the texture features are extracted using GLCM method. From these features, neural network is trained and it helps to differentiate the images into different categories namely, Good Fruit, Fruit Spot, Bacterial Blight, Fruit Rot, Good Leaf and Leaf Spot. Five sample images of each category are used for testing purpose and one from each category is shown in the fig. (1)

Table I shows classification of different pomegranate plant disease samples. All the samples of good fruit and good leaf categories are giving proper result. But for fruit spot bacterial blight, fruit rot and leaf spot categories, one sample each shows the improper result. The category-wise classification is shown in the following fig. (4) And from that, the average accuracy of the proposed method comes to be around 90%.

TABLE I: Classification of Different Pomegranate Plant Diseases

Samples	Categories						
	Good Fruit	Fruit Spot	Bacterial Blight	Fruit Rot	Good Fruit	Good Leaf	Leaf Spot
6Test image(Good Fruit)	Yes	-	-	-	-	-	-
6Test image(Fruit Spot)	-	Yes	-	-	-	-	Yes
7Test image(Bacterial Blight)	-	-	Yes	-	-	-	Yes
7Test image(Fruit Rot)	Yes	-	-	Yes	-	-	-
5Test image(Good Leaf)	-	-	-	-	Yes	-	-
8Test image(Leaf Spot)	-	-	-	-	Yes	Yes	-

conclusion:

The aforementioned approach is used to identify illnesses including Bacterial Blight, Fruit Spot, Fruit Rot, and Leaf Spot. According to the experimental findings, practically all samples provide the best categorization of the categories, however just one sample categorization reveals the various categories.

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