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Soil Parameter Analyzing Using Curse of Dimensionality for Accuracy and Prediction

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ABSTRACT: Agriculture is the mainstay of the Indian economy. Almost 70% people depend on it and shares major part of the GDP. Diseases in crops mostly on the leaf's effects on the reduction of both quality and quantity of agricultural products. Perception of human eye is not so much stronger so as to observe minute variation in the infected part of leaf. Thus the machine learning based software solution to automatically detect and classify plant leaf diseases. By using image processing techniques to classify diseases and quickly diagnosis can be carried out as per disease. This approach will enhance productivity of crops. It includes several steps viz. image acquisition, image pre-processing, segmentation, features extraction and neural network based classification.

I. INTRODUCTION

Agriculture has played a key role in the development of human civilization. If there is decrease in agro products, total economy will get affected. Therefore judicious management of all input resources such as soil, seed, water, fertilizers etc. is essential for sustainability. As diseases are inevitable, detecting them plays major role. The naked eye observation of farmers followed by chemical test is the main way of detection and classification of agricultural plant diseases. In developing countries, farming land can be much larger and farmers cannot observe each and every plant, every day. Farmers are unaware of non-native diseases. Consultation of experts for this might be time consuming and costly. Also unnecessary use of pesticides might be dangerous for natural resources such as water, soil, air, food chain etc. as well as it is expected that there need to be less contamination of food products with pesticides.

There are two main characteristics of plant disease detection machine-learning methods that must be achieved, they are: speed and accuracy. There is need for developing technique such as automatic plant disease detection and classification using leaf image processing techniques. This will prove useful technique for farmers and will alert them at the right time before spreading of the disease over large area. Solution is composed of four main phases; in the first phase to create a color transformation structure for the RGB leaf image and then, color space transformation for the color transformation structure. Then image is segmented using the K-means clustering technique. In the second phase, unnecessary part (green area) within leaf area is removed. In third phase to calculate the texture features for the segmented infected object. Finally, in the fourth phase the extracted features are passed through a pre-trained neural network.

II. METHODOLOGY

Convolutional Neural Networks are very similar to ordinary Neural Networks. They are made up of neurons that have learnable weights and biases. Each neuron receives some inputs, performs a dot product and optionally follows it with a non-linearity. The whole network still expresses a single differentiable score function from the raw image pixels on one end to class scores at the other. And they still have a loss function (e.g. SVM/Softmax) on the last (fully-connected) layer and all the tips/tricks are developed for learning regular Neural Networks still apply. ConvNet architectures make

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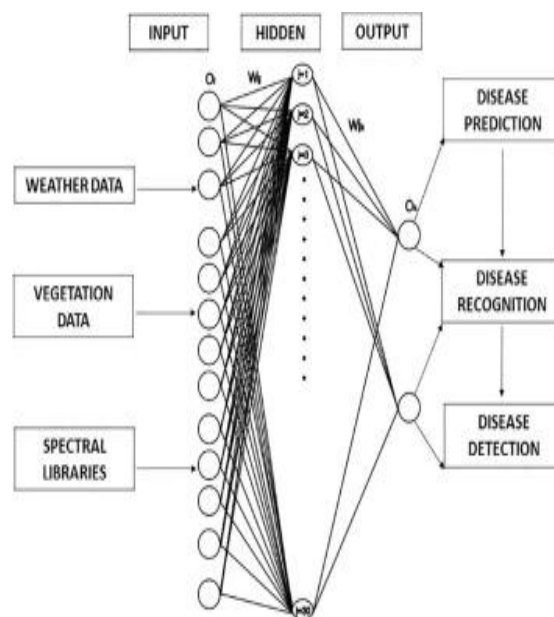
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the explicit assumption that the inputs are images, which allows us to encode certain properties into the architecture. These then make the forward function more efficient to implement and vastly reduce the amount of parameters in the network. In CIFAR-10, images are only of size $32 \times 32 \times 3$ (32 wide, 32 high, 3 color channels), so a single fully-connected neuron in a first hidden layer of a regular Neural Network would have $32 \times 32 \times 3 = 3072$ weights. This amount still seems manageable, but clearly this fully-connected structure does not scale to larger images. For example, an image of more respectable size, e.g. $200 \times 200 \times 3$, would lead to neurons that have $200 \times 200 \times 3 = 120,000$ weights. Moreover, to have several such neurons, so the parameters would add up quickly. Clearly, this full connectivity is wasteful and the huge number of parameters would quickly lead to overfitting.

Convolutional Neural Networks take advantage of the fact that the input consists of images and they constrain the architecture in a more sensible way. In particular, unlike a regular Neural Network, the layers of a ConvNet have neurons arranged in 3 dimensions: width, height, depth. For example, the input images in CIFAR-10 are an input volume of activations, and the volume has dimensions $32 \times 32 \times 3$ (width, height, depth respectively). The neurons in a layer will only be connected to a small region of the layer before it, instead of all of the neurons in a fully-connected manner. Moreover, the final output layer would for CIFAR-10 have dimensions $1 \times 1 \times 10$, because by the end of the ConvNet architecture will reduce the full image into a single vector of class scores, arranged along the depth dimension.



III. BLOCK DIAGRAM

In figure 1.1 shows the block diagram of plant leaf disease detection using machine learning. The sample dataset is given as the input to the input image it undergoes various process given below,

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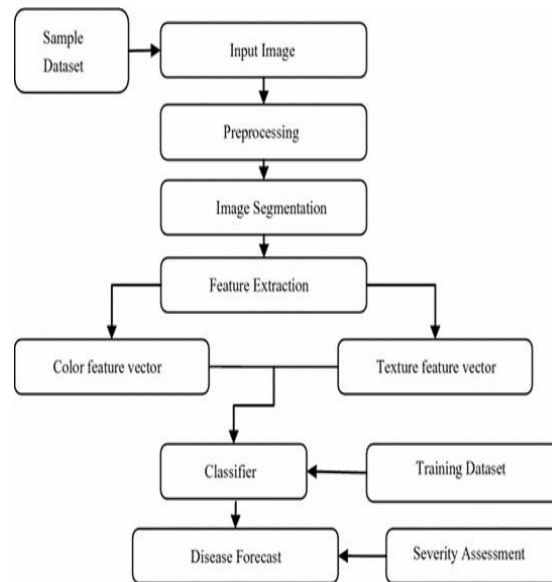


Fig 1.1 Block Diagram of the Plant Leaf Disease Detection Using Machine Learning Technique

IV. BLOCK DIAGRAM DESCRIPTION

IMAGE PRE PROCESSING

Noise gets added during acquisition of leaf images. By using different types of filtering techniques to remove noise. It creates device independent color space transformation structure. The next step to apply device-independent color space transformation, which converts the color values in the image to color space specified in the color transformation structure. The color transformation structure specifies various parameters of transformation. A device independent color space is the one where the resultant color depends on the equipment used to produce it. color produced using pixel with a given RGB values will be altered as brightness and contrast on display device used. To improve the precision of the disease detection and classification process, a device independent color space is required. In device independent color space, the coordinates used to specify the color will produce the same color regardless of the device used to take the pictures.

IMAGE SEGEMENTATION

Image segmentation is the process of separating or grouping an image into different parts. There are currently many different ways of performing image segmentation, ranging from the simple thresholding method to advanced color image segmentation methods. These parts normally correspond to something that humans can easily separate and view as individual objects. Computers have no means of intelligently recognizing objects, and so many different methods have been developed in order to segment images. The segmentation process is based on various features found in the image. This might be color information, boundaries or segment of an image.

Image segmentation classified into following types:-

- 1) Edge Based
- 2) Threshold
- 3) Region Based

Edge Detection Technique:

This technique is intended for locating boundaries of leaf within image. It segments the image by identifying the difference between intensities at border. SobelCanny, Laplacian, and fuzzy logic are the some of the techniques used for edge detection.

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Threshold Technique:

Threshold is the simplest method of segmentation. This method based on threshold value calculated by converting image to binary image. Thresholding methods includes Global and Local thresholding, which having methods like Otsu global thresholding and Adaptive local thresholding.

Region Based:

The main purpose of this method is to partition an image into different same types of regions. Pixels of same type identified and grouped together into same type of regions. The Main types of Region based Segmentation are Region Growing, Region Splitting and Region Merging.

WORK COMPLETED

Agriculture sector consists of major difficulties in improving the production. So the Agriculture with image processing is chosen as the domain of the project. It aims to identify the diseases in crops due to several factors such as mineral deficiency, fungal infections and the weed detection. The infections in plant leaf are analyzed. Area of disease identification and weed detection were chosen and analyzed. From the view of the papers, the coding and disease identification algorithms were formed. The algorithm of identification of disease from color, shape and another, feature variation using image processing. The image is captured from the plant and the specimen is applied to identify the variation. The image available in the internet source is processed and provided for comparison with specimen. The specimen is involved in edge detection process and segmentation algorithm is performed to segment the image to detect the variation of features. The feature of the image under test is extracted and classified according to K-mean, SVM and soft computing techniques. The variation in feature from the image classified provides the infection identification. Then the analyses of images are performed and result of disease identification is performed. From the variations and symptoms, the data of sample image, test image and disease are trained in the model.

V. RESULT

DISEASE SPECIFICATION

The input images with diseases are fed and their diseases are predicted using CNN algorithms. Each disease varies with one another and thus each disease is classified and respective disease is listed below.

1. Bacterial Spot

The bacterial spot pathogen may produce lesions on all aboveground parts of the plant leaves, stems, flowers and fruit. It is difficult to reliably distinguish bacterial spot from bacterial speck based on visual symptoms, especially in the early stages. Initial leaf symptoms are small, circular-to-irregular, dark lesions, which may be surrounded by a yellow halo. The lesions tend to concentrate on the leaf edges and tip and may increase in size to a diameter of 3-5 mm. Infected leaves may develop a scorched appearance. When spots are numerous, foliage turns yellow and eventually dies, leading to defoliation of the lower portion of the plant.

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Fig 1.2 Bacterial Spot

2. Late Blight

This disease is caused by the fungi *Alternariatomatophila* and *A.solani* and is first observed on the plants as small, brown lesions mostly on the older foliage. Spots enlarge and concentric rings in a bull's-eye pattern may be seen in the center of the diseased area. Tissue surrounding the spots may turn yellow. If high temperature and humidity occur at this time, much of the foliage is killed. Lesions on the stems are similar to those on leaves and sometimes girdle the plant if they occur near the soil line.



Fig 1.3 Late Blight

3. Tomato Yellow Leaf Curl Virus

TYLCV causes the most destructive disease of tomato, and it can be found in tropical and subtropical regions causing severe economic losses. This virus is transmitted by an insect vector from the family *Aleyrodidae* and order *Hemiptera*, the whitefly *Bemisiatabaci*, commonly known as the silverleaf whitefly or the sweet potato whitefly. The primary host for TYLCV is the tomato plant, and other plant hosts where TYLCV infection has been found include eggplants, potatoes, tobacco, beans, and peppers.^[1] Due to the rapid spread of TYLCV in the last few decades, there is an increased focus in research trying to understand and control this damaging pathogen.

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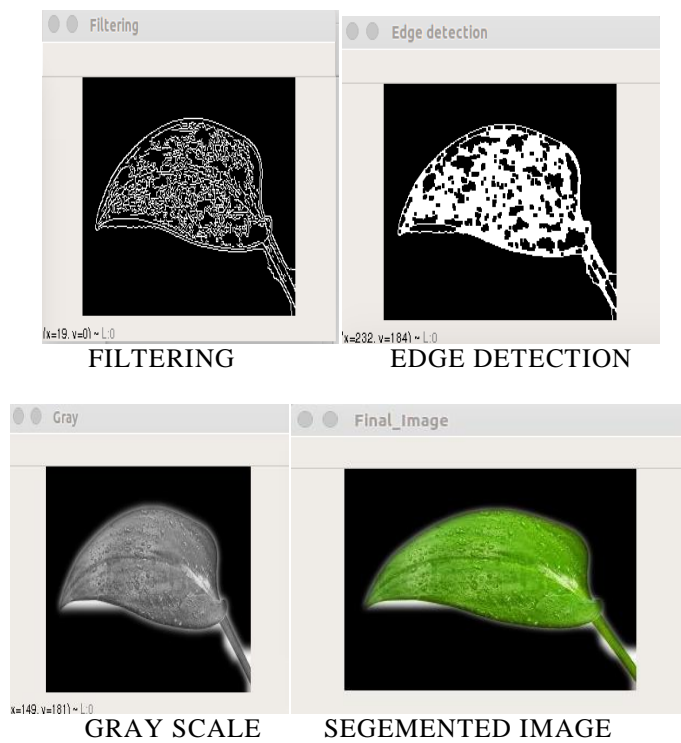
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Fig 1.4 Tomato Yellow Leaf Curl Virus



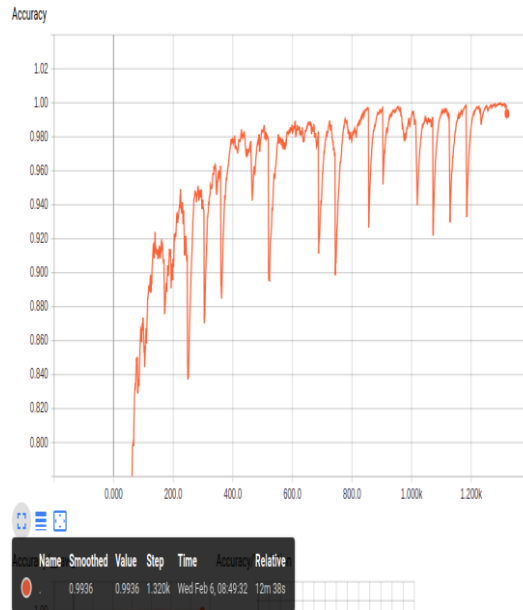
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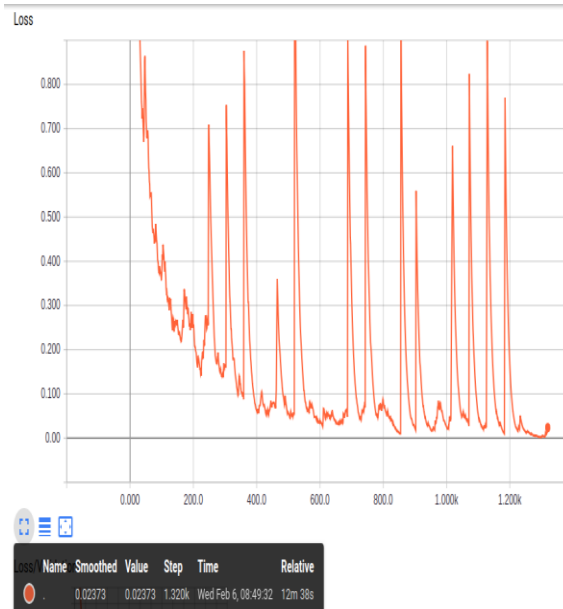
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PERFORMANCE ANALYSIS



X axis - Number of Leaf Trained
Y axis – Percentage



X axis - Number of Leaf Trained
Y axis – Percentage

VI. CONCLUSION

The classification and segmentation of leaf images were performed using CNN. The various features of the leaves were initially extracted and sent for segmentation of the respective images. After comparison with various disease names, the optimal disease for the image is analyzed, identified and the disease will be determined using CNN. In future we

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compare the results of various algorithms such as K-Means Algorithm and SVM technique to detect the diseases with high accuracy.

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