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Smart Plant Disease Detection

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ABSTRACT

It is not always possible for the farmers to predict the situation that can arise and their prediction can fail. The main reason is the plant disease. So, to assist the farmers in safeguarding the plants from diseases becomes the motivation. The majority of the researchers have identified that leaf images play a crucial role in the automatic detection of plant diseases. Currently, various advancement techniques are used in automatic disease detection of plants such as Machine Learning, Deep Learning, Computer Vision, Internet of Things (IoT), Expert Systems. The purpose of this system is to detection leaf disease using the machine learning technique based on Raspberry Pi controller for processing the plant leaf image to detect diseases.

Keywords: Machine Learning, Leaf Disease Detection, IoT, Raspberry Pi.

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I. INTRODUCTION

India is agricultural country and most of population depends on agriculture. Farmers have wide range of selection in Fruit and Vegetable crops. The cultivation can be improved by technological support. Disease is caused by pathogen in plant at any environmental condition. In most of the cases diseases are seen on the leaves, fruits and stems of the plant, therefore detection of disease plays an important role in successful cultivation of crops. In most of cases plant pathogens, microorganism, fungi, bacteria, viruses, cause diseases etc. Sometimes unhealthy environment include soil and water is also responsible for diseases in plants. There are lots of techniques to detect the different types of diseases in plants in its early stages. Conventional method of plant disease detection is naked eye observation methods and it is non-effective for large crop. Using digital image processing method, the disease detection in plant is efficient, less time consuming and accurate. This technique saves time, efforts, labours and use of pesticides. Different authors propose different techniques with the help of digital image processing for accurate plants disease identification. Lots of algorithms have developed by different researchers for image processing.

Problem Statement:

The global economy mainly depends on the agricultural sector. Rising incidents of diseases that are discovered recently or did not exist before is an increasing concern in the Agriculture sector. The environment is changing continuously which is harmful to the crops and leading farmers towards debt and suicides. The majority of the researchers have identified that leaf images play a crucial role in the automatic detection of plant diseases.

II. LITERATURE SURVEY

In paper [1] authors present image processing technique for Rice disease identification and considered the two most common diseases in the north east India, namely Leaf Blast (Magnaporthe Grisea) and Brown Spot (Cochiobolus Miyabeanus). Image acquisition is basic step, after that author use segmentation, boundary detection and spot detection method for feature extraction of the infected parts of the leave. In this paper author introduces zooming algorithm in which SOM (Self Organising Map) neural network is used for classification diseased rice images. There are two methods to make input vector in SOM. First method is the padding of zeros and the second method is the interpolation of missing points. For fractional zooming to normalize the spots size, interpolation method is applied. Image transformation in frequency domain does not give better classification. For testing purposes, four different types of images are applied; the zooming algorithm gives satisfactory results of classification for test images.

In paper [2] authors present image-processing technique for Leaf & stem disease detection. The author used a set of leaf images from Jordan's Al-Ghor area. The five plant diseases namely: Early scorch, Ashen mold, Late scorch, Cottony mold and Tiny whiteness is tested by image processing technique. In this technique at starting, image

acquisition is obtained and then K-Means clustering method is used for segmentation. After that in feature extraction, CCM (Colour Co-occurrence Method) is used for texture analysis of infected leaf and stem. Lastly paper presents Back propagation algorithm for neural network in classification of plant diseases. Result of this image processing technique shows accurate detection and classification of plant diseases with high precision around 93%.

In paper [3] authors used both LABVIEW and MATLAB software for image processing to detect chili plant disease. This combined technique detects disease through leaf inspection in early stage. The Image is captured using LABVIEW IMAQ Vision and MATLAB is used for further operations of image processing. Image pre-processing operations are Fourier filtering, edge detection and morphological operations. In feature extractions, the colour clustering is used to distinguish between chili and non-chili leaves. Then image recognition and classification determine the healthiness of each chili plant. This technique results in reducing use of harmful chemicals for chili plant which reduces production cost and increases high quality of chili.

In paper [4] authors present image processing technique for detecting the Malus Domestica leaves disease. Intensity values of grayscale images are obtained by histogram equalization method. In image segmentation, Co-occurrence matrix method algorithm is used for texture analysis and K-means clustering algorithm is used for colour analysis. Texture analysis is characterization of regions in an image by texture content. Colour analysis refers to minimizing the sum of squares of distance between objects and class centroid or corresponding cluster. In threshold matching process individual pixels value is compared with threshold value, if value is greater than threshold then it is marked as object pixel. The texture and colour analysis images are compared with the previous images for detection of plant diseases. Author will use Bayes and K-means clustering in future.

In paper [5] authors present image processing techniques for detecting the Bacterial infection in plant. Common infection seen on plant is Bacterial leaf scorch and early detection of this helps in improvement of plant growth. The image processing starts with image acquisition which involves basic steps such as capturing of image and converting it to computer readable format. Then clustering is done to separate foreground and background image with help of K-means clustering method in image segmentation. Clustering is based on intensity mapping and leaf area highlighting is done by subtracting the clustered leaf images from base images. Compared to Fuzzy logic, K-means clustering algorithm is simple and effective in detecting the infected area with reduced manual cluster selection requirement. With ADSP target boards and FPGA tools, further implementation is possible

III. METHODOLOGY

CNN Algorithm Process:

Step 1: Convolution Operation

Here are the three elements that enter into the convolution operation:

1. Input image
2. Feature detector
3. Feature map

Step 1(b): ReLU Layer

The reason we want to do that is that images are naturally non-linear. When you look at any image, you'll find it contains a lot of non-linear features (e.g., the transition between pixels, the borders, the colours, etc.). The rectifier serves to break up the linearity even further in order to make up for the linearity that we might impose an image when we put it through the convolution operation.

Step 2: Pooling

Again, max pooling is concerned with teaching your convolutional neural network to recognize that despite all of these differences that we mentioned, they are all images are same. In order to do that, the network needs to acquire a property that is known as "spatial variance." This property makes the network capable of detecting the object in the image without being confused by the differences in the image's textures, the distances from where they are shot, their angles, or otherwise.

Step 3: Flattening

This will be a brief breakdown of the flattening process and how data move from pooled to flattened layers when working with Convolutional Neural Networks

Step 4: Pooling

What happens after the flattening step is that you end up with a long vector of input data that you then pass through the artificial neural network to have it processed further which is called pooling. Types of pooling: Mean, Max, Sum

Step 5: Full Connection

In this part, everything that we trained throughout the section will be merged together. By learning this, you'll get to envision a fuller picture of how Convolutional Neural Networks operate and how the "neurons" that are finally produced learn the classification of images.

Step 6: Summary

In the end, it will wrap everything up and give a quick recap of the concept covered in the training.

Step 7: SoftMax & Cross-Entropy

Optimization Functions for CNN model. To calculate final accuracy and losses.

IV. CONCLUSION

We have proposed in our system to recognize and detection of plant leaf diseases detection in their farmer daily life. Our proposed system uses the detection of the leaf diseases using the image processing and hardware. Here we are using CNN techniques and methods for our system to classify the result from leaf images and detect the early to the farmer.

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