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Analysis of Infection in Plant Leaf and Implication of Suitable Pesticides based on Image Processing

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Abstract: ***Agriculture plays a vital role in livelihood. Agriculture is the only way to feed ever growing populations. Several researchers are going on energetically in plant disease detection. Plant infection can affect the leaf which leads to huge loss in cultivation of crop and economical value of market. Mainly, in between the stages of sowing and harvesting. Plant infection are caused by various pests like virus, fungus and bacteria which causes infection to plants and results in loss of quantity and amount of production. Also, plant diseases increase due to pollution and other environmental changes. The plants should be supervised from its germinal stage of their life-cycle to evade such diseases. To monitor such type of infection manually is extremely difficult and also time consuming. It is necessary to devise a method to speed up this identification process. This technique is imperative, so it is decided to automate the disease detection system. Hence, image processing is used for the recognition of plant infection. Here, matching and segmentation algorithms are used for identifying the diseases. Classification algorithm is used for classifies the disease. Machine learning techniques are used for improving the diagnosis of plant infection. Identification of pesticides for those affected diseases is also suggested.***

Keywords: Crops, Cultivation, Plant infection detection, Contrast stretching, Support vector machine, Region growing algorithm, Image processing, Gaussian filter.

I. INTRODUCTION

Agriculture is the mainstay of our India. It is the main source in development of India. Nowadays, agriculture faces lots of problems including massive losses in the production of crops. Plants are the living organisms which helps in survival of human and animals. Plants are in different forms like huge trees, herbs, shrubs and bushes. Plants are helps in balancing the oxygen in environment. The oxygen is most important gas to breathe, because animals and human emit carbon dioxide, but consumes oxygen. The plant diseases are caused by fungi, bacteria, and viruses. Diseases in plants are leads to destruction of yield. Diseases and parasite transmitters or any unfavourable conditions causes infection in plants. Parasitic diseases are spread by agent like bacteria and viruses. Plant disease are more economic importance to humans because plant diseases causes damage to plants and plant products. It commonly involves with an associated economic effect, which either positive or negative. Most plant diseases are caused by fungi, bacteria and viruses. Due to the plant diseases are important factor to solve, because it causes loss in production.

A. The Common Plant Diseases

1) *Black Spot:* Black spot in rose plant is a widespread disease. This is caused by the fungus named Diplocarpon rosae. In rose plants, the spots are round up to 1 cm (0.5 inch) in diameter also with fringed margins. In some scenarios, leaves turn yellow and drop early. Affected plant defoliate twine in a season, also greatly weakened. It also produces inferior blooms and also subjected to canker diseases and winterkill.

Fig 1. Black Spot

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2) *Rust Spores:* Rust spores is one of the common diseases occurring in plants. This disease is caused by more than 4,000 species of fungi and fungus like phylum oomycote. It affects the economically important species. Rust spores appears as yellow, orange, red, rust, brown, or black powdery pustules on fruits, young shoots, and leaves. It commonly reduces plant growth and productivity and some plants are died. The rust spores are controlled by observing stringent sanitation measures, and using appropriate pesticides or fungicides.

Fig 2. Rust Spores

3) *Leaf Gall:* Leaf Gall is a swelling disease that occurs on plants. Galls form on roots, stems leaves and branches. This infection is caused by knot nematodes and insects. Leaf gall is a common plant disease caused by the soil-borne bacterium Agrobacterium tumefaction. Sometimes, plants with several galls unable to move water and nutrients up the trunk, become weakened, stunted and unproductive. Young plants are killed due to the development of gall tissue.

Figure 3. Leaf Gall

4) *Leaf Curl:* Leaf curl is a disease which is identified when leaves initiate to curl and wilt. This is caused by numerous viruses. It is a fungal disease that affects peaches and nectarines. Leaf curl (Taphrina deformans) is one of the common disease problems found in backyard orchards. Leaf curl symptoms appears in spring as reddish areas on developing leaves. The fruit production is reduced when leaf curl

Figure 4. Leaf Curl

5) *Powdery Mildew:* Powdery Mildew is one of the diseases which has less harmful occur on plants. Mildew is identified by a grey or white powdery coated on the plant. This disease is caused by fungal pathogens that affects a wide range of plants. Powdery mildew diseases are caused by different species of fungi in the order Erysiphales, with Podosphaera xanthii. Infected plants display white powdery spots on the leaves and stems.

Fig 5. Powdery Mildew

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II. LITERATURE SURVEY

Alexandre A. Bernardes and Jonathan G. et al. proposed a method for identification of Ramularia plant disease, Bacterial Blight, Ascochyta Blight are the two types of blight on cotton crop. The input image is decayed in various color divisions (channels) like R, G, B, H, S, V, I3a, I3b, and grey level channels then DWT is applied to each and every color channel and the energy of wavelet is computed for every sub-band and composes the feature of vectors. [2].

H. Al-Hiary, et al. [4] proposed a system to classify and detect the diseases automatically. K-means clustering technique is used here for segmentation and back propagation for classification to get the efficiency of 94.67% (average). Haiguang Wang and Guanlin Li proposed a method for automatic detection of plant diseases like as Downy Mildew and Powdery mildew and Stripe rust and leaf rust [5].

Shailendra Singh Negi, Yatendra Singh et al. says that the Low contrast images gives the result of inadequate illumination and lack of dynamic range in image sensor or even the wrong placing and setting of a lens aperture during the image acquisition phase. Contrast stretching is a process and procedure that enlarges the range and vareity of intensity levels in image. It is used to increase the contrast of the images by making the dark portions darker and the bright portions brighter [17].

P.R. Rothe, Dr. R. V. Kshirsagarsays that the Gaussian filter is applied to remove the noise present in the images before segmentation. Gaussian filter is a linear filter. It is used to blur the image or to reduce the noise. It performs averaging of the current pixel with the neighboring pixel values. Their effect is observed as blurring of the image. The output of Gaussian filter is a 'weighted average' of each pixel's neighborhood and the average is weighted more towards the value of central pixel [18].

Siddharth Singh Chouhan1, Ajay Kaul1, et al. says that Region growing algorithm is used for image segmentation technique. It is used to classifying the image based upon the region. It is also classified as a pixel-based image segmentation method since it involves the selection of initial seed points. The fundamental drawbacks of histogram-based region detection are that histograms provide no spatial information [19].

Muhammad attique khan, m ikramullah lali, et al. says that Local binary patterns is used in feature extraction technique. LBP is a simple efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as binary number. The most important property of the LBP operator in real-world applications is its robustness to monotonic gray scale changes. Another important property is its computational simplicity, which makes it possible to analyze images in challenging real-time settings. The main goal of segmentation is to partition an image into regions. Some segmentation methods such as thresholding achieve this goal by looking for the boundaries between regions based on discontinuities in grayscale or color properties [20].

Rong Zhou, Shun'ichi Kaneko, et al. says that Support vector machine provides a solution for nonlinear two-class classification problems by mapping the training vectors into a higher dimensional space via a nonlinear mapping, and an optimal separate hyperplane can be constructed by the maximum margin between two sets of vectors. The SVM kernel was selected as kernel function for the nonlinear mapping. A two-dimensional (2D) xy-color histogram feature was introduced in this study for training SVM classification model to segment the disease pixels from healthy and their background pixels. Support vector machine is superior than other classification techniques like k-Nearest neighbors, naive bayes etc..., [21].

III. PROPOSED SYSTEM

In this section, the basic steps for plant infection detection, classification and suggestion of pesticides using image processing are shown (Figure 6)

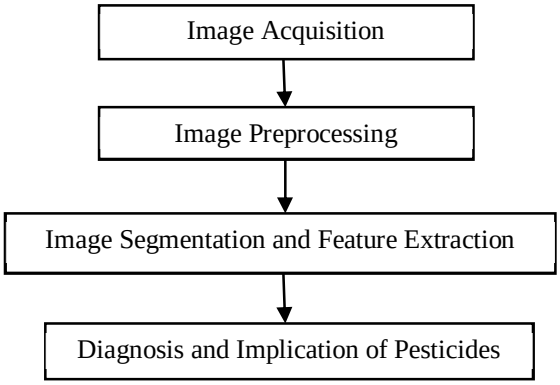

Fig 6. Basic Steps for Plant Disease Detection and Classification Cation

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A. Image Acquisition

In this phase, images of the plant leaf are captured at seasonal time using camera, mobile phones etc., with desired resolution and size. The affected leaf image should be taken. The images also taken from the web or database. The leaf image is in RGB (Red, Green, Blue) form. The transformation structure of RGB color is created.

B. Image Preprocessing

1) Image Enhancement: Low contrast images are the result of inadequate illumination, lack of dynamic range in the image sensor or even the wrong setting of a lens aperture during image acquisition phase. To eliminate these contrast stretching is used in image enhancement technique. It tries to improve the contrast in image by stretching. I.e. depends on pixel ratios. It can only apply a linear scaling function to the image pixel values. Here, it gives a result of enhanced image.

Equation of contrast stretching is

$$s = \begin{cases} l * r & 0 \le r < a \\ m * (r - a) + v & a \le r < b \\ n * (r - b) + w & b \le r < 1, -1 \end{cases}$$

Where l, m and n are the slopes. we make the dark gray levels darker by assigning a slope of less than one (between (0, 0) and (r1, S1) and between (r2, S2) and (L-l, L-l)). Make the bright gray levels brighter by assigning a slope greater than one (between (r1, S1) and (r2 , S2)) i.e., the slopes 'l' and 'n' are less than one while 'm' is greater than one. The lower and upper threshold level to be fixed. Upon Different slopes can be applied depending upon the input image and the application which it is used [17].

2) Image Filtering: In image filtering, the noise is added and removed using same filter. Here, gaussian filter is used for image filter. Gaussian filtering is used to blur the images and remove the noise. It performs averaging of the current pixel with the neighboring pixel values. Their effect is observed as blurring of the image. The output of Gaussian filter is a 'weighted average' of each pixel's neighborhood and the average is weighted more towards the value of central pixel.

3)

Gaussian equation is denoted by $g(x\,,\,y) = \frac{1}{2\pi\sigma^2}.e^{\frac{-x^2+y^2}{2\sigma^2}}$

2-D distribution is used as a point-spread function for smoothing and this is performed using convolution. The image is stored as matrix of discrete values a discrete approximation of Gaussian function is to be performed before convolution. The output of Gaussian filter is a 'weighted average' of each pixel's neighborhood and the average is weighted more towards the value of central pixel [18].

C. Image Segmentation and Feature Extraction

1) Image Segmentation: In image segmentation the disease part has to be segmented correctly. Region growing algorithm is used for image segmentation technique. It is used to classifying the image based upon the region. It is also classified as a pixel-based image segmentation method since it involves the selection of initial seed points. The main goal of segmentation is to partition an image into regions. Some segmentation methods such as thresholding achieve this goal by looking for the boundaries between regions based on discontinuities in grayscale or color properties. The main goal of segmentation is to partition an image into regions. Some segmentation methods such as thresholding achieve this goal by looking for the boundaries between regions based on discontinuities in grayscale or color properties.

RGA equations are given by

a) $\bigcup_{i=1}^{n} R_i = R$.

b) R_i is a connected region, i =1, 2…, n.

c) $R_i \cap R_j = \emptyset\,, i \neq$ j

d) P (R_i) = TRUE for I = 1, 2…, n.

e) P ($R_i \cap R_j$) = FALSE for any adjacent region R_i and R_j. P(R_i) is a logical predicate which is defined by the points in the set R_i and $\emptyset$ = null set [19].

2) *Feature Extraction:* In the segmented images, features are extracted and processed further. Local binary patterns are used in feature extraction technique. LBP is a type of visual descriptor used for classification in computer vision. LBP is the particular case of the Texture Spectrum model. The LBP feature, in its simplest form, is created in the following manner: Divide the examined window into cells. For each pixel in a cell, compare the pixel to each of its 8 neighbors. Where the center pixel's value is greater than the neighbor's value, write "0". Otherwise, write "1". This gives an 8-digit binary number. Compute the histogram, over the cell, of the frequency of each "number" occurring (i.e., each combination of which pixels are smaller and which are greater than the center). This histogram can be seen as a 256-dimensional feature vector.

a) Optionally normalize the histogram.

b) Concatenate histograms of all cells.

c) This gives a feature vector for the entire window.

After that the feature vector can be processed using the support vector machine or any other learning techniques [20].

D. Diagnosis and Treatment

1) *Detection and Classification of Plant Disease:* Disease in the leaf is detected in this phase by using support vector machines. To classify the diseases support vector machine is used. The main objective of SVM to segregate the given dataset (leaf with disease) in the best possible way. Support vector machine is implemented through SVM-kernels and classifying using SVM-classifiers.

Support Vector Machine (SVM) Classifier for Plant Disease Classification

In a machine learning method of Support vector machine was further used to identify and quantify the diseases.

a) *Feature Definition and Extraction:* SVM classification model was used for training a two-dimensional feature. It is used to segmenting the affected pixels and healthy pixels. To represent the luminance and chromaticity of color Luminance-chromaticity CIE is used. Chromaticity of the color is given by CIE chromaticity by removing the luminance component of the color by which could provide more stable performance of object color information against illumination change.

b) *SVM Classifier:* Solution for non-linear two-class classification problems is proposed by support vector machine. It represents the training into a high dimensional space through a nonlinear mapping and a separate hyperplane is constructed by taking maximum margin between the two sets of vectors. In this study kernel function of nonlinear mapping is was selected by the Radial Basis Function (RBF). If the classification problems include more than two classes, SVM has several methods to extend the dichotomous SVM classifier to multi-classification.

c) *Database for SVM:* Here, new training and testing data is added to the data based on the existing one. The clipped image of the completely killed leaf from the un diseased plant or new plant and put in to the white background in horizontal. In the next step one day images were captured in a sequence (00:00 - 23:00) for the leaf. Nearly 12 plant images are captured for every two-hour interval. The captured images are the sets of training sample and testing sample. Then the next step is 1200 pixels per image with color intensities of x and y were randomly taken out from the entirely diseased leaf. Finally, all the image data is divided into two sets and also extended the existing one. The two sets are one is the training data at interval of 2:00, 6:00, 10:00, 14:00, 18:00, 22:00, the other is test data at time of 0:00, 4:00, 8:00, 12:00, 16:00, 20:00. A desired classification of 96.52% and 99.47% is obtained for samples (training and testing) with their relative parameters setting are given as c= 4, σ^2= 2 [21].

2) *Suggestion of Pesticides for the Affected Disease:* The pesticides for the affected disease in leaf are identified. Necessary treatments for the disease are detected to prevent the plant from severe infection. By using SVM technique the result of affected disease and pesticides for those diseases are detected. After detecting the diseases, the necessary treatments are listed out with their range of diseases. It is identified and classified by using SVM technique

IV. CONCLUSION

The accurate disease detection and classification is very essential for the successful cultivation of crop and this can be done using image processing.

Various techniques to segment the disease part of the plant is discussed here. Feature extraction and classification techniques are used to extract the features of the infected leaf are discussed. SVM method is used for classification of disease in plants such as self-organizing feature map, back propagation algorithm, SVMs etc. can be efficiently used. From these methods, the various plant disease is identified and classified accurately using image processing techniques. After identifying the diseases suggestion of pesticides and their information is also listed. In future this concept was developed to find the water level and nutrients in plant using IOT.

REFERENCES

[1] Yan-Cheng Zhang, Han-Ping Mao, Bo Hu, and Ming- Xi Li, "Features Selection of Cotton Disease Leaves Image based on Fuzzy Feature Selection Techniques", Proceedings of the International Conference on Wavelet Analysis and Pattern Recognition, Beijing, China, 2007.

[2] P.Revathi and M.Hemalatha, "Classification of Cotton Leaf Spot Diseases using Image Processing Edge Detection Techniques" International Conference on Emerging trends in Science, Engineering and Technology, 2012.

[3] Alexandre A. Bernardes, Jonathan G. Rogeri, Roberta B. Oliveira, Norian Marranghello and Aledir S. Pereira, "Identification of Foliar Diseases in Cotton Crop" Springer Link Lecture notes in computational Vision and Biomechanics, Volume 8, pp6785,2013.

[4] H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. Al. Rahamneh, "Fast and accurate Detection and Classification of Plant Diseases", International Journal of Computer Applications (0975-8887) pp 31-38, Volume 17-No.1, March 2011.

[5] Haiguang wang, Guanlin Li, Zhanghong Ma "Image recognition of plant diseases based on backpropagation networks", Fifth international congress on Image and Signal Processing (CISP2012), pp 894-900, 2012.

[6] G. Anthonys, N. Wickramarachchi "An image recognition system for crop disease identification of paddy fields in Sri lanka", fouth international conference on Industrial and Information system (ICIIS2009).

[7] Savita N. Ghaiwat, Parul Arora "Detection and Classification of Plant Leaf Diseases Using Image Processing Techniques: A Review", International Journal of Recent Advances in Engineering & Technology, ISSN (Online): 2347 - 2812, Volume-2, Issue - 3, 2014.

[8] Prof. Sanjay B. Dhaygude, Mr.Nitin P.Kumbhar "Agricultural plant Leaf Disease Detection Using Image Processing" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 1, January 2013.

[9] Mrunalini R. Badnakhe and Prashant R. Deshmukh "An Application of K-Means Clustering and Artificial Intelligence in Pattern Recognition for Crop Diseases", International Conference on Advancements in Information Technology 2011 IPCSIT vol.20 (2011).

[10] S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features" Agric Eng Int: CIGR Journal, 15(1): 211˜217 2013.

[11] Anand.H.Kulkarni, Ashwin Patil R. K. "Applying image processing technique to detect plant diseases", International Journal of Modern Engineering Research, Vol.2, Issue.5, Sep-Oct. 2012 pp-3661-3664.

[12] Sabah Bashir, Navdeep Sharma "Remote Area Plant Disease Detection Using Image Processing", IOSR Journal of Electronics and Communication Engineering, ISSN: 2278-2834 Volume 2, Issue 6 2012, PP 31-34.

[13] Smite Naikwadi, Niket Amoda "Advances in Image Processing for Detection of Plant Diseases", International Journal of Application or Innovation in Engineering & Management, Volume 2, Issue 11, November 2013.

[14] Sanjay B. Patil et al. "Leaf Disease Severity Measurement Using Image Processing", International Journal of Engineering and Technology Vol.3 (5), 2011, 297-301.

[15] Piyush Chaudhary et al. "Color Transform Based Approach for Disease Spot Detection on Plant Leaf", International Journal of Computer Science and Telecommunications, Volume 3, Issue 6, June 2012.

[16] Arti N. Rathod, Bhavesh Tanawal, Vatsal Shah "Image Processing Techniques for Detection of Leaf Disease", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 11, November 2013.

[17] Shailendra Singh Negi, Yatendra Singh Bhandari (25 September 2014), "A hybrid approach to image enhancement using contrast stretching on image sharpening and the analysis of various cases arising using histogram", IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE-2014), May 09-11, 2014.

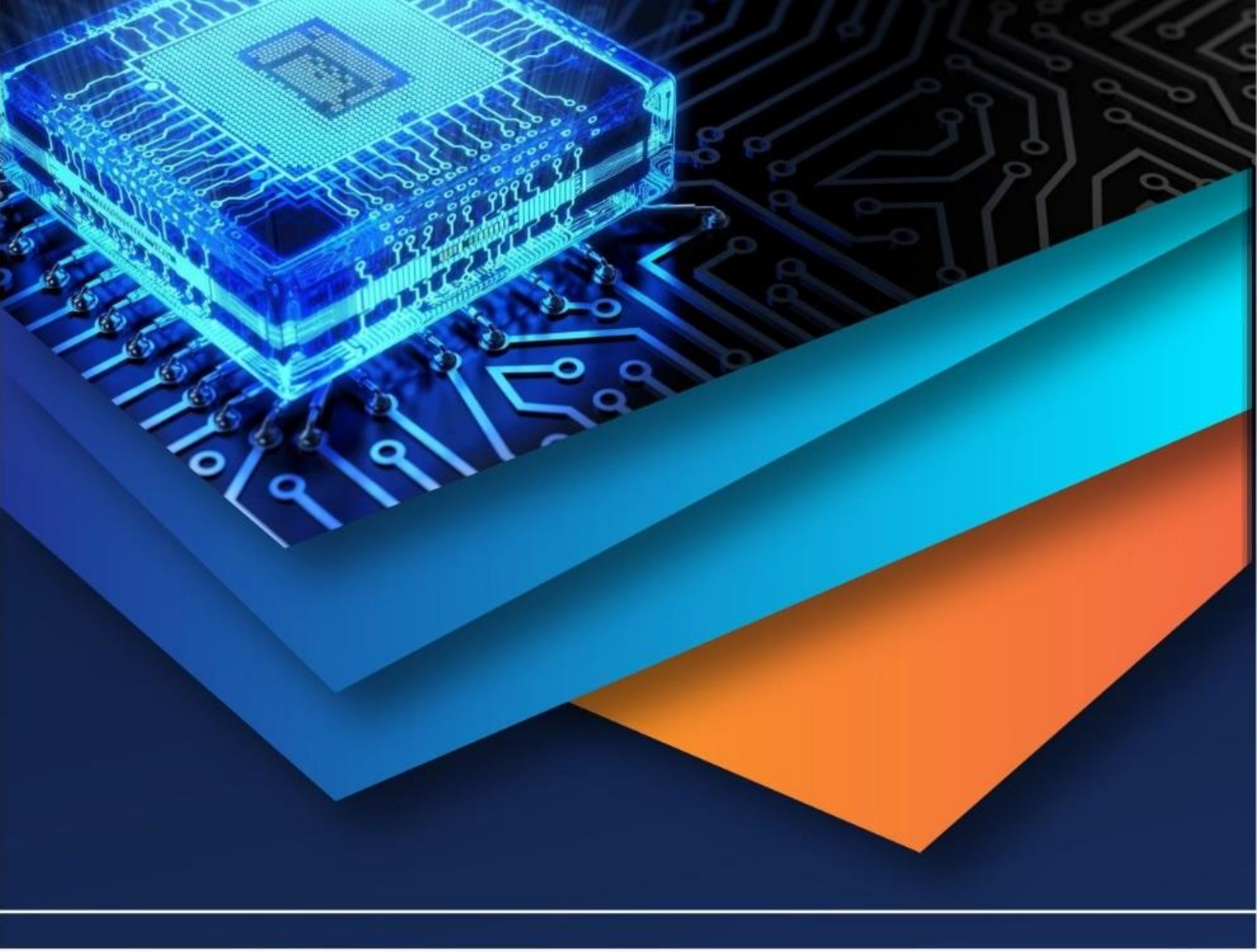
[18] P.R. Rothe, Dr. R. V. Kshirsagar (16 April 2015), "Automated extraction of digital images features of three kinds of cotton leaf diseases", 2014 International Conference on Electronics, Communication and Computational Engineering (ICECCE) 17-18 Nov. 2014.

[19] Siddharth Singh Chouhan1, Ajay Kaul1, Uday Pratap Singh2 and Sanjeev Jain1 (Feb 12, 2018), "Bacterial foraging optimization based radial basis function neural network (BRBFNN) for identification and classification of plant leaf diseases: an automatic approach towards plant pathology", Vol: 6, pp. 8852 – 8863.

[20] Muhammad attique khan, mikramullah lali, muhammad sharif, kashif javed, khursheed aurangzeb, syed irtaza haider, abdulaziz saud altamrah, and talha akram, "An optimized method for segmentation and classification of apple diseases based on strong correlation and genetic algorithm-based feature selection", Vol: 1, pp. 2169-3536.

[21] Rong Zhou, Shun'ichi Kaneko, Fumio Tanaka, Miyuki Kayamori, Motoshige Shimizu (Jan -30- 2014), "Early detection and continuous quantization of plant disease using template matching and support vector machine algorithms", 2013 First International Symposium on Computing and Networking.

[22] Sharath D M, Akhilesh, S Arun Kumar, Rohan M G and Prathap C (4-6 April 2019), "Image based Plant Disease Detection in Pomegranate Plant for Bacterial Blight", 2019 International Conference on Communication and Signal Processing (ICCSP).



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