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Detection of Disease in Paddy Crop Using Image Processing

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ABSTRACT: For a country like India, agriculture plays a pivotal role in the economy of the nation. Paddy is the major crops in India. This is one of the reasons that disease detection in crops like paddy plays an important role in agriculture field, as having disease in plants are quite natural. If proper care is not taken in this area then it causes serious effects on plants due to which respective product quality and quantity are affected.

Detection of the symptoms of the disease or the disease itself through some technique at a very early stage is beneficial, as its reduces a large work of monitoring in farms. In this project, we are going to develop an image processing technique which is used for detection of some of these plant diseases.

We implement the technique using matlab.

I. INTRODUCTION

The agriculture is very commercial aspect in today's world. Indian economy which is mostly dependent on agriculture productivity. Disease detection in plants or crops plays a very prominent role in the agriculture field. Farmers have a great diversity of crops. In environment, various pathogens are present. Those will be severely affect the crops or the plants and the soil also, there by affecting the production of crops.

Various diseases are observed on the plants and crops due to presence of various pathogens. The main identification of the affected the crop which seems on its leaves and stems .the various colored spots, patterns and discolorization on the leaf or stem of the crop are very useful in recognizing the disease.

The ancient approach for plant disease detection and recognition involved direct eye observation i.e., naked eye observation. It is very difficult to remembering the particular set of disease as per season; climate etc., this method of observation is very slow method, time consuming and inaccurate. In some countries, detecting the plant disease by consulting experts. It is also time consuming and expensive aspect due to availability of experts.

The current methods of detecting the plant disease which are involved availability of skilled people, well equipped laboratories for testing. Results in growing of various diseases on plant due to irregular checkup of plant .detection of plant diseases is essential to detect the various symptoms of diseases in early stages when they appear on the growing leaf and stem of the plant .these things are not available everywhere especially in remote areas .

The method using digital image processing with concept of neural network.

II. RELATED WORK

The Existed system which is using the svm classifier for training the images. the svm classifier the classification of the disease is not sufficient .it is not classifying it is used for only recognition of the single disease.but ,we have to propose the system using neural network and soft max classifier.it is very efficient and get accurate results.

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III. PROPOSED SYSTEM

The aim of this project is to recognize disease of the paddy field from the images of the leaves or stems of the paddy.here,considering the three types of diseases of paddy crop which is classified by the neural network i.e.,rice blast disease.

Rice blast :

rice blast is a fungal disease which is infected a pathogen is magnaporthe orzyae.it occurs in the areas containing low soil moisture.

Fig : Rice blast

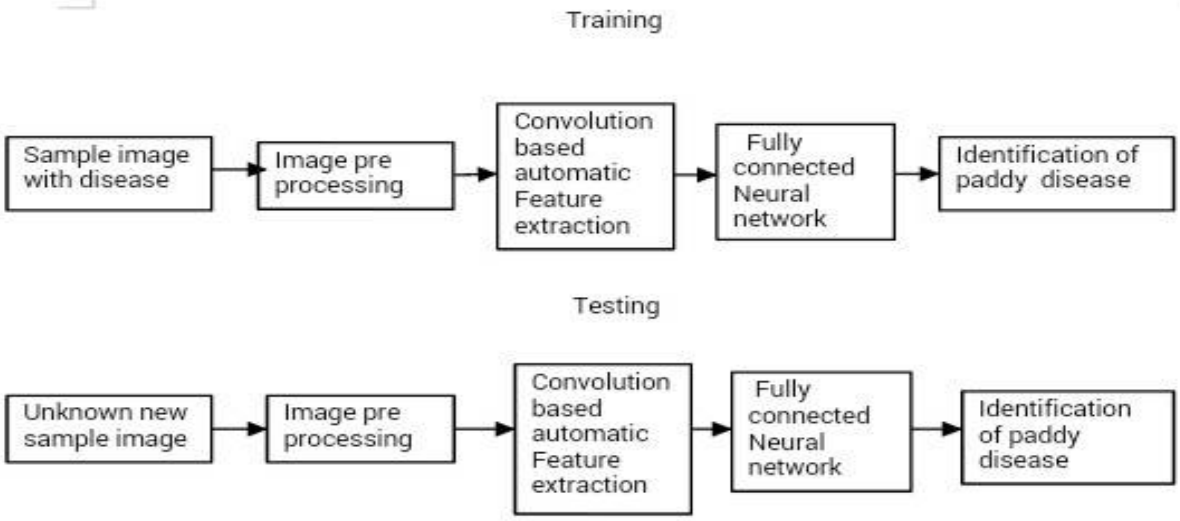

Fig: block diagram

Here, for image recognition use neural networks for this purpose. Different steps in recognition process, firstly do preprocessing on the image captured and then extract these features from these images .so, features can be used by neural network to the recognition step. Obtaining these features from convolutions, these features are supplied to the neural network to recognize the disease from the image given as an input.

1. Image pre-processing:

Image preprocessing is first need to load the image into two dimensional matrix into matlab.once load the image into two dimensional matrix. The matrix or image are re-sized to bring image is into pre-defined size. It need to fixed

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size of the image that could be any size it should be fixed size. For examples, in this project considering 128x128 image size is to be work on. In 128x128 images which having 128 width, 128 height image size have need to scale or re-size the input image into this particular size because input image could be in any size.

2. convolution based feature extraction:

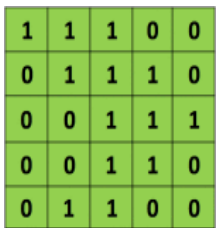
Convolution is a general purpose algorithm to extract features from the input image. It is a matrix applied to an image and a mathematical operation comprised of integers. It works by determining the value of a central pixel by adding a weighted value of all its neighbors together. It gives a new output modified image. It is the process of adding each element of the image to its local neighbors, weighted by the kernel. Formula for convolution is given below:

$$g(x,y)=\sum_{s=-a}^{a}\sum_{t=-b}^{b}\omega(s,t)\,f(x-s,y-t)$$

Here,f-filter kernel
w-input image
g(x,y) be the convolved feature of the image.
w(s,t) is the central pixel
a, b are the filter kernel width and height.
Typically a&b are same because we having square matrix filter kernel3x3 matrix.
Here a is from-1 to +1 and b is from -1 to +1 because 3x3 matrix.

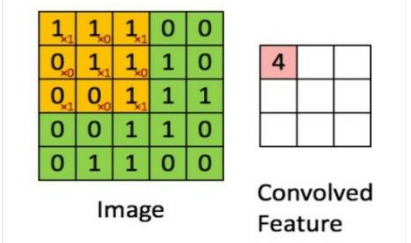
Example of the convolution of image:

Input image is two dimensional matrix. In convolution, filter kernel is taken for the process of convolution. It having typical sizes 3x3, 5x5, 7x7etc,



Fig(a): input image

Fig(b): filter kernel



Fig(c): output convolved image matrix

3x3 matrix having 9 pixels overlapping with input two dimensional image. Just multiplying these 9 pixels and then summing these pixels and get some new modified matrix i.e., convolved output image.
Features are extract by this convolution. Features having different edges are horizontal edges and vertical edges. These are obtained by the convolution.
After we choosing filter size, we have to choose the stride and padding. Stride will controls that how to convolve the filter around the input. The filter convolving around the input by shifting the one unit at a time.

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Padding is a margin of zero values those are placed around the image. Padding depth is to be set so that the output from the current convolutional layer does not become smaller in size.here, zero padding maintaining the same as that of input dimension. It refers to surrounding a matrix with zeros. This can help preserve features that exist at edges at original matrix and control the size of the output feature map.

III. FULLY CONNECTED NEURAL NETWORK

Neural network:

DEFINITION: A system made up of a number of simple, highly interconnected processing elements, which process information by their external inputs.

Artificial Neural Network (ANN) are inspired from the neurons connections in brain and how brain works.ANN having nodes which would behave like actual function of neuron in the brain. Different neurons are working for the recognition task. Not all the neurons are working in all the time when show some image because some neural network part is more active and some neurons may not be active. Collectively they form the network gives the recognition of the image. It is thought that brain consists of billions of neuron connected with each other forming a network. The connection between the neurons passes electrical pulses from one to other. The amount of signals passed from one neuron to other depends on the weight of the connection between them. These weights are learnt by the brain to recognize the objects, to understand the language. ANN also has multiple nodes/neurons connected to each other and a connection between them has weights and these are learnt from the recognition tasks. Depending on the object that need to recognized, different neurons will be working. All the connections are not equally importance some are more important and some are less importance .the weight is nothing but importance of the connections. Basically, all these connections together have weights and then as per the weight of connection they will produce the amount of signals.

Input of neural network is features of the image. Neural network not stores the image. It will try to capture the features of the image. These features are used by artificial neural network to understand to recognize the image.

In ANN having two phases:

1. Training
2. Testing

In training ANN is trained by giving multiple images that have known output. Neural network try to learn that the images. During the learning it will adjust the weights of the connections. There is need to show to multiple images because all images will not be exactly same i.e., different in texture, some little variations in the image. Neural network should be able to understand the variations in the images.

In testing unknown image is shown to the neural network to recognize the disease.

In fully connected neural network consists of three layers are input layer, hidden layer and output layer. It connect every neuron in one layer to every neuron in another layer and each connection has its own weight .this is a totally general purpose connection pattern and makes no assumption about the features in the data. This network as its name indicates is made up of multiple layers. This architectures of this class besides processing an input and output layer also have one or more immediatary layers called hidden layers the computational units of the hidden layer are known as hidden neurons or hidden units. The input layer neurons are linked to the hidden layer neurons the weights on these links are referred as input hidden layer weights. Again the hidden layer neurons and the corresponding weights are referred to as hidden output layer weights.

In fully connected neural network the input images are given to the input layer convolution, maxpool, relu operations are takes place in hidden layer of fully connected neural network. Output layer consists of different classes of the diseases of images.

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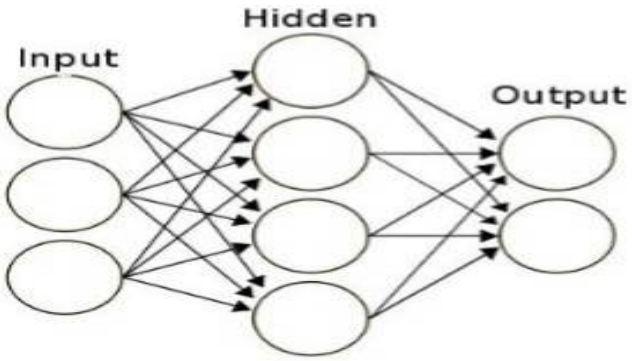

Fig: fully connected neural network

Need of maxpooling is the features are to recognize in different scales. We have multiple convolution layers with size is scaling down. For each of the regions represented by the filter, it will take the maximum of that region and create a new output matrix where each element is that maximum of a region in the original input.
Relu(rectified linear unit) layer does not change the size of the input.it performs a threshold operation for each element of the input.

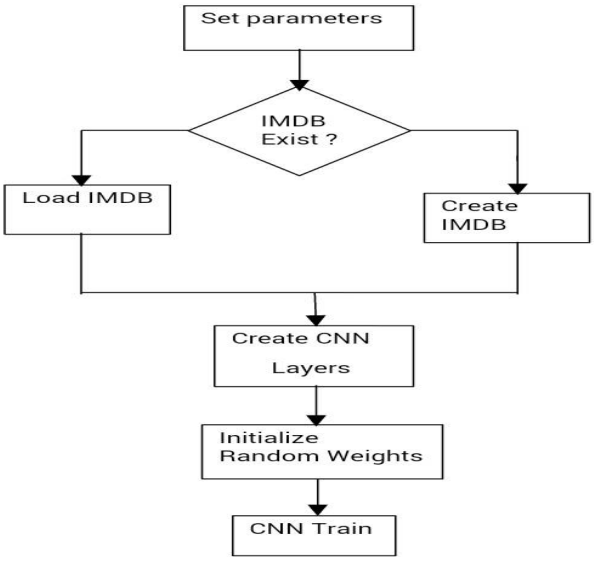

Fig: flowchart

Set parameters:
Here, set parameters consisting of batch size,epoch and learning rate.
Batch size: no.of images are present in each batch.
Epoch: it is a iteration process that which providing the network with an input and updating the network's weights is called epoch.
Learing rate: for neural network, when we have to adjust the weights with a particular value is called the learning rate.

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CNN TRAIN:

Steps to be taken for the training the neural network :

1. take the input as matrix.
2. initialize the weights with random values in matrix.for error propogation process is a iteration process ,keep the updating the weights.
3. until the error is minimized,the steps will be repeat for each training process.
4. apply the inputs to the fully connected neural network
5.calculate the output for every neuron from input layer,through the hidden layer and to the output layer.

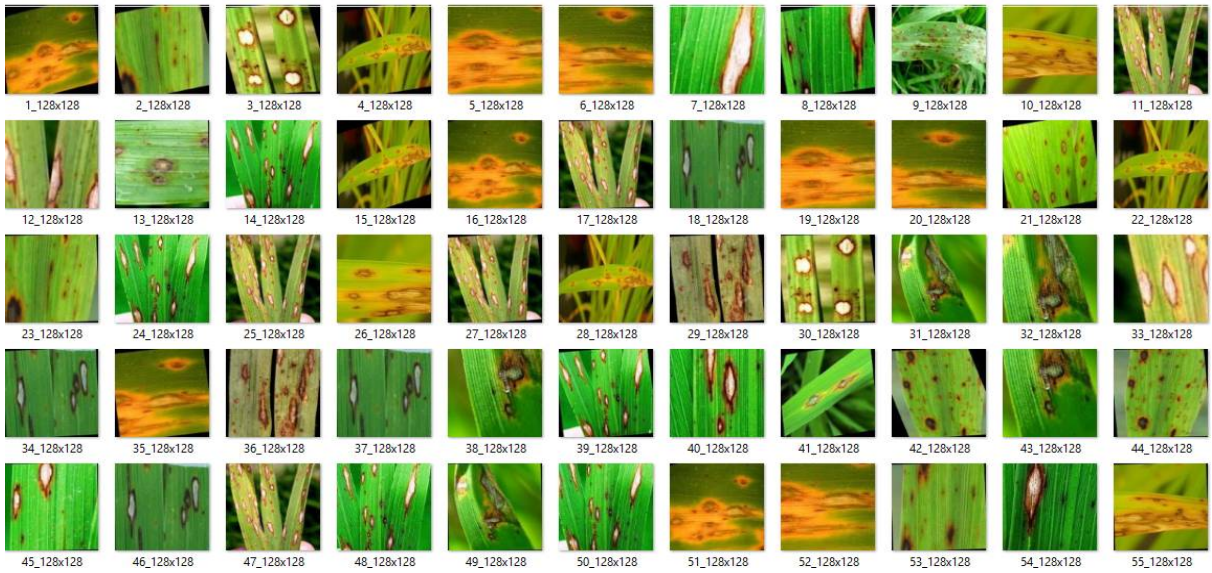

Fig:rice blast images for training

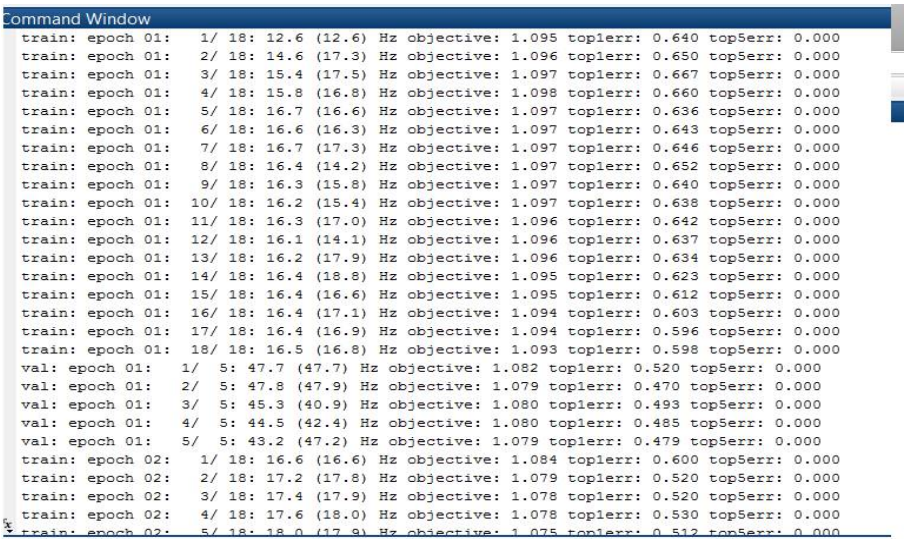

Fig: Iteration process for training

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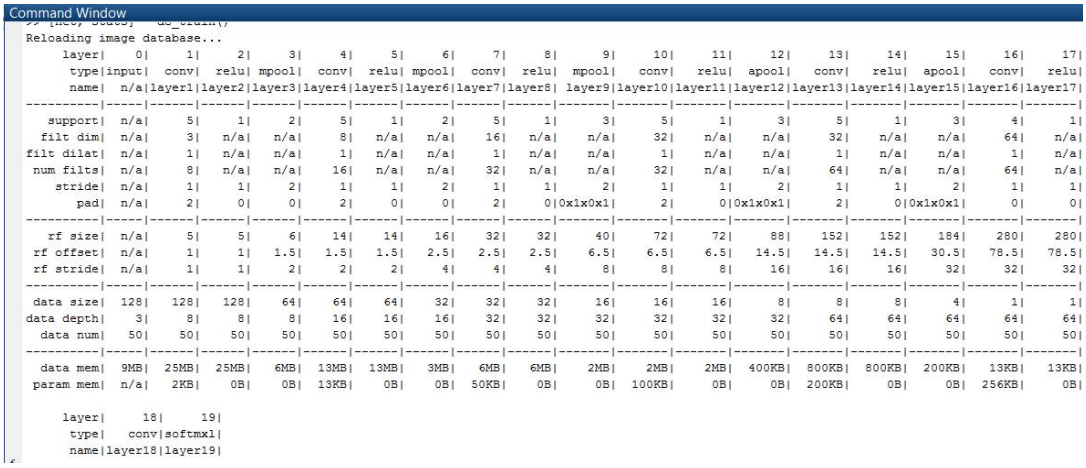

Fig:creation of cnn layers

IV. EXPERIMENTAL RESULTS

```
>> run_single_prob(4)
Loading the CNN Trained Network

Selected Below Image from Test Database
tests/114.jpg

prob(:,:,1) =

   14.7157


prob(:,:,2) =

    9.9559


prob(:,:,3) =

   -3.4288

Image is classified as ..
Rice Blast
```

Fig(a): output with probabilities **fig(b):output image**

Here, implementing the neural networks to obtain the resultgivng the command of run_ single_prob it gives the classifies the disease based on the connection probabilities .in fig(a) the disease is classified with the respective probabilities.fig(b) is the output image.

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V. CONCLUSION AND FUTURE SCOPE

This paper provides accurate result and plant disease detection and classification technique by using matlab and image processing. The proposed methodology in this paper depends on neural network concept .it got 90% accuracy result. In future work will extend our data base for more plant disease detection.

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