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Disease Detection in Plant using Artificial Neural Network

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Abstract: Disease means that affect the quality and quantity of the plant. This paper describes an image processing technique used to identify citrus plant malady based on the healthy and diseased parts of plants. The purpose of this work is to recognize citrus plant disease detection. It includes several steps viz. first image acquisition, second image pre-processing, third k-means based segmentation, fourth feature extraction and last classification using a neural network.
Keywords: Pre-processing, Segmentation, Feature Extraction, Classification, Neural Network

I. INTRODUCTION

India is one of the growing countries wherein most of population of country is aims on agriculture and agricultural construction [1]. Various malady occurs in numerous parts of the plant can be found by observing the change in symptoms, spots, Color etc. The less time intense and automatic diagnosing technique is that major demand in agriculture to upgrade the crop production rate [2]. Citrus is a crucial fruit in China with a cultivated space of 2.57 million hectares and a yield of better than 38 million tons [3]. Citrus plants are inclined to diseases such as citrus canker, anthracnose, scab, gummosis, etc. To manage these diseases an outsized variety of chemicals or fungicides are used on the citrus crop. This ends up in each economic loss and environmental pollution [4]. Leaf space plays a crucial role in plant growth analysis and photosynthesis. Leaf space is measured using different damaging and non-destructive strategies. In damaging strategies initial the leaf is isolated from plant and then measured. In non-destructive strategies, dimensions of a leaf are measured without eliminating the leaf [5].

II. LITERATURE REVIEW

Disease detection and diagnosis of the plant using image processing explained by Kushal Khairkar et al. [6]. Color and texture and shape features are extracted through color space, color histogram, gray level co-occurrence matrix, Gabor filter and canny, Sobel edge detector. SVM and NN are used as a classifier. In this paper, we have used image processing techniques such as first image acquisition second image preprocessing third segmentation, fourth feature extraction and last classification. Firstly, RGB color images are captured using a digital camera then the next step improves image data that remove background noise then RGB image is converted into other color spaces such as HIS and CIELAB. In segmentation step to finding out the infected region and it done by k means clustering then color, shape and texture feature are extracted. In the final stage recognizing a rule according to selected features and assigning each disease to anyone the predetermined classes.

A.H. Kulkarni et al. [7] proposed a leaf identification technique for plant classification through RBPNN and Zernike moments". In this paper, we are detecting and identifying plants through shape vein, color, texture features which are combined Zernike movements. Radial basis probabilistic neural network [8] is used as a classification purpose. RBPNN includes four various layers one input layer, two hidden, and one output layer. This method achieved overall accuracy is 93.82%.

Patil et al. [9] presented Classification of cotton leaf spot diseases using support vector machine". Foliar is the type of malady of cotton and appears in all increasing Indian cotton regions shape. Color, shape and texture feature are extracting using texture and color feature extraction techniques for the disease spots to identify malady. SVM used as a classifier.

Shiv kumarBagde et al. [10] developed artificial neural network based plant leaf disease identification. The researcher discussed a method for detecting diseases such as black spot, white powder, ring spot. Shape feature is extracted using k- means techniques for image segmentation. ANN is used as a classifier. In this paper describe a various type of disease like bacterial, viral and fungal diseases. This paper used in image processing in agricultural demands for the following purpose firstly to recognize diseased fruit, stem,leaf and second step quantify affected area by disease third to discover the shape of the affected area and the last is to determine size of fruits.

MS Kiran et al. [11] discussed unhealthy region of citrus leaf identification using image processing technique. Texture feature extracting using statistical GLCM and color feature by means of mean values. SVM is used as a classifier. In this, we detect disease like a citrus canker, anthracnose, citrus greening disease (dataset 200). This paper there is five measures used for the identification

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of plant leaf malady. Firstly, image acquisition acquired leaves using a digital camera. The next step improves the image data that suppress unwanted distortion and the image enhancement used for providing better color images. The third is image segmentation is done using feature-based technique after segmentation extracts the texture feature. The last step SVM classifiers distinguish citrus leaf malady and classification is used to develop a hyperpalne in a high dimensional.

Yogesh Dandwate et al. [12] developed an "automated method for classification of plant malady towards the improvement of futuristic decision support system in Indian perception". Researchers discuss a method for identification of malady of soybean plants (dataset 120) color b and cluster-based technique is used for segmentation. For extracting the region of concentration from the intial image multithresholding techniques [13] is used. The SVM machine used as a classifier to prove capacity in automatic and accurate classification of images. This algorithm achieved 93.79% accuracy. The paper consists of four main technique first image acquisition, second preprocessing, third segmentation, fourth feature extraction, and last classification.

Mrunmayee Dhakate et al. [14] described the identification of pomegranate plant diseases using a neural network. The researcher proposed a method for detecting diseases such as first bacterial blight, second fruit spot, third fruit rot and last leaf spot (dataset 500) through k- means clustering for segmentation techniques. The texture feature is extracted using gray level co-occurrence method (GLCM) [20]. Pomegranate fruit is affected by different diseases caused by fungus, bacteria and climatic conditions. The artificial neural network is used as a classification purpose. The overall accuracy of this technique is 90%. In this paper image preprocessing step is image database gathered and then preprocessing of individual images then feature extraction from individual images using k means based color segmentation techniques.

Monzurul Islam et al. [15] presented recognition of potato malady using image segmentation and multiclass support vector machine. Researcher discusses a method for detecting diseases from leaf images (dataset 300) using Otsu thresholding for segmentation techniques. The GLCM was used for extracting statistical four texture features such as contrast, correlation energy, and homogeneity. SVM is used as a classifier and this method is used overall accuracy is 95%. In segmentation firstly we cover out the background as well as the green section of the leaves. Thus, we extract our region of interest that only contains visible disease symptoms.

Pranjali B. Padol et al. [16] explained "Fusion Classification method used to identify downy and powdery mildew grape leaf malady". Researcher discusses a method for detection of leaf diseases (dataset 137) through k-means based segmentation techniques. Texture and color feature is extracted. In this paper SVM and ANN are used as a classification purpose. A new classifier is proposed using fusion classification method [17] which whole classifiers from SVM and ANN to stimulate base classifier for grape leaf diseases recognization.

In this paper, plant leaf disease identification are used for different methods and algorithm.

Bhumika s. Prajapati et al. [15] have proposed a review on identification and classification of cotton leaf malady. Researcher discusses a method for detecting malady which arise on the leaf of cotton such as cercospora leaf spot, red spot, bacterial blight, and alternaria leaf spot (dataset 190). Color, texture and shape feature is extracted using Otsu thresholding for image segmentation techniques. Followed by support vector machine are used as a classification purpose. In this paper proposed system to identify and classify cotton leaf diseases.

Image acquisition, image pre-processing, segmentation, feature extraction, and classification steps of image processing. In the image acquisition acquired the image then the pre-processing the image and RGB is changed into HSV color space. After converting HSV, the threshold value is useful to the H component to eliminate unnecessary noise. In image segmentation green pixels are masked and removed by extracting H, S and V components then the texture features can be extracted using GLCM and shape features are removed from the Otsu thresholding image. The next step SVM will be used for classification. It will offer nonlinear mapping and uses the hyperplane to individual data.

Ramakrishnan M et al. [17] presented a groundnut leaf malady identification and classification by through a back propagation technique. Researchers discuss a method for detecting disease such as bacteria, fungi, viruses of groundnut leaf (dataset 100). Color and texture features are extracted.

The neural network is used for classification purpose. In this paper every level is described by the range of decimal digit from 0 to 255 and the RGB image is changed into HSV color images. This paper finds out green colored pixels so green color pixel quality is set to be zero it is fewer than the pre-computed threshold value then the RGB color module of the pixel is set to be zero. So, the green color pixel region is not involved. Here texture feature is extracted in two approaches first structured approach and second statically approach

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III. PROPOSED WORK

The proposed system is describes a model for citrus disease recognition. In our proposed work, we identify six citrus diseases such as citrus canker, gummosis, anthracnose, scab, leprosies, and eprosis. The flow diagram of the proposed work is shown in figure 1.

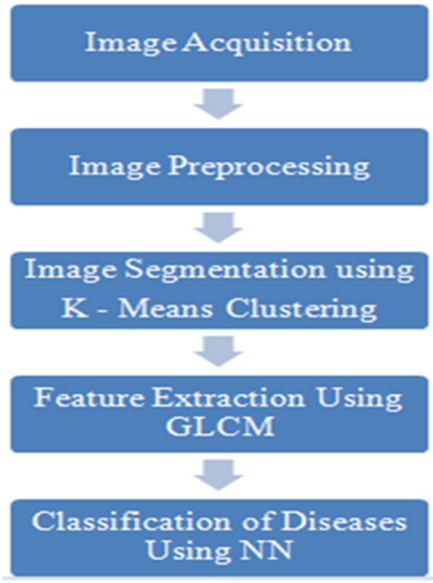


Figure 1: block diagram of proposed work

A. Image Acquisition

The images are several from various resources are called image acquisition. Citrus malady detection using image processing techniques a number of the sample is already taken from the net and few of the samples manually capture in Agriculture University. We got collected sample of citrus leaves each healthy and diseases. There have collected about 60 data sample. It consists of six sorts of citrus diseases. Then these pictures are cropped and resized to 256*256 pixels in order that they are often so effectively tested. Pictures area unit is held on in .jpg format..

B. Image Pre-processing

Image preprocessing is to reinforce the standard of images by removing unwanted noise from the images. Then, it contains color space conversion. Citrus leaf images measure in RGB color format. Then, RGB images of leaves are altered into LAB color model. The aim of the color space is to facilitate the specification of colors in some commonplace accepted manner. RGB images altered into a LAB color model because this conversion increases the intensities values within the RGB images.

C. Image Segmentation

Segmentation is a method of distribution a label of each pixel in an image. K-means technique is utilized for the segmentation. K-means technique is an unsupervised learning technique which makes k cluster is an assortment of objects that have similar property cluster in one and dissimilar property of cluster in different clusters. Three clustering are applied in citrus leaf disease images. One cluster offers foreground second cluster offers background and the third cluster offers pathological a part of the image.

D. Feature Extraction

Feature extraction phase of image analysis focuses on identifies inherent qualities of features of objects present within the image. Texture feature is that the vital feature which might be classified and establish objects. Texture feature is extracted using GLCM. Gray-Level Co-occurrence Matrix (GLCM) is a second-order statistical extraction methodology. This methodology was planned by "Haralick". In the proposed work, four feature are extracted which contain contrast, energy, homogeneity, and correlation. Let P_{ij} represents the (i, j)th entry in the normalized Gray-Level Co-Occurrence Matrix. N represents the number of distinct gray levels in the quantized image.

1) Contrast: Contrast evaluates intensity contrast of a pixel and its neighboring pixel over the whole image. The equation of the contrast is given by equation (1).

$$Contrast = \sum_{i,j=0}^{N-1} (p_{ij})\ (i-j)^2 \qquad (1)$$

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2) *Energy:* Energy evaluates of equality with squared elements summation in the GLCM. The equation of the energy is given by equation (2)

$$Energy = \sum_{i,j=0}^{N-1} (p_{ij})^2 \quad (2)$$

3) *Homogeneity:* Homogeneity evaluates the similarity among the pixels. The equation of the homogeneity is given by equation (3)

$$Homogeneity = \sum_{i,j=0}^{N-1} \frac{(p_{ij})^2}{[1+(i-j)^2]} \quad (3)$$

4) *Correlation:* Correlation evaluates how correlated a pixel is to its neighborhood. The equation of the correlation is given by equation (4)

$$Correlation = \sum_{i,j=0}^{N-1} p_{ij} \left(\frac{(1-\mu)(j-\mu)}{\sigma^2}\right) \quad (4)$$

E. Classification Using Artificial Neural Network: Artificial neural network could be a supervised learning technique used as a classification tool. Classification is done based on the neural network and different types of the malady are detected like a canker, scab, anthracnose, gummosis, eprosis, and leprosies. The neural network is selected as a classification tool due to its well-known techniques as a fortunate classifier for several real demands.

IV. RESULT

First, the dataset is collected utilizing 60 images of citrus leaves with 40 diseased leaves and 20 healthy leaves. Figure 2 shows image acquisition.



Figure 2: Image Acquisition

Then, the RGB images are converted into LAB color model and increase the intensity value. Figure 3 shows the processed images after image pre-processing step.

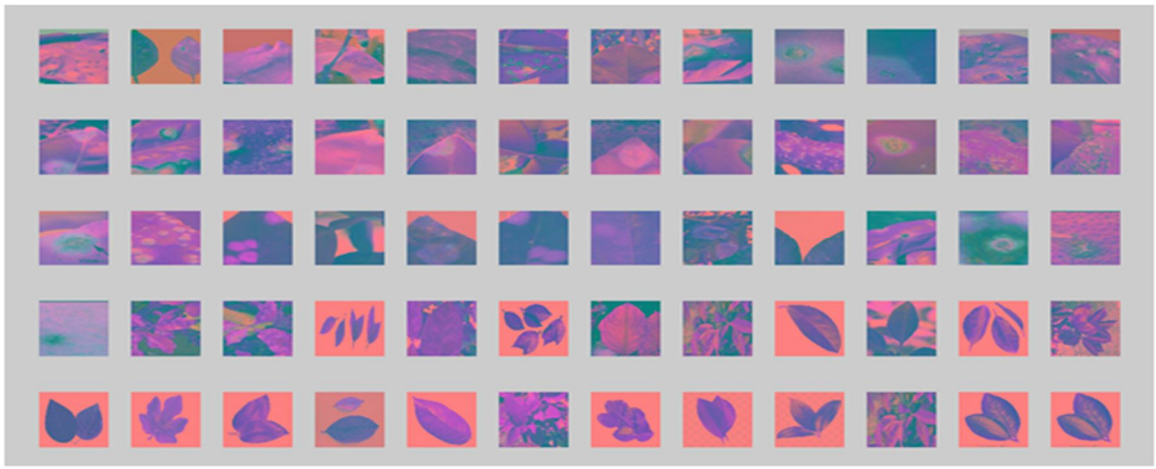


Figure 3: Image Pre-processing

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Then, the image segmentation step was performed using k-means clustering technique which was mentioned in above section. After that finding the four texture feature of all the images and the value of all the images in texture feature is given as input to the classifier. Figure 4 shows image segmentation of few images.



Figure 4 (a): k-means based segmentation



FIGURE 4 (B): K-MEANS BASED SEGMENTATION

After these steps, ANN is used as a classification purpose. The proposed work gives high accurate detection of citrus leaf diseases with less computation time. The neural network is used to identify diseases.

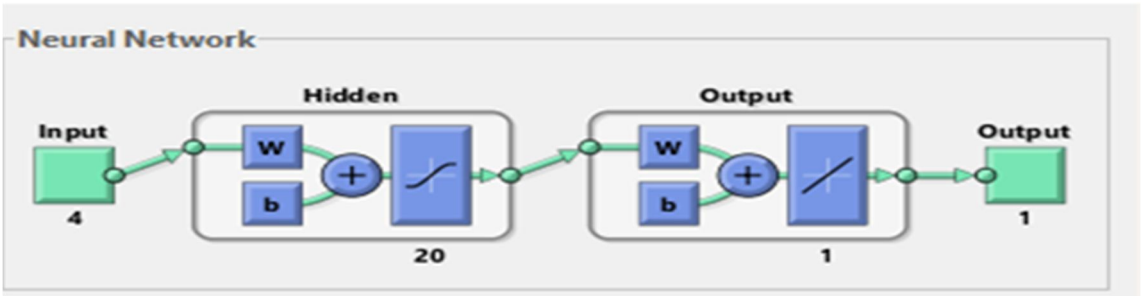


Figure 5: Typical architecture of Neural Network

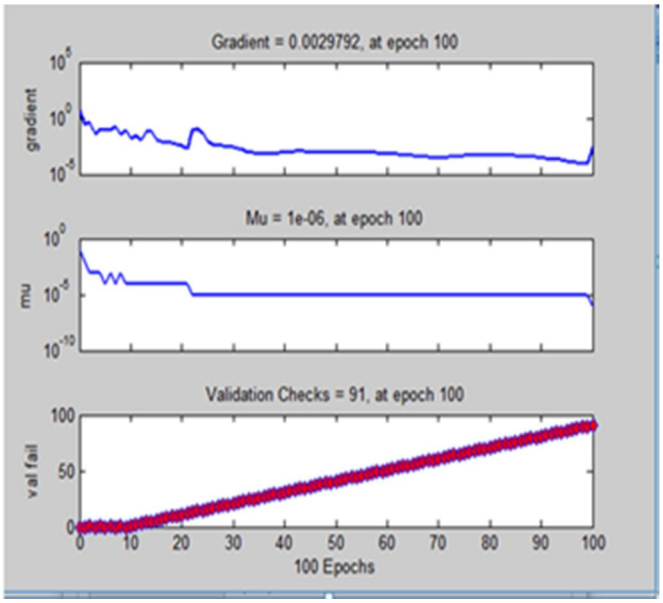


Figure 6: Training State of NN

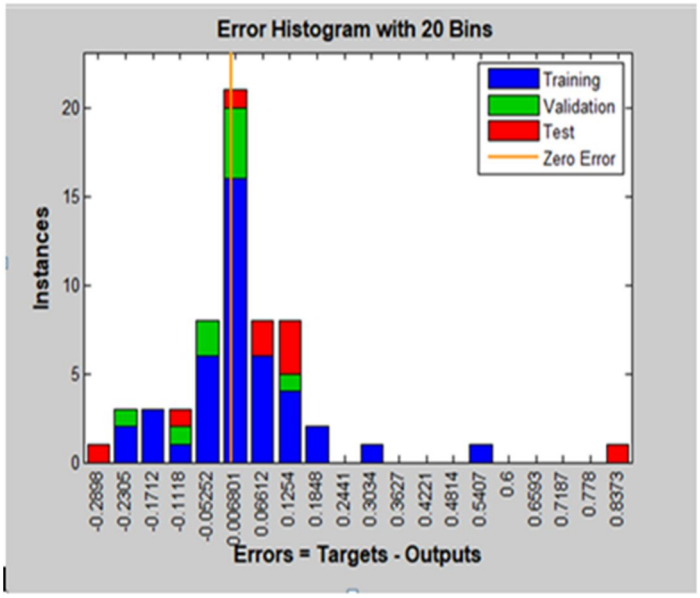


Figure 6: Error Histogram of NN

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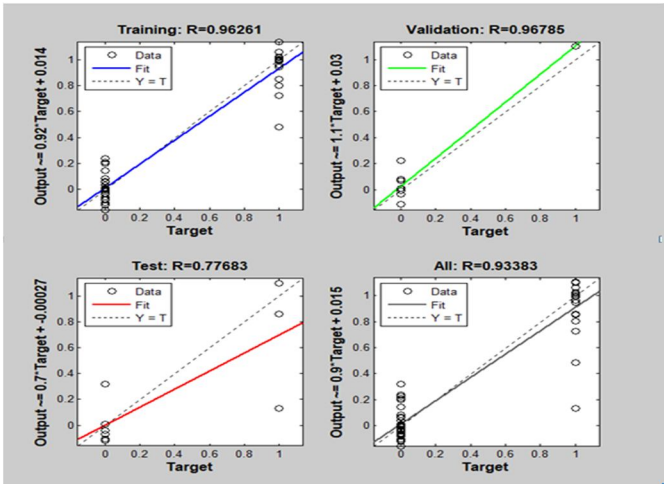


Figure 8: Regression of NN

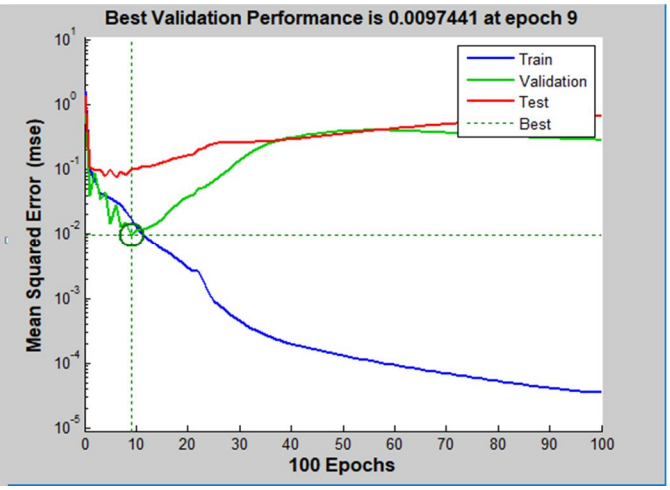


Figure 8: Performance of NN

TABLE 1- CLASSIFIER PERFORMANCE

Diseased Leaves	Healthy Leaves	Classification Accuracy
40	20	96%

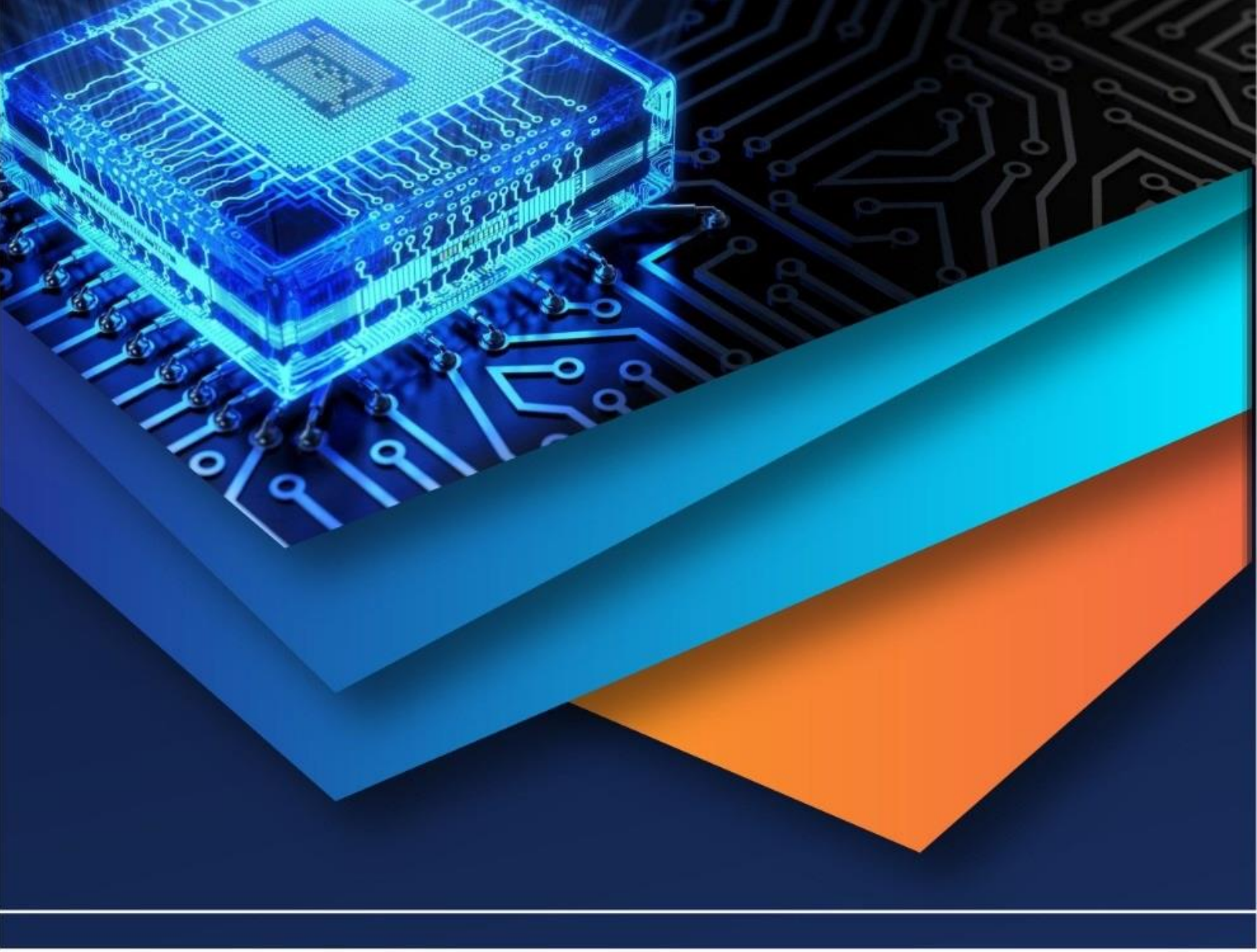
V. CONCLUSION

The study summarizes image processing steps for various plant species that have been used to extract and identifying plant diseases. The paper describes the healthy and diseased part of the citrus leaf. The plant is affected by bacterial, viral and fungal leaf diseases. Accuracy is a major characteristic use for detection of diseases. The proposed work achieves an accuracy is 96%. In future work, we identify the particular disease on the leaf.

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