

# Soft Approach for Plant Pathology

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*Abstract- Agricultural productivity is something on which economy highly depends. This is the one of the reasons that disease detection in plants 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 and due to which respective product quality, quantity or productivity is affected. Detection of plant disease through some automatic technique is beneficial as it reduces a large work of monitoring in big farms of crops, and at very early stage itself it detects the symptoms of diseases i.e. when they appear on plant leaves. This paper presents an algorithm for image segmentation technique which is used for automatic detection and classification of plant leaf diseases. It also covers survey on different diseases classification techniques that can be used for plant leaf disease detection. Image segmentation, which is an important aspect for disease detection in plant leaf disease, is done by using Convolutional Neural Network (CNN) algorithm.*

**Keywords:** *Texture, Diseases and symptoms, Plant Leaf Disease, Image Segmentation, Image Acquisition, Convolutional Neural Network (CNN)*

## I. INTRODUCTION

Botany is the scientific examination of plants characters. Indian economy is highly dependent of agricultural productivity. Therefore in field of agriculture, detection of disease in plants plays an important role. To detect a plant disease in very initial stage, use of automatic disease detection technique is beneficial. Here is the number of plant diseases that occur and affects the normal growth of a plant. These diseases affect complete plant including leaf, stem, fruit, root, and flower. Most of the time when the disease of a plant has not been taken care of, the plant dies or may cause leaves drop, flowers, and fruits drop. Appropriate diagnosis of such diseases is required for accurate identification and treatment of plant diseases. Plant pathology is the study of plant diseases, their causes, procedures for controlling and managing them. But, the existing method encompasses human involvement for classification and identification of diseases. This procedure is time-consuming and costly. Automatic segmentation of diseases from plant leaf images using soft computing approach can be reasonably useful than the existing one.

The computer has a ability to process multimedia information like images captured from some computing devices. An image contains important information that can be retrieved by using some computational method. Image segmentation is a task for partitioning an image into smaller parts that are more meaningful. Interestingly, it can be stated as identification and classification of some region of interest. The segmentation is performed based on some common properties of the objects present in an image like color, texture and, shape etc. Image segmentation is a preprocessing step for image processing generally performed by using two methods (i) Traditional method and (ii) Soft computing method.

Soft computing having the capability to deal with uncertainty has been most widely used for image segmentation nowadays. Soft computing methods are designed to simulate human intelligence by learning from their skills to perform some complex task automatically. The Soft Computing (SC) methods is a group of methods mainly Fuzzy Logic (FL), Neural Network (NN), and Genetic Algorithm (GA) and Bacterial foraging optimization (BFO) etc. Soft computing methods generally do not require human intervention they perform the segmentation task automatically.

## II. EXISTING SYSTEM

The existing method for plant disease detection is simply naked eye observation by experts through which identification and detection of plant diseases is done. For doing so, a large team of experts as well as continuous monitoring of plant is required, which costs very

high when we do with large farms. At the same time, in some countries, farmers do not have proper facilities or even idea that they can contact to experts. Due to which consulting experts even cost high as well as time consuming too.

#### Drawbacks of the existing system:-

- Existing approaches of plant disease identifications are time-consuming and unmanageable.
- Plant disease identification by visual way is more laborious task.
- The existing methods are less accurate and can be done only in limited areas.

#### Key Solution:-

Plants play an important role in all the aspects of life. They serve as a backbone to sustain the environment. Plants do suffer from diseases, which affects the normal growth of plants. These diseases affect complete plant including leaf, flower, fruit and stem. Detection of such plant diseases is an important task to perform. The existing method for the identification and classification of diseases from a plant is done with the help of human intervention.

So to monitor the plant disease at an early stage, use of some automatic method can be quite beneficial. **Soft computing technique** having the ability to simulate human thinking is having the capability to perform the task of identification and classification of such plant diseases automatically. Soft computing will take less effort, less time and become more accurate.

### III. PLANT DISEASES

Plants do suffer from diseases, like human beings and animals. These diseases affect a complete plant including leaf, stem, fruit, root and flower. There is the number of plants diseases that occur and affects the normal growth of a plant. Most of the time when the disease of a plant has not been taken care of, the plant dies or may cause leaves drop, flowers and fruits drop etc. Appropriate diagnosis of such diseases is required to for accurate identification and treatment of plant diseases. The diagnosis of diseases depends upon aspects like;

- **Looking for signs or symptoms:** can be seen by naked eyes are the appearance of some unwanted spots, dead areas etc. on the part of the plant.
- **Having the knowledge of the normal characteristics of the host plant:** one should know about the properties of the host plant then it is easier for one to diagnosis the plant disease.
- **The timing of symptoms:** it depends upon two factors
  1. **Disorder:** - Disorders are caused based on some environmental problems, happens suddenly like within a day or week and does not spread over the parts of the plant.
  2. **Diseases:** - Diseases are slow takes several days, weeks, months or even a year to grow, having the property of affecting the other parts of the plant.
- **Noticing the pattern of the diseases on the host plant:** patterns can be uniform and non-uniform in nature. Uniform is known as abiotic that are caused by non-living factors and non-uniform are biotic that are caused by some disease or insect.

Leaf Image	Disease Name	symptoms	Effect	Suitable clinical conditions
	Common Rust	White, Slightly raised spots on the undersides of the leaves and on stems.	Most commonly found on corn leaves causes leaf drop	Cold Temperature

	Leaf spots	Infected plants have brown or black water soaked spots in the foliage.	Found on an shaded trees	Moisture and warm Temperature
	Leaf curl	Reddish area on developing leaves. These areas become thick and causing curl	Observed on peaches, almonds and apricots plants	Cold & wet weather (Spring Season)

#### IV. LITERATURE REVIEW

The analysis, grayscale images are easy to process and implement. [1] They have better clarity and suited for analysis than RGB images. Histogram equalization is used to enhance the contrast of the images and provides a clear image to human eyes. So, these types of images will be used to analyze and diagnosis the plant leaves diseases and determines the level of the disease of the plant leaves. The mobile phone has become available at the grass-root level providing different social and economic benefits. This proposal aimed to develop a user-friendly automated system for the farmers that will help them in determining detection diseases of leaves without bringing an expert to the field.

##### **Content-Based Image Retrieval (CBIR) [3]:-**

The authors had taken the approach of the CBIR Technique, which is used for content-based retrieval of images. Both the query image and database image are extracted based on color, shape, and texture and are stored in a separate database which has undergone similarity measurement using Euclidean distance. The output images are retrieved based on the threshold value.

##### **Support Vector Machine (SVM) [7]:-**

The author dealt with the classification of leaf diseases using the SVM classifier. The diseased images are preprocessed with the Gaussian filter and are segmented using k-means clustering which produced three clusters. The Euclidean distance measure is calculated. Nine texture and color features are calculated for all segmented parts of a single leaf image. The feature values are given to train SVM classifier which classifies the diseases.

##### **CIG-DFNN (Cross Information Gain - Deep Forward Neural Network) [2]**

The classification is done using CIG-DFNN (Cross Information Gain - Deep Forward Neural Network). In its first phase, the parameters are initialized and training data is fed to the input layer and is processed in the hidden layer producing the classes as output. In the second phase, the parameter value is fine-tuned with gradient descent and the backpropagation method. In DFNN, the CIG rate is performed to diminish the error rate of the hidden and input vector layer.

##### **Advantage:-**

*The accurate classification of diseases by increasing the accuracy rate and diminish the error rate of layers.*

##### **Fuzzy C- Mean (FCM)**

The authors presented the prediction of leaf diseases based on Hierarchical clustering, k-means clustering, and Fuzzy C- Mean (FCM) [4] clustering. The clustering techniques produced many diseased and undiseased clusters. Hierarchical clustering produced better accuracy in terms of performance. Then the features are extracted for disease classification using the SVM classifier.

The remote monitoring of soil characteristics. [5] For a farmer it is important to know the soil and its characteristics so based on it he can develop strategies. The soil has different characteristics like the capacity of holding moisture, temperature, pH value and its

organic components and they help crops grow. They collected soil samples and measured its humidity, pH value and temperature remotely in real-time through smartphones. The author used Bluetooth to remotely monitor between nearby mobile phone and MCU. SMT23 series MCU is used. The designed system works in real-time and is cost-effective and reliable. When the system starts it always checks whether all the devices are connected are not, if they are then data is transmitted over Bluetooth.

## V. PROPOSED SYSTEM

Initially, Images of the infected plants are captured by the digital camera and processed using image growing, image segmentation techniques to detect infected parts of the plants. Secondly apply preprocessing technique that is also known as image enhancement phase on an input image. Then the image is sent to the CNN classification where the leaf and its disease are detected. After applying the CNN the leaf disease segmentation is done by using processes like grey scaling and second is binarization to recognize the leaf disease accurately.

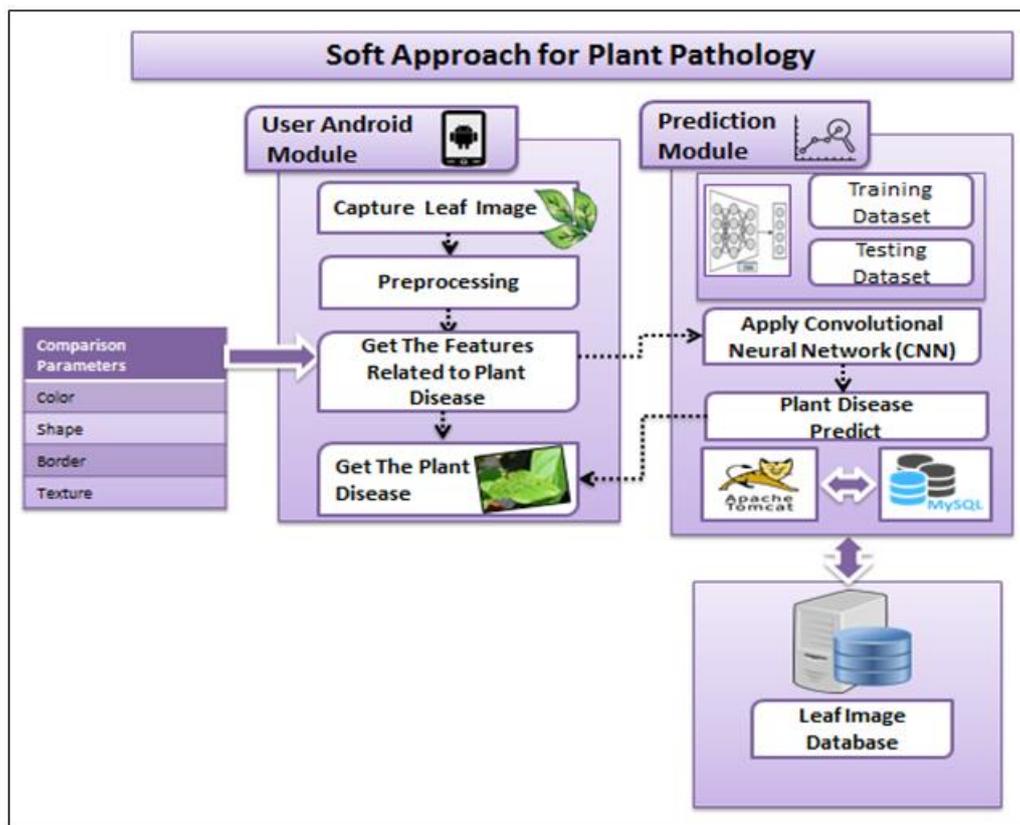


Figure: - System Architecture.

### 1. Camera Capture Using Android:

In this phase, the user can capture the plant leaf image using an android phone. The proposed system for plant leaf disease detection based on the infected images of various plants. Images of the infected plants are captured by the digital camera and processed using image growing, image segmentation techniques to detect infected parts of the plants.

### 2. Image Acquisition and Enhancement

We are getting input images and applying image enhancement techniques which are called as preprocessing phase of an input image.

In Image enhancement noise reduction and contrast adjustment will be performed, following is the formula for the RGB Normalization:

### 3. Image Segmentation

After the alteration of captured image, the processed image is converted to binary level image (black and white image) using the thresholding.

#### 4. Feature Extraction

The Gray Level Co-occurrence Matrix<sup>1</sup> (GLCM) features are extracted to analyze the plant disease. The image is compared with the following parameters,

- i. Leaf Shape
- ii. Color
- iii. Texture
- iv. Border etc.

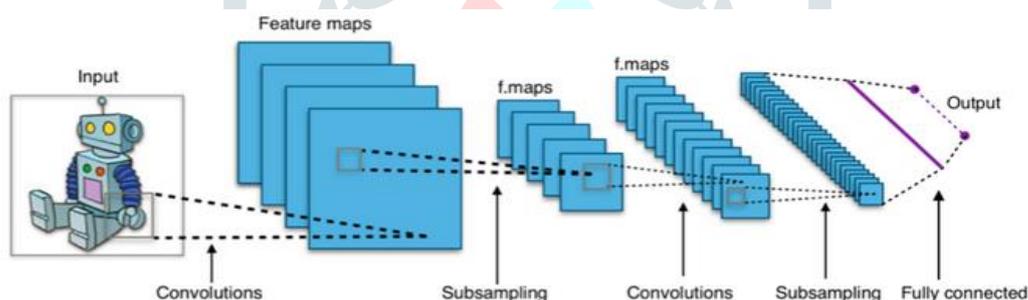
#### 5. Disease prediction

We can apply the Machine learning algorithm on the trained dataset to detect whether the plant is having some disease or not. By using an image processing we can easily recognize the plant disease. The system can use CNN algorithm for prediction.

Algorithm Used

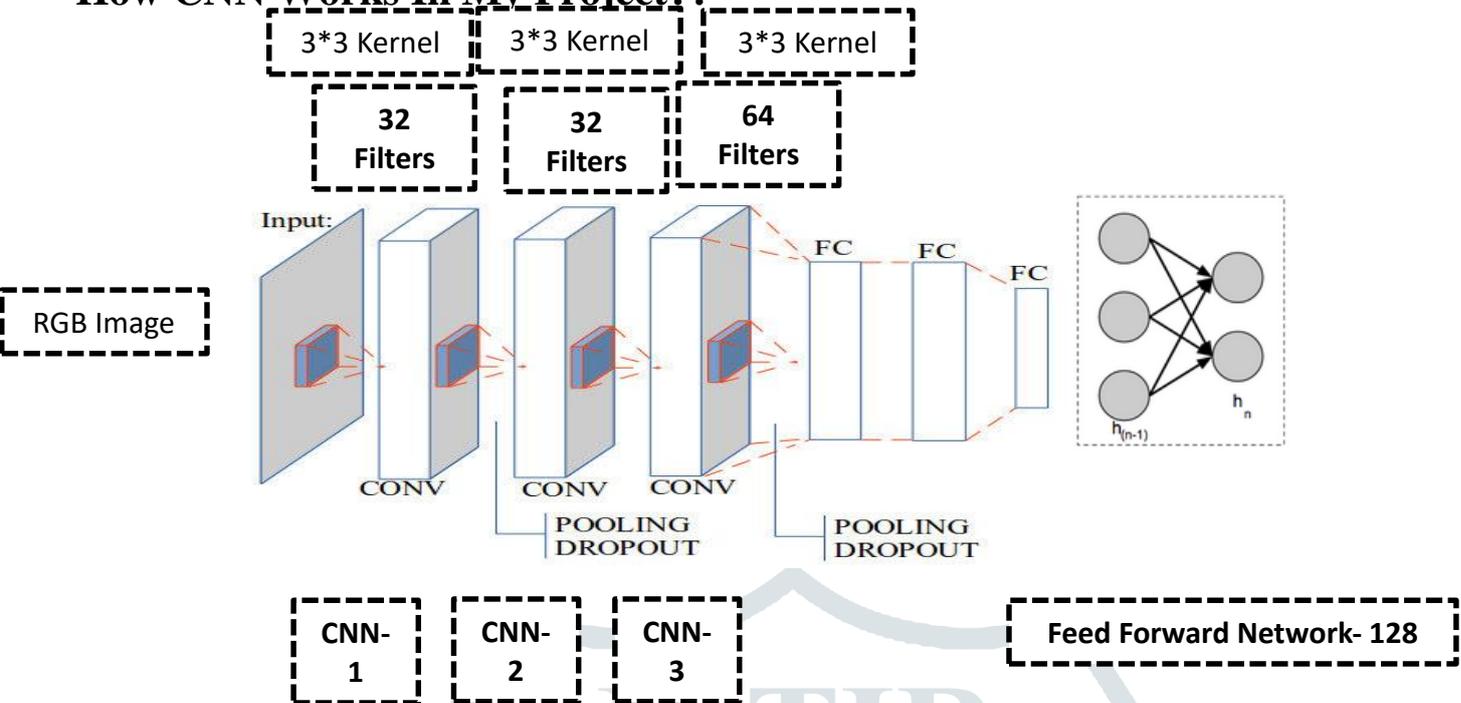
### How CNN Works??

Convolution Neural Network Traditional feature learning methods rely on semantic labels of images as supervision. They usually assume that the tags are evenly exclusive and thus do not pointing out towards the complication of labels. The learned features endow explicit semantic relations with words. We also develop a novel cross-modal feature that can both represent visual and textual contents. CNN is a method of categorizing the images as a part of deep learning. In which we apply a single neural network to the full image. The steps in CNN are as follows: convolution, subsampling, activation and full connectedness.



- **Step 1:** Convolution it is the primary layers that accept an input signal are called convolution filters. Convolution is a procedure where the network tries to tag the input signal by referring to what it has learned in the past.
- **Step 2:** Subsampling Inputs from the convolution layer can be smoothed to decrease the sensitivity of the filters to noise and variations. This smoothing procedure is labeled as sub- sampling, and can be attained by taking averages or considering the maximum over a sample of the signal.
- **Step 3:** Activation the activation layer manages the signal flows from one layer to the subsequent Output signals which are strongly connected with past references would activate more neurons, enabling signals to be propagated more efficiently for identification.
- **Step 4:** Fully connected the final layers in the network are fully connected, such that the neurons of preceding layers are connected to every neuron in subsequent layers. This imitates high Level reasoning where all feasible path ways from the input to output are measured.

## How CNN Works In My Project??



### CONCLUSION

The plant serves as the basic need for any living organisms. They are the most important and integral part of our surroundings. Just like a human or other living organism does plant do suffer from different kind of diseases. The literature survey has its advantages and disadvantages, to overcome its disadvantages and increase the accuracy of the plant disease prediction an attempt is made to develop the system like "Soft Approach for Plant Pathology". So in this work, we have proposed a novel method named as Convolutional Neural Network (CNN) for identification and classification of plant leaf diseases. The proposed method is also superior in terms of computational efficiency for identification and classification of diseases. For this work, we have worked with plant leaf diseases dataset, in future, this work can be extended working on with different databases with dissimilar diseases like bacteria, viruses and so on.

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