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Diagnosis of Plant Diseases using Neural Network

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Abstract: Pomegranate plant is one of the most widely grown fruit crop in the India. Manual observation of experts is used in practice for detection of leaf diseases, which takes more time for further control action. Diseases in fruit cause devastating problem in economic losses and production in agricultural industry worldwide. In this paper, a solution for the detection and classification of fruit diseases is proposed and experimentally validated. The image processing based proposed approach is composed of the following steps; in the first step K-Means clustering technique is used for the image segmentation, in the second step some features are extracted from the segmented image, and finally images are classified into one of the classes by using a artificial neural network.

Index Terms: plant disease identification, image processing, k-means, feature extraction, neural network

I. INTRODUCTION

Research in agriculture is aimed towards increase of productivity and food quality at reduced expenditure and with increased profit. In the past few years new trends have emerged in the agricultural sector. The objectives of precision agriculture are profit maximization, agricultural input rationalization and environmental damage reduction, by adjusting the agricultural practices to the site demands. Plant disease is one of the crucial causes that reduces quantity and degrades quality of the agricultural products. Plant diseases are usually caused by fungi, bacteria and viruses. Also there are other diseases which are caused by adverse environmental conditions. There are numerous characteristics and behaviors of such plant diseases in which many of them are merely distinguishable.

The requirements for reduced production costs, the needs of organic agriculture and the proliferation of diseases have been the driving forces for improving the quality and quantity of food production. Thus, in the area of disease control, most research has been focused on the treatment and control of weeds, and few studies have been focused on the automatic identification of diseases. Automatic plant disease identification by visual inspection can be of great benefit to those users who have little or no information about the crop they are growing. So using this method it is possible to detect and classify the diseases.

II. DIFFERENT DISEASES OF POMEGRANATE PLANT

1) *Bacterial Blight:* It is one of the most severe diseases of the pomegranate and caused by the bacteria. It shows up to 100% severity in some orchards. The symptoms can be initially found on stem part 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 survive on the tree, on the diseased fallen leaves, to the healthy plants in the area through wind splashed rains and infected cuttings. High temperature and relative humidity favors the disease. It is shown in fig. (1) (a)
2) *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)
3) *Anthracnose:* the fungus causes a wide range of symptoms ,depending the tissue attacked and the weather .minute sunken spots of various colors appear on leaves ,stem, flower or fruit. often surrounded by a more or less marked yellow halo .on leaves, the spots later enlarge to form lesions and can cover a major part of the blades. They turn yellow and can shed prematurely leading to defoliation. It is shown in the fig. (1) (e)
4) *Alternaria Alternata:* Alternaria alternata is a fungus which has been recorded causing leaf spot and other diseases on over 380 host species of plant. It is an opportunistic pathogen on numerous hosts causing leaf spots, rots and blights on many plant parts.

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

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

III. METHODOLOGY

A. Image Acquisition

In this step the sample images are collected .Some images are used for the training algorithm so that classification and detection can be made possible and the remaining images are which are required to train the system, used as test images.

B. Preprocessing

The image preprocessing is done on gathered images for improving the image quality. It removes the background noise as well as to suppress the undesired distortion. In this image is first resized to 300x300 size, and then thresholding is done to get all green color component . Gaussian filtering is carried out to remove noise in the image.

C. Segmentation

Image segmentation is the process of partitioning the given image into different regions with respect to some features. Clustering is a method by which the large sets of data are grouped into clusters of smaller sets or segments of similar data. In present work, K-means clustering is used to for segmenting an image into groups . Before clustering 'a' component is extracted from L*a*b space.

D. Feature Extraction

Feature extraction is used to extract the information that can be used to get the meaning of the given image. Shape, texture and color are the major types of features that are mostly used in image processing technique. Hence in this system color and texture features both are extracted to get better accuracy. Before training the classifier, the texture and color (9+9=18) features are first need to be combined.

E. Flow Chart Diagnosis Plant Using ANN

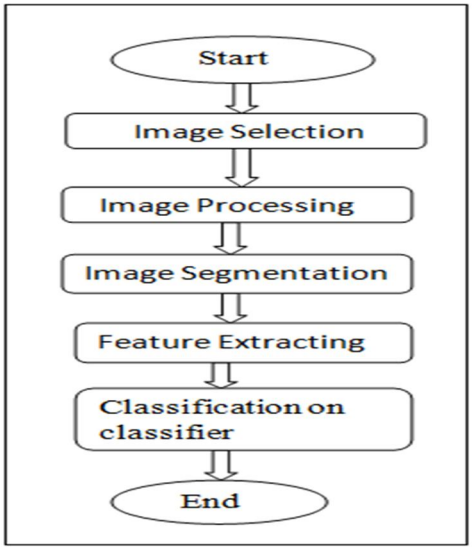

Fig2.Flow chart for diagnosis of pomegranate plant

Present work proposes an image-processing-based solution for the automatic diseases detection and classification of diseases of pomegranate plant. 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 radial basis function 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. To create device independent color space transformation structure. Thus establishing color transformation structure that defines the color space conversion. And applying device-independent color space transformation, to converts the color values in the image to the color space specified in the color transformation structure. The color transformation structure specifies various parameters of the transformation. Applying K-means clustering which is used to partition the image into number of clusters in which one or more clusters contain the disease in case when the fruit is infected by one or more than one disease. K-means uses squared Euclidean distances' minimizing the sum of squares of distances between the objects and the corresponding cluster or class centriod. By this method the different diseases can be detected .For disease classification ANN will be used where the activation function for ANN can be radial basis function (RBF). Using ANN the system will classify the disease based on previous training.

F. Artificial Neural Network

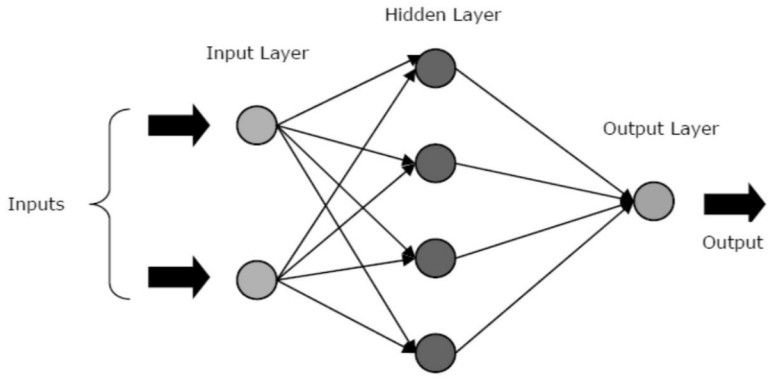

Fig Artificial Neural Network

An ANN is based on a collection of connected units or nodes called artificial neurons, which loosely model the neurons in a biological brain. Each connection, like the synapses in a biological brain, can transmit a signal from one artificial neuron to another. An artificial neuron that receives a signal can process it and then signal additional artificial neurons connected to it. disease classification ANN will be used where the activation function for ANN can be radial basis function (RBF). Using ANN the system will classify the disease based on previous training. a radial basis function network is an artificial neural network that uses radial basis functions as activation functions. The output of the network is a linear combination of radial basis functions of the inputs and neuron parameters. There are different types of network on the basis of the layers activity. A simple type network is referred as where the hidden units are free to construct their own representation of the input. The weights between the hidden and input units decide when each hidden unit is active, and so by adjusting these weights, a hidden unit can select what it represents. There are also other architectures like single layer and multilayer. In single layer, all layers are connected to one another. In single layer network generally consist of only inputs and outputs. The inputs are fed to outputs through a series of weights. In multilayer all units are in different layers includes inputs, hidden and outputs.

IV. CONCLUSION

From this proposed work, mainly four diseases of pomegranate plant are classified and detected using Digital Image Processing and Neural Network techniques. The diseases like Bacterial Blight, Fruit Spot, Fruit Rot and Leaf Spot are diagnosed using above technique. The experimental results shows almost all the samples give the best discrimination among the categories. An image processing based solution is proposed for detection of pomegranate fruit disease. Once the disease is detected proper treatment can be suggested. The proposed system consist pre processing, segmentation, feature extraction, training and classification. The existing system providing the solution requires experts and farmers can't identify disease just by necked eyes observation. This system will provide immediate solution to farmers. It is time saving and reduce loss of fruits due to disease. The main purpose of this system is to improve the efficiency of automatic fruit disease detection system.

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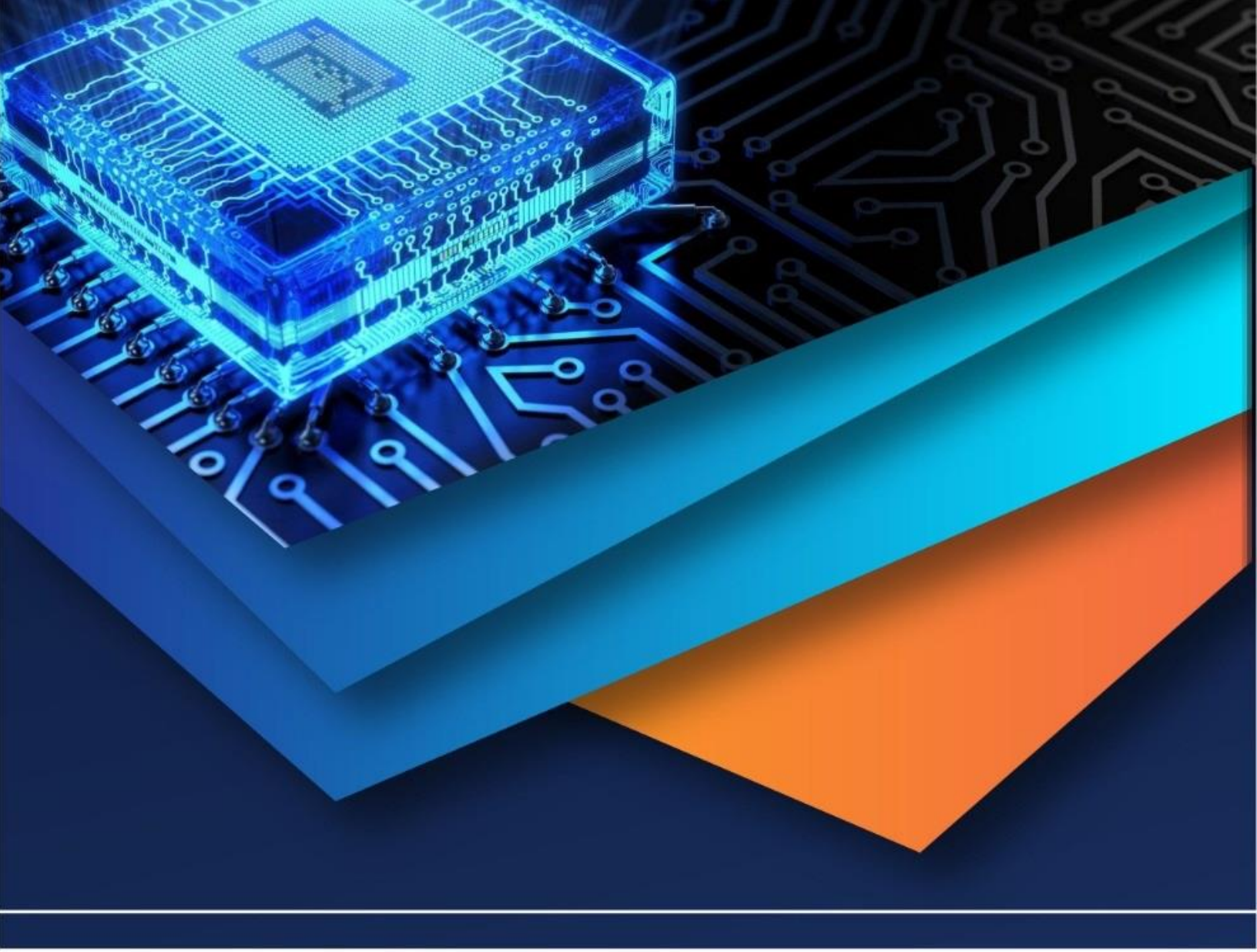

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