

# Plant Leaf Disease Detection using Image Processing

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**Abstract—** As we all are aware of without the civilization we can't think about Agriculture. India is known as an agricultural country this is only because of the economy of India that is properly targeted by grains yielding. It is the pillar on which the economy of every country depends. Now-a-days we can see that due to the increasing graph of population there is a high demand of food and grains and it is only fulfilled by the agriculture.

It is only the sector that is require and puts itself in the topmost position to fulfill the needs of every citizen of the country, so that they can survive and enjoy their life. Agriculture sectors also helps the country to make them more strong in term of relation with other nations. But main point that comes to our mind is that the crop or grain that is shown is healthy, free from chemicals? So to answer that I am writing this research paper because all the foods and grains that we eat is controlled by pesticides and insecticides that harms our body and not good for our health. In this paper I have defined the techniques to detect the diseases in the leaf of the plant by image processing.

**Keywords—** *Image segmentation, Feature Extraction, Alex-Net Algorithms, Image Processing, Convolution Neural Network*

## I. INTRODUCTION

India is one of the most largely production of crop and grains in the world for that reason it holds its place as the spine of country's economy. Our country farmers works day and night to yield their crops but due to not having proper facilities and modern technologies some of them suffer with a huge loss of their crops due to diseases that will stop the crop and destroy it. One of the reason is high price of the modern technologies so that every farmer can't afford it.

Now-a-days we can see that there is a variety of diseases which is very tough to control this will occurs only due to changing climate condition and environment of our country. There are varieties of disease that a plant can suffer from like bacterial pests, viral and sometimes it is due to fungal. We have done a survey and found that in most of the cases plant suffers from fungal diseases[3] as it is very easy to happen like in humans. It is all about 80-86% that plants can suffer from fungal diseases. Sometimes these diseases are very very tiny so that they can't be observed or seen by the naked eyes.

Farmers are using many kinds of pesticides and insecticides to get control over these diseases. Traditional method is used by 90% farmers in the country this is only because of too much cost of workers if they use modern technologies to

control these diseases. We have created a model that will help the farmer to detect the accurate disease in the plant through image processing and CNN[4]. This will reduce the number of disease in the plant and helps farmer to yield their crops at a high scale, so that it helps the nation to build a strong backbone of the economy of the country.

## II. LITERATURE SURVEY

Our main motive is to design a system that will be helpful for detecting diseases in plants. Our system will easily detects the virus, fungal and bacterial diseases in the crop and alert the farmer about that disease, so that they can easily look up the disease and take necessary precautions to avoid the loss of the crop with pests and insects.

In a short period of time the crop is free from disease. In fungal and bacterial disease we can easily find that there is some spots or yellowness on the leaf of the plant this objects can be predicted by the image processing technique. For a right and accurate prediction we have taken some of the dataset[6] of accurate and healthy leaf that are free from diseases. This feature will helps us to recognize the disease more accurately and easily without affecting the affected leaves in the plants.

There are so many machine learning algorithms used while processing any image and to detects the disease some of them are given below—

- CNN algorithm
- ANN algorithm
- SVM classifier
- Canny edge detection
- Alex net algorithm

There are already so many research has been done over this topic to detect the diseases in the leaf of the plant using image processing. Some of the good research paper list have been updated below to see that what technique has been used by others for the same problem.

S. No.	Title of the paper	Year of Publication / Author	Publisher	Methodology	Findings
1	Applying Image Processing Technique to detect plant disease	2012/Anand H. Kulkarni, Ashwin Patil R.K	International Journal of Modern Engineering Research	Images are captured using cameras are made to undergo preprocessing steps.	The system developed here is for plant diseases recognition which is based on Gabor filter for feature extraction.
2	An effective Algorithm of edges and veins detection in Leaf images.	2014/R. Radha, S. Jayalekshmi	World Conference on Computing Communication and Technologies.	Deficiency detection is done by classification algorithm which classifies leaf is healthy or not.	This algorithm is based on the feature extraction technique using digital image processing.
3	Multiple Nutrients deficiency detection	2016/MV Latte, Sushila Shidnal	International Conference on Communication and signal processing.	Edges along with veins are detected by Canny Edge detection	This algorithm lead to an early detection of deficiency.
4	SVM classifier based grape leaf disease detection.	2016/Pranjali B. Padol, Anjali A. Yadav	Conference on Advances in Signal Processing	Segmentation for image Processing and image classifier issued.	The proposed work can be used to increase the yield of grape cultivation.

Table 1. Various research on Plant leaf disease

### III. PLANT DISEASES AND ITS SYMPTOMS

There is one technique used to determine the pixel of the images known as RGB image feature pixel[1] that is commonly used by the department of agriculture to detect the diseases in the leaf of the plants. We have taken a sample of images of leaf and apply or check these below features on it.

- Detecting shape and size of crop/fruits.
- Detecting the area of leaf that is caught by disease and its color.
- Detecting the area around the leaf in which disease are seen.
- To identify the stem or leaf of the plant that is affected by the disease.

Leaf disease can mainly be classified into three categories bacterial, fungal and virus some of their symptoms are –

#### A. Bacterial leaf disease symptoms

This disease in plant can only be seen when the water[7] from the leaves[15] is purely consumed then we can see a very small green pale spot on the leaf, as soon as the leaf get dry and enlarge the spot on the leaf as the lesions of the leave enlarge their size.



(a) Bacterial leaf spot  
Figure 1. Bacterial disease on leaves

#### B. Viral leaf disease symptoms

Viral disease in plant leaf is very common and very difficult to analyze. As the virus[8] itself is too small to detect that can be observed only under the microscope this will affect the nutrient of the crops and the crop is not good to eat. Whiteflies and grasshopper are the most important insects to bring this disease in plant leaf.



(b) Mosaic Virus  
Figure 2. Viral disease on leaves

#### C. Fungal leaf disease symptoms

Fungal disease can be most easily seen in the leaf of the plant. These can be seen on old leaf that are totally soaked by water and then it will become mature it shows a sign of white darkened spot[12] on the leaves.



(a) late blight (b) early blight (c) downy mildew  
Figure 3. Fungal disease on leaves

#### IV. CONVENTIONAL TECHNIQUES FOR DISEASES DETECTION

For the detection of diseases in plant there is a process which we have to follow that is known as process of classification[2] which are having mainly two parts in it.

- Machine learning algorithms-
- Image processing digitally

Here Machine Learning algorithms are used to detect and analyze the feature of the leaf and detect the accuracy with analyzing them with the dataset. Most commonly ML algorithms that has been used are CNN-algorithm, SVM (support vector machine).

Similarly on the other hands Image that are processed digitally have some objects before processing like capturing of the images, segmentation[4] of the images, extracting feature from the images and finally remove the noise this will easily detect the disease in the leaf of the plant.

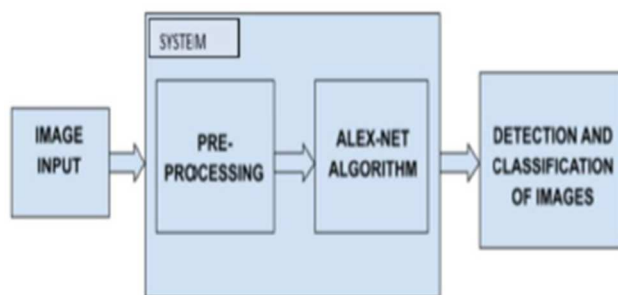


Figure 4. Convolutional disease detection technique

##### A. Working

###### • Image Conversion

In this image conversion we have to convert the RGB to Grayscale that is the most important factor in which there are some pixels given and only a single pixel will be representing the quantity of light which will be holding only the information of the intensity of images.

It is a black-white image only having these two colors and shade of grey sometimes. It will be having black colour at the lowest intensity contrast and white at a very highest intensity contrast.

###### • Detection of Edges

There is a detector that was developed by John F Canny for the detection of edges of images which is known as Canny Edge Detector[11].

It uses many algorithms to detect the edges of the images.

###### • Thresholding

Thresholding[9] of any image is a very important factor as it converts the images into two parts foreground and the background.

Thresholding helps to make a build of images in the form of binary from the given grayscale images[13].

###### • Reduce the Noise

There are so many algorithm developed right now to reduce the noise from the images it will helps us to give the smooth images from the corner while decreasing the contract of images.

This will give a very smoothen images having no noise in it. There are some noise that can be seen in the images are—

1. Pepper and salt.
2. Shot noise.
3. Gaussian noise.

Now we have to process the image by using Alex-Net Algorithm.

This is the algorithm that is used for the processing purpose of the image which is consisting of five layers of convolutional and three layers that are fully connected. Now we have to get the extracted objects or features from the images multiple convolutional kernel[3].

As we can see there are multiple many number of kernels in the single convolutional that are of equal size. For understanding purpose lets take an example—

From the five convolutional layer, the uppermost layer of the algorithm contains the 96 kernel of equal size like 11x11x3. By looking into this we can understand that for a single layer two parameters are same known as height and breadth and for channels we are having the same depth. The top 2 layers of the convolutional are using the logic of overlapping pooling[10] which is at max, and the remaining three are interlinked together. The last most layer is also following the same concept of overlapping max pooling for which the result of fifth layer will be seen in the layer of 2 layers that are fully connected layer in series with each other. The middle layer known as second layer of fully connected goes into softmax classifier with a layer of 1000 class. At last we have to apply the ReLU concept.

##### B. Figures

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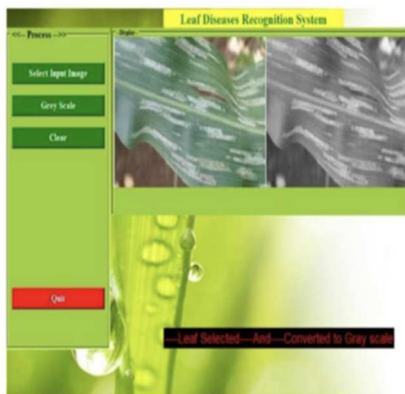


Figure 5. Scale conversion from RGB to GREY

- While processing any image segmentation process is very important tasks referred as surveillance purpose, image that can be used when we need and recognition of pattern.

The main motive or objective of the segmentation is to get better understanding of the image while identify the region around the images. It is mainly used to figure out the lines and boundaries in the image for better processing purpose. It will also helps in see the curve in the images its intensity[14] and texture for good analyze purpose.

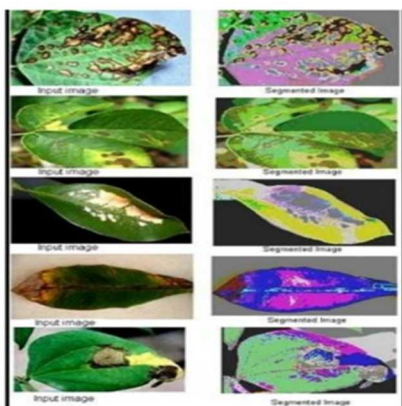


Figure 6. Segmentation of Image

## V. CONCLUSION

There are varieties of plant that suffer with bacterial, fungal and viral disease which will lead to the huge amount of loss to the crop production as well as the economy of the nation.

But now-a-days everyone is aware of the modern technologies that is developed to detect the disease in the plant leaf. One of the method that we have implemented is by using image processing by Alex-Net Algorithm that will easily classify the disease in the plants leaf and alert the farmers to take care of the crop on time, so that there is no loss to the crop production.

We have correctly analyze Sorghum leaf disease through image processing using python.

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