A Disease Prediction and Rectification System for Banana Leaf using CNN

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***Abstract*: Banana is one of the major and economically important fruit crop in India. Banana occupy 20% of the total area of crop in India. In India banana is grown under diverse conditions and production systems.**

This system focuses to identify, detect and rectify the diseases in banana leaves and also continuously providing updates about the diseases in the leaves of banana plant to the farmer .Here, the system will be provided with the input as regular images of banana leaves captured through different image capturing medias, and the system will further process those images to detect the disease if any and then notify the farmer as well.

The system will also guide the farmer about the further actions to be taken such as suggesting him with the right pesticides, fertilizers to use and farming techniques so that diseases will be cured and would not corrupt the crops nearby. Therefore, the further yield of his crop will reach the maximum level and the disease would not replicate in the future.

***Keywords*: Convolutional Neural Network (CNN), K- NN**

1. Introduction:

Banana leaves have a wide range of applications because they are large, flexible, waterproof and decorative. They are used for cooking, wrapping and food-serving in a wide range of cuisines**.** Banana leaf is full of antioxidants and eating hot, freshly cooked foods on the Banana leaf is one good way to get all the antioxidants easily. Therefore its of very high importance to detect diseases in Banana leaves through an automatic system .Some of the Banana leaf diseases are Panama disease, Moko disease, Sigatoka disease, black spot, banana bunchy top, infectious chlorosis, banana streak virus and banana bract mosaic virus diseases. Hence it would be very beneficial to use a automatic system that will detect diseases of Banana leaves and provide with remedial actions to be taken.

2. Related Work:

a. A Deep Learning-based Approach

for Banana Leaf Diseases Classification:

Description: Apply deep neural networks to detect two famous banana diseases which are banana sigatoka and banana speckle in real scene and under challenging conditions such as illumination, complex background, different images resolution, size, pose and orientation.

b. Banana Plant Disease Detection and

Grading Using Image Processing

Description: Software solution for automatic plant disease detection and finally the percentage infection using an image processing technique. The proposed work uses Artificial Neural Network to classify the Banana plant diseases. The proposed system involves several steps, which include- dataset creation, image pre-processing, HOT feature extraction and artificial neural network based training and classification.

c. Detection and Prevention Of Banana Leaf Diseases From Banana Plant Using Embeeded Linux Board

Description: The detection and prevention of banana streak viral disease is carried out using an Embedded Linux development board interfaced with a camera, which is used to capture the leaf of banana plant. The captured image is to be processed by an algorithm called Economic Threshold Level (ETL). This algorithm is used to set the threshold value of a healthy banana leaf of the captured image.

d. A Survey on Methods of Plant Disease Detection

Description: Agriculture is important sector in Economy and Social life. Earlier unscientific methods were in existence**.** Study and evaluation of existing techniques for detection of plant diseases to get clear outlook about the techniques and methodologies followed.

e. Study on Banana Leaf Disease

Identification Using Image

Processing Methods:

Description: Gives a brief review about major banana plant diseases that show symptoms in leaves and explains in detail the image processing techniques that are involved in the process of disease identification in banana leaves.

3. Motivation:

 To help farmers to keep their banana crop healthy and continuously provide then updates about any disease that occurred in the banana leaves.

 Also provide farmers with remedial actions against the disease predicted. So that the further yield of his crop will reach the maximum level and the disease would not replicate in the future.

4. System Architecture:
That will procure the images from a banana farm as well as provide remedial measures for the detected disease using CNN.

The system initially works on the training dataset. The training data set and the input procured go through similar stages.

The stages are:

1. Image Preprocessing

2. Feature Extraction and Classification

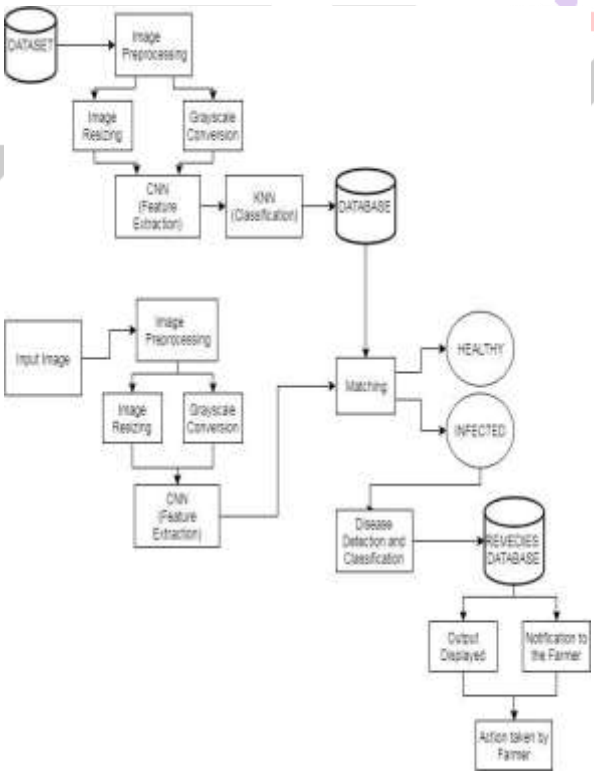

Fig 1**: System Overview**

4.1. Image Preprocessing:

It basically includes 2 steps.
Image resizing followed by Grayscale conversion.
To overcome the limitations that exists in the previous papers, we introduce a system

Image resizing is necessary because we need to increase or decrease the total number of pixels, according to the

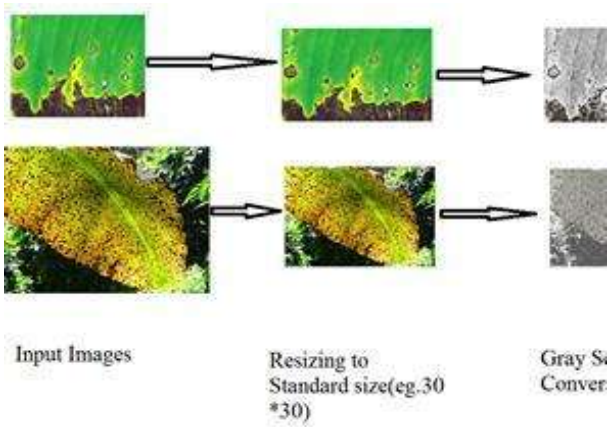

Fig 2: **Image Pre-processing**

standard input size. Let's take the example of the two inputs of infected banana leaves. The input we procure can be of variable length but resizing helps us to bring it to a standard size.

Grayscale conversion is basically used for reducing the memory required for processing .As the inherent complexity of gray level images is lower than that of color images the computations required will be less.

4.2. Feature Extraction and Classification

In this system, CNN classifier (Convolutional Neural Network) algorithm images and KNN algorithm used to stores all available cases and classifies new cases based on a similarity measure to validate the disease.

4.2.1 Convolutional Neural Network (CNN)

Convolutional neural networks are deep artificial neural networks that are used primarily to classify images (e.g. name what they see), cluster them by similarity (photo search), and perform object recognition within scenes. They are algorithms that can identify faces, individuals, street signs, tumors, platypuses and many other aspects of visual data.

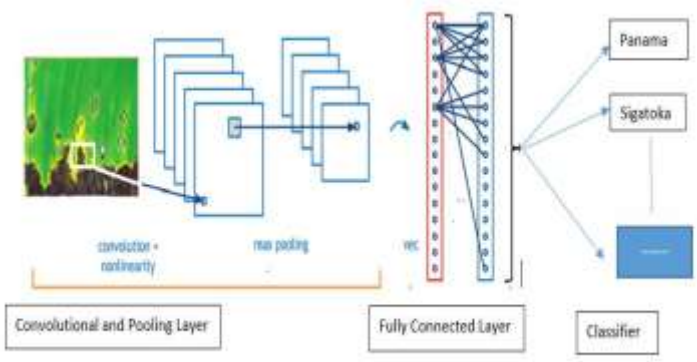

Fig 3: **CNN Layers**

Steps in CNN:

1. Convolution Layer- In this layer we apply filter (3*3) on image.

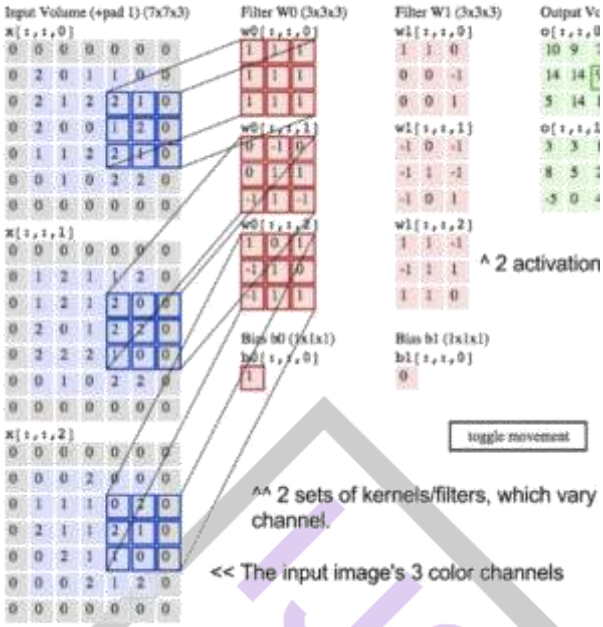

Fig 4: **Filter Multiplication**

2. Pooling layer- Pooling is an important component of convolutional neural networks for object detection.

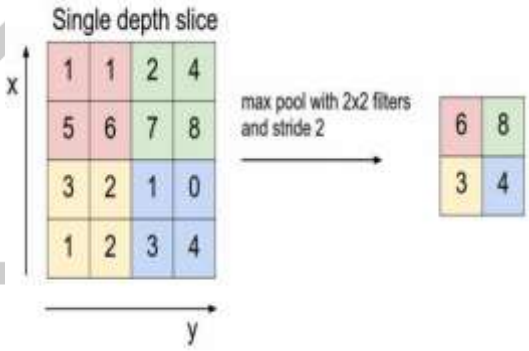

Fig 5: **Max Pooling**

3. Fully Connected layer- It is the fully connected layer of neurons at the end of CNN.

a. A CNN consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of Convolutional layers, pooling layers, fully connected layers and normalization layers.
b. Convolutional layers apply a convolution operation to the input, passing the result to the next layer.

4.2.2 K-Nearest Neighbors (KNN)

K nearest neighbors is a simple algorithm that stores all available cases and classifies new cases based on a similarity measure (e.g., distance functions). KNN has been used in statistical estimation and pattern recognition already in the beginning of 1970's as a non-parametric technique.

Assumptions in KNN

KNN assumes that the data is in a feature space. More exactly, the data points are in a metric space. The data can be scalars or possibly even multidimensional vectors. Since the points are in feature space, they have a notion of distance – This need not necessarily be Euclidean distance although it is the one commonly used. Each of the training data consists of a set of vectors and class label associated with each vector. In the simplest case, it will be either + or – (for positive or negative classes). But

KNN, can work equally well with arbitrary number of classes. We are also given a single number "k". This number decides how many neighbors (where neighbors are defined based on the distance metric) influence the classification. This is usually a odd number if the number of classes is 2. If k=1 , then the algorithm is simply called the nearest neighbor algorithm.

4.3. Future Actions:

Further, the system will process those images and match the features of those images with the already existing dataset based on which the prediction of disease is carried out. Then user will come to know if the banana leaves are infected or healthy. If the input received is healthy then the functionality of system is over else if, it is infected the user will be redirected to the analysis report consisting of remedial actions to be taken for that particular disease and notify the user for the same.

The system will be used by the farmers to analyze their banana leaves if they are healthy or infected with any kind of disease. After the prediction of the disease by the system, it will further provide the remedial action to be taken by the farmer to protect his crop. The remedial actions include suggesting the farmer type of pesticides, fertilizers and other chemicals to be used. System also provides regular notification to the farmer. The system can be used easily by the farmer.

5. Conclusion:

The system works efficiently for the identification, detection and providing remedial action (rectification) of the Disease's in the Banana leaves. The system uses the Convolutional Neural Network(for feature extraction) and KNN algorithm (for disease prediction).The system predicts banana diseases like mosaic, black Sigatoka, yellow Sigatoka, Panama wilt, streak etc. The system also provides the user with an analysis report that consists of the symptoms and remedies of predicted disease which will be passed on to the farmer's for further actions i.e. preventive measures and precautions etc. The system will notify the farmer through alerts such as message about the infection in banana leaves.

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