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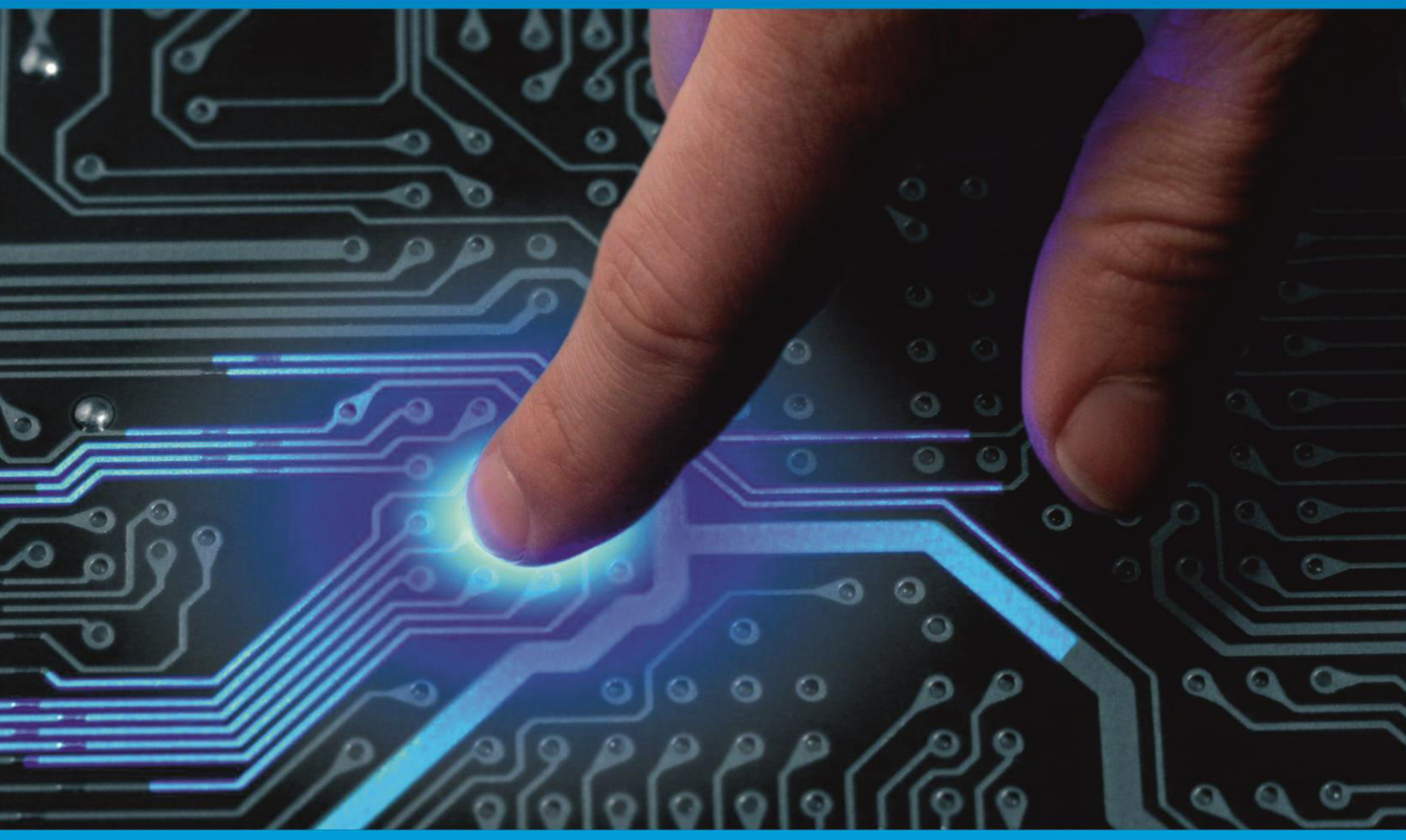

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Extraction of Infected Regions from Banana Leaf using Machine Learning Technique

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ABSTRACT: In developing countries like India, banana has spurred agriculture driven growth in the past century, when export of agricultural produce was the major source of foreign exchange. At times, the prices face a blow from the demand side, while at times facing drastic conditions on the supply side, owing to which, the prices of the commodity have seen a drastic fall. The solution we have proposed, is a low cost system that uses image processing and machine learning to extract the infected regions from the leaves of banana plants to make things easier for both the farmers as well as consumers.

In this project, the infected leaves are captured as images using a camera. These images are then processed further using various methods and the dominant features are extracted from them using various methods. Comparison of the features is done using various algorithms that detect the variance in color and its dominance in the recorded samples. This will help in faster and cost effective addressing of such conditions.

KEYWORDS: Extraction of Infected Regions, Banana leaf, Image Pre-processing, CNN(Convolutional Neural Network), K-Means Image Segmentation

I.INTRODUCTION

Agriculture is the backbone of India, most of the scientist are doing research for the cultivation of crops. The main problem which is a main concern for the cultivation of the crops is crop pests/diseases.

Earlier, complex computer programs to identify such infected regions and extraction of the very same were never materialized or brought into the mainstream owing to the affordability of agricultural consultants and advisors; as well as the complexity and non-user-friendliness of the development environments. However, as the platforms have become more user-friendly than ever; when a computer is taught to simply extract infected regions and also recognize leaf diseases to begin with suggesting remedial measures for the same can be easily incorporated. Since, the affects are recognizable through the appearance of a leaf, which can be perceived by vision, using image processing is a good approach.

This project focuses on identification and extraction of infected regions in leaf especially in banana leaf and automation of agriculture process.Plant leaf casualties are indeed challenging as they are a noteworthy risk to sustenance security and causes substantial losses on the farmers' ends. A common practice for plant scientists is estimation of damage of crop just by a naked observation based on percentage of affected area; which is not accurate, as it is much of a laborious task which requires more amount of time and effort. It results in subjectivity and low throughput.

II.RELATED WORK

R. Meena Prakash [1] has proposed that Image processing techniques are used to detect the plant leaf diseases. The objective is to implement image analysis classification techniques for detection of leaf diseases and classification. The proposed framework consists of four parts. They are (1) Image pre-processing (2) Segmentation of the leaf using K-means clustering to determine the diseased areas (3) feature extraction (4) Classification of diseases. Texture features are extracted using statistical Gray-Level Co-Occurrence Matrix (GLCM) features and classification is done using Support Vector Machine (SVM).

Pranjali B. Padol [2] had intended to aid in the detection and classification leaf diseases of grape using SVM classification technique. First the diseased region is found using segmentation by K-means clustering, then both color and texture features are extracted. Finally classification technique is used to detect the type of leaf disease.

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M. R. Tejonidhi [3] proposed an approach to tell the farmers about the type of the disease present or occurring to their plants. Considering the paddy plant for the experimental purpose, later which could be implemented for other crops too. First the leaves are classified into healthy and the diseased samples. Using Bhattacharya's similarity calculation method in finding similarities in histogram of test image or sample images with respect to clinically proved healthy image(standard image). During the training phase, 100 sample images of healthy, disease one, disease two leaves for obtaining standard values which represents respective types, based on which type of the test leaf is detected.

III.PROPOSED METHOD

Architecture using CNN :

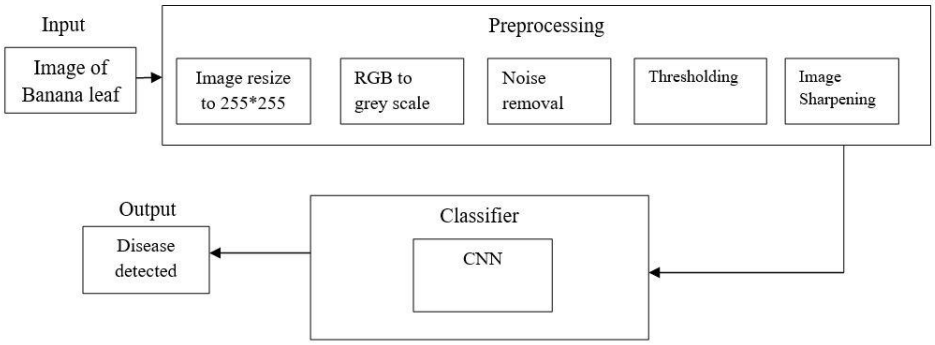

Figure1: Workflow of the system using CNN

Fig.1 shows the system architecture for the proposed method. Here we can see that the leaf image input is fed into the leaf disease detection system, in which it is pre-processed, then features are extracted. Then the extracted features are fed to softmax classifier which is the last part of Convolutional Neural Networks(CNN).
The input image is pre-processed and converted to grey scale image to find the Threshold value based on input image. Based on Threshold value further image sharpening is done, then further process is carried out.

A. Image resize to 255*255
In the first step of proposed approach, the input image of banana leaf is resized to 255*255 pixels.

B. RGB to grey scale
To store a single color pixel of an RGB color image we will need 8*3 = 24 bits (8 bit for each color component).

C. Noise Removal
Noise removal is the process of removing or reducing the noise from the image.

D. Thresholding
Thresholding is a type of image segmentation, where we change the pixels of an image to make the image easier to analyze.

E. Image Sharpening
Image sharpening refers to any enhancement technique that highlights edges and fine details in an image.

F. Feature Extraction and Classification
Feature extraction is a process of dimensionality reduction by which an initial set of raw data is reduced to more manageable groups for processing.

CNN :
CNN architecture is inspired by the organization and functionality of the visual cortex and designed to mimic the connectivity pattern of neurons within the human brain. The neurons within a CNN are split into a three-dimensional structure, with each set of neurons analyzing a small region or feature of the image.
In other words, each group of neurons specializes in identifying one part of the image. CNNs use the predictions from the layers to produce a final output that presents a vector of probability scores to represent the likelihood that a specific feature belongs to a certain class.

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A CNN is composed of several kinds of layers in the Typical CNN Architecture which is shown in fig.2.

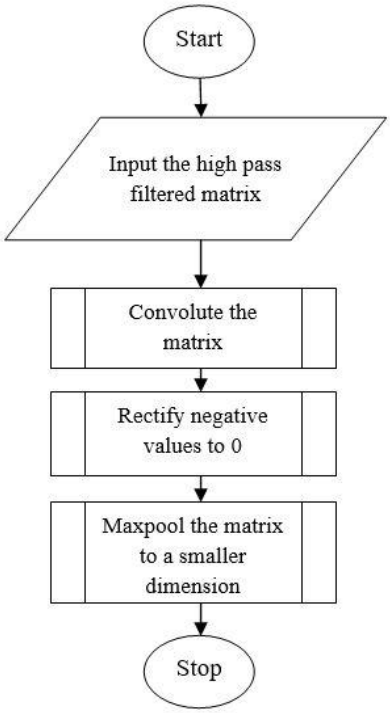

Figure 2: Flowchart for classification using CNN

A. Convolutional layer
It creates a feature map to predict the class probabilities for each feature by applying a filter that scans the whole image, few pixels at a time.

B. Pooling layer(downsampling)
Pooling layer scales down the amount of information the convolutional layer generated for each feature and maintains the most essential information (the process of the convolutional and pooling layers usually repeats several times).

C. Fully connected layer
Fully connected layer "flattens" the outputs generated by previous layers to turn them into a single vector that can be used as an input for the next layer.

D. Output layer
Output layer generates the final probabilities to determine a class for the image.

Architecture using K-Means :

K-Means clustering is a method of vector quantization, originally from signal processing, that aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean (cluster centers or cluster centroid), serving as a prototype of the cluster.It results in a partitioning of the data space into Voronoi cells. k-means clustering minimizes within-cluster variances (squared Euclidean distances), but not regular Euclidean distances, which would be the more difficult Weber problem: the mean optimizes squared errors, whereas only the geometric median minimizes Euclidean distances. For instance, better Euclidean solutions can be found using k-medians and k-medoids.Fig.3 shows the block diagram of K-Means algorithm principle.

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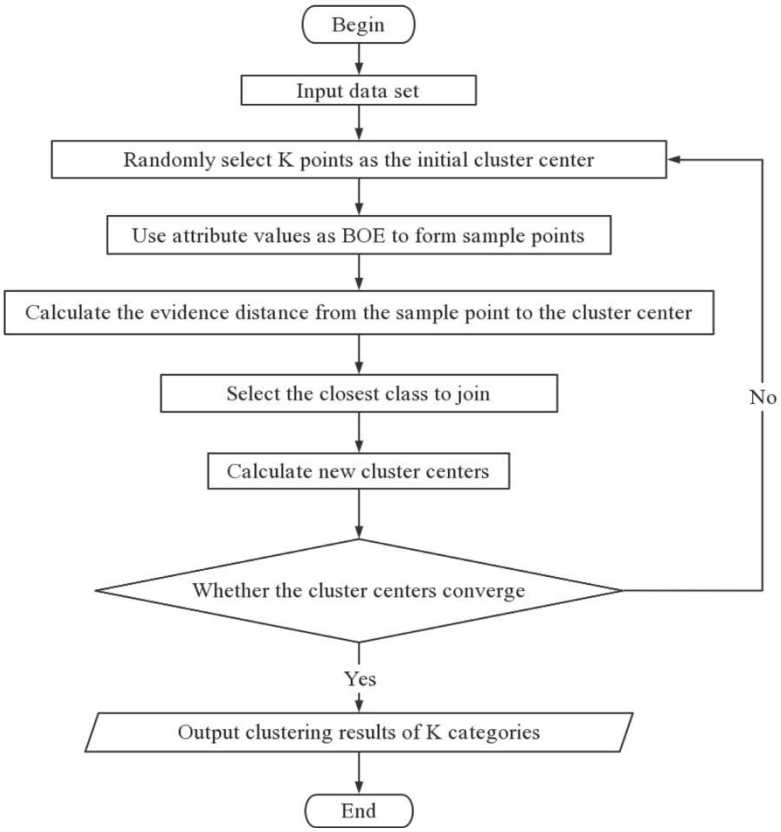

Figure 3: Block diagram of K-Means Algorithm

Image Segmentation :

The fig.4 shows the diagrammatic representation of Image Segmentation, where the image undergoes pre-processing followed by Noise Removal.

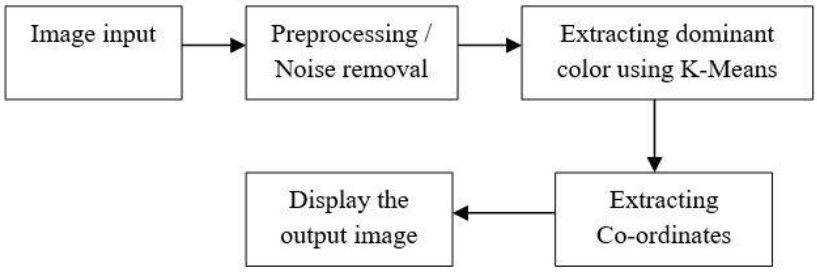

Figure 4: Block diagram of Image Segmentation

The next step is considered to be one of the important steps viz., Extracting the Dominant Colors using K-Means algorithm. Here, the segmentation of 5 different dominant colors takes place. This step is followed by the Extraction of co-ordinates and then the final output images are displayed.Here, we have taken 5 clusters for getting dominant color and displayed each segmented image for each cluster.

IV.CONCLUSION AND FUTURE WORK

Here, we focus on extracting infected regions from banana leaf and detecting disease.By following a new approach, we have got a presumably good accuracy of 70% which has been calculated manually.At the present level, farmers at the lower end of the spectrum may use this system to input pictures of affected leaves as input to the system and obtain the name of the disease as the output and infected region from banana leaf.We can improve segmentation by considering

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different number of clusters like 3 , 5, 7 and developing models and methods for majority voting to which segmented image is closer to the precise cropping.

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