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Identification and Detection of Sugarcane Crop Disease Using Image Processing

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Abstract: Sugarcane is a renewable, natural agriculture resource and it is most important crop of India. Sugarcane Crop is a perennial crop which results into less labour and high yields. Sugarcane crop is one of the main pillar for Indian economy. Nowadays there are different diseases which affecting the sugarcane plants in diverse areas. So In this work we are going to use machine learning algorithms and image processing for sugarcane leaf disease detection. Machine learning is a trending area where the technological benefits can be imparted to the agriculture field also. In this we are going to use PCA algorithm which is one of the unsupervised machine learning algorithms. The dataset consists of 3 types of diseases. Total dataset is divided into various proportions of training and testing sets. There are various detection and classification techniques which are done using various algorithms at each stage but in PCA algorithm detection and classification is done by same algorithm which is PCA. The diseases of sugarcane consider in this project are red rot, smut, wilt.
Keywords: Sugarcane, leaf disease detection, image processing.

I. INTRODUCTION

Agriculture mainly depends upon the quality of its products. In the 2019–2020 crop year, global sugar production was approximately 166.18 million metric tons. The largest sugar-producing countries in 2019–2020 were Brazil, India, the EU, China. India was the second largest producer, with 28.9 million metric tons of sugar produced in 2019–2020. On large scale sugarcane is used in production of sugar. The following flowchart shows production and consumption of sugar in india from year 2021 to 2021. Upto 2017 the production is less than 30 million. From 2018 the production has been increased. India, the world's largest sugar producer, is all set break its own record by exporting 5 million tonnes of sugar in 2020. India produced 26.2 million tonnes of sugar in 2019-20 and consumed 24.3 million tonnes of sugar in the same period. According to India export data of sugar, the country shipped sugar worth US$ 1,164 million in 2018. Sugarcane Plants are affected by various diseases and some of these disease can destroy the whole crop, if not diagnosed and treated in time. It reduce sugarcane weight by up to 29% and loss in sugar recovery by 31%, and these lead to burden on the economy. Everyday human being need to have sugar to enrich their food items. It has many uses like we can make from sugarcane crop white sugar, brown sugar, jaggery and ethanol. As a byproduct we also get bagasse.The sugarcane Industry remains one of the main pillars of the Indian economy, though facing many problems. Identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product.Sugarcane Leaf Disease detection and identification based on image processing could provide fast and precise information for the prediction and control of diseases.

II. METHODOLOGY

A. Block Diagram

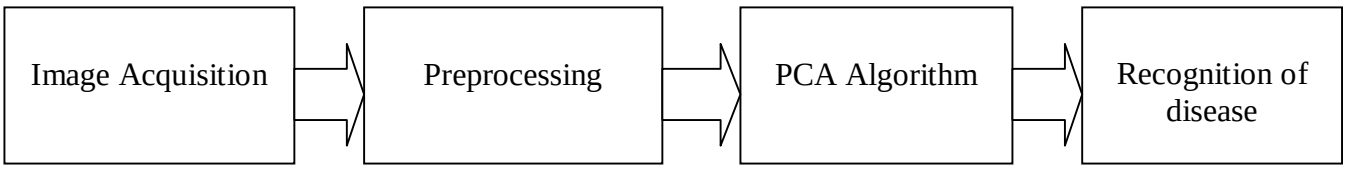


Fig.1 Block Diagram

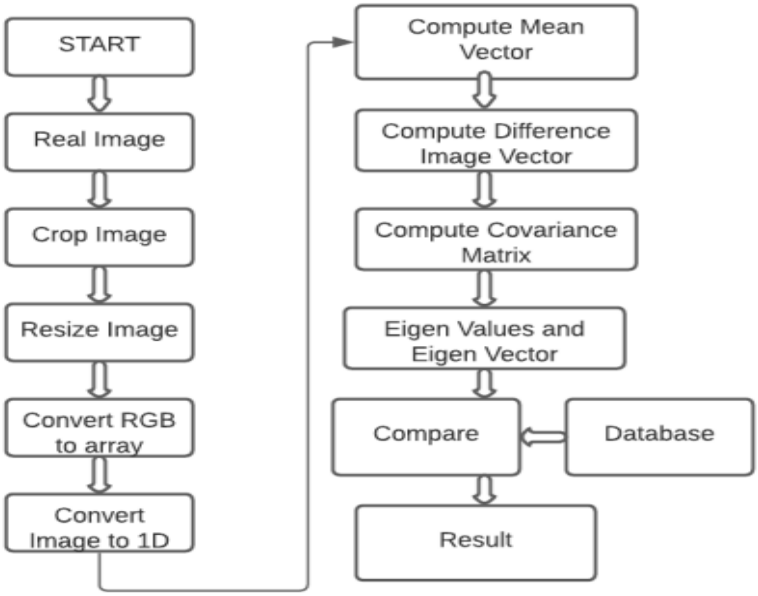
Description of each block of above block diagram:

1) *Image Acquisition* :It is described as capturing the image through digital camera .The camera is held horizontally to the plane of the leaf. The photograph distance is neither too close nor too far; it is adjusted such a way that the photograph is covering only background. And store it in digital media for further MATLAB operations. Image acquisition stage is the first stage of any vision system. Sample images are obtained or collected of the leaves using different mobile cameras with different resolutions, which are used to train the system for processing. These sample images are stored in standard format.

2) *Image preprocessing* :Image preprocessing is done in order to enhance the quality of image, to improve the Image data by changing image size & shape, filtering of noise image conversion, These types of variations are occurred due to many reasons such as camera settings, variation in light etc .Training set of M images of size N*N are represented by vectors of size (N 2 *1) images X1,X2….Xm.
3) *PCA Algorithm*: Steps of PCA algorithm are to read the images ,convert the image from RGB to gray, convert it into 1D array, calculate mean , calculate difference image vector, calculate covariance matrix , calculate the Eigen value and Eigen vector of a several images and store it in database.
4) *Classification and Recognition of Disease* :Eig (C) = The eigenvectors of covariance matrix used for recognition . Apply the PCA algorithm and find the Eigen value and Eigen vector of a several images and store it in database. By applying PCA algorithm find the Eigen value and Eigen vector of a test image. Compare test image value with database and detect the disease of sugarcane.

III. SOFTWARE IMPLEMENTATION

Following is the flow chart of steps that are performed in the software implementation.



1) *Read Image:* Imread reads the image from the file specified by filename, inferring the format of the file from its contents. If filename is a multi-image file, then imread reads the first image in the file. by using external camera store that image in test folder. First read the the healthy leaf image and second is infected crop leaf image. That input image is stored in test database.
2) Image Pre-processing: Image preprocessing is done in order to enhance the quality of image , to improve the Image data by changing image size & shape, filtering of noise image conversion, These types of variations are occurred due to many reasons such as camera settings, variation in light etc. Training set of M images of size *N*N* are represented by vectors of size (N^2*1) images X1,X2….Xm.
3) Convert RGB to Gray level: Convert that RGB image into the Gray level image because if the image is in RGB format then the number of pixels deal with thrice than the number of pixels in gray level images so reduce the number pixels. The reason for differentiating such images from any other sort of color image is that less information needs to be provided for each pixel. In addition, grayscale images are entirely sufficient for many tasks and so there is no need to use more complicated and harder-to-process color images.Following figure shows the gray level image of infected leaf image.
4) Calculate mean vector : Before applying PCA, we have to bring our data to a common format through standardization. The purpose of doing this is to make sure that variables are internally consistent with each other regardless of their type. To keep data in standardization mean is calculated. Calculate mean value of array by using m= (1/M) $\sum_{i=1to\ M} T_{i\ (Mean\ of\ all\ Single\ Column)}$ this formula.

5) Calculate difference image vector

Calculate the difference image vector by using following formula

m= average image vector

A_i = Single column vector – mean

$\mathbf{A_i = T_i - m}$

Standardization is done by centering the variable by subtracting mean from each pixels .

6) *Calculate Covariance Matrix:* If there are two variables in the variable set which are highly correlated, then, we are not gaining any extra information by retaining both the variables because one can be nearly expressed as the linear combination of the other. In such cases, PCA transfers the variance of the second variable onto the first variable by translation and rotation of original axes and projecting data onto new axes. The direction of projection is determined using Eigen values and eigenvectors.

7) *Eigen value Eigen Vector:* In this step, data compression and dimensionality reduction come into the picture. If you look at Eigen values you will notice that values are quite different. These values give us the order of significance of eigenvectors or directions i.e axis along eigenvector with the largest eigenvalue is the most significant PC axis and so on. The next step is to order eigenvectors by their eigenvalue, highest to lowest, to rearrange principal components in order of significance. We need to transform the data. If v is a nonzero vector and λ is a number such that $\mathbf{C\ v = \lambda v}$

Then $\boldsymbol{v}$ is said to be an eigenvector of C with eigenvalue $\boldsymbol{\lambda}$.

IV. RESULT

Following are the images of sugarcane crop diseases which are detected using this proposed system**.**

1) *SMUT:* Following figure shows the SMUT diseases of sugarcane .

2) *WILT:* Following figure shows the WILT diseases of sugarcane.

3) *Red Rot:* Following figure shows the Red rot diseases of sugarcane .

4) *Healthy Crop:* Following figure shows the healthy sugarcane.

V. CONCLUSION

Many Farmer's spend money on disease management of crop but without adequate technical support it results in poor disease control. In the proposed system, expecting that it will helps farmers to detect disease more accurately with less effort. In this system PCA algorithm is used to detect the disease with maximum efficiency of around 98%. It will reduce the time required to detect the disease with maximum accuracy.

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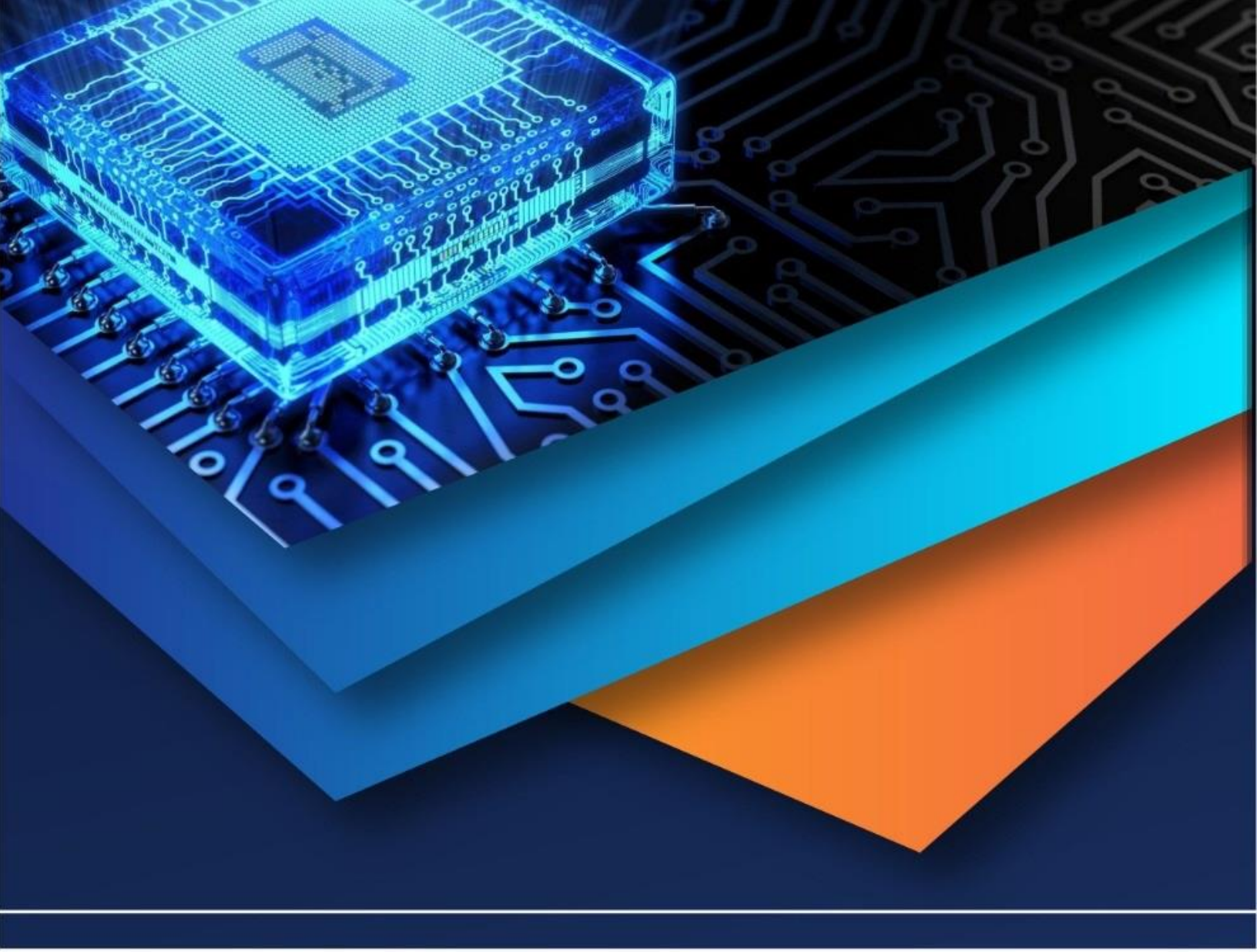

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