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# Smart Plant Disease Detection System

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***Abstract***— *Food is one of the basic needs of human being. Population is increasing day by day. So, it has become important to grow sufficient amount of crops to feed such a huge population. Agricultural intervention in the livelihood of rural India is about 58%. But with the time passing by, plants are being affected with many kinds of diseases, which cause great harm to the agricultural plant productions. It is very difficult to monitor the plant diseases. It requires tremendous amount of work, expertise in the plant diseases, and also require the excessive processing speed and time. Hence, image processing is used for the detection of plant diseases by just capturing the images of the leaves and comparing it with the data sets available. Latest and fostering technologies like Image processing is used to rectify such issues very effectively. In this project, four consecutive stages are used to discover the type of disease. The four stages include pre-processing, leaf segmentation, feature extraction and classification. This paper aims to support and help the farmers in an efficient way.*

***Keywords***— ***CNN Algorithm, Disease Detection.***

## I. INTRODUCTION

Agriculture is the backbone of our country. It is one of the most important need to bring technological advancement in the fields related to crop productivity. Research initiatives and tentative study process in the important domain of qualitative farming towards improving the yield, with greater monetary outcome. Modern technologies have given human society the ability to produce enough food to meet the demand of more than 7 billion people. However, food security remains threatened by a number of factors including climate change. Plant diseases are not only a threat to food security at the global scale, but can also have danger consequences for small farmers whose livelihoods depend on healthy crops. Vegetable and fruits exist as one of the present significant agricultural achieved output. Diseases are disablement state of the plant that translates or hinders its important roles such as transpiration, photosynthesis, fertilization, pollination, germination etc. These diseases are spawned by pathogens like, fungi, bacteria and viruses, because of unfavorable environmental situations. Accordingly, the preliminary stage for diagnosing of plant disease is a significant task. Plant disease identification by visual way is more arduous task and at the same time less effective and can be done only in limited areas. Whereas if automatic detection technique is used it will take less efforts, less time and will provide with more accuracy. Farmers need periodic monitoring by paid professional which might be prohibitively costly and time absorbing. Thence, looking for quick, less costly and precise way to detect the diseases is the need of modern era. In our study we are proposing a system which can be used to identify the particular type of disease in plants leave might have. It is of major concern to identify the type of disease in an important crop like tomato, potato can have, by implementing technologies like image recognition. Image processing is the technique which is used for measuring affected area of disease, and to determine the difference in the color of the affected area. Machine based approaches for disease detection and classification of agricultural product have become an important part of civilization. It presents a review on existing reported techniques useful in detection of disease. It also describes application of agriculture using computer vision technology to recognize and classify disease of plant leaf.

The paper deals with association between disease symptoms and impact on product yield. It also deals with the number of training data and testing to accomplish better accuracy. They proposed mobile based design for leaf disease detection using Gabor wavelet transom (GWT). In this system firstly color conversion from the device dependent to color space model.

## II. KEY CHALLENGES

Many researchers had done research on various types of plants and their diseases also they had given various techniques to identify that disease. Here is a quick review about the key challenges faced by us:

- Quality of captured image
- Dataset should be enough large to divide into data set and test set
- Collected images may contain noises.
- Segmenting the exact point of disease that it can find accurately.
- Color of plant leaf changes depending on climate.
- Classification plays a role in recognizing segmented spot into meaningful disease.
- Regular classification is needed for some specific plants.
- Identifying diseases for different plant leaves is challenging.

## III. IDENTIFICTION OF DISEASE

The need of this section is that researchers can understand various type of image processing operation and type of feature need to be considered when observing various diseases. Disease to the plants takes place when a virus, bacteria, fungi infects a plant and disorders its normal growth. Effect on plant leaves can vary from discoloration to death. Disease causes due to including fungi, microbes, viruses, nematodes etc.

- *Rust*: It is usually found on leaves lower surfaces of mature plants. Initially raised spots on the undersides of leaves. As time passes these spots become reddish-orange spore masses. Later, leaf pustules turn to yellow-green and eventually black.
- *Yellow leaf Disease*: This disease caused by pathogen Phytoplasma in arecanut where green leaves tuning into yellow that gradually decline in yield.
- *Leaf Curl*: Disease can be characterized by leaf curl. It can cause by fungus, genus Taphrina or virus.
- *Leaf Spot*: It is serious bacterial disease found in chili spread by Xanthomonas campestris pv vesicatory.
- *Late Blight*: Late Blight spreads rapidly. The development of the fungus due to Cool and wet weather. It forms irregularly shaped ashen spots signs on leaves. Around the spots there will be a ring of white mold.

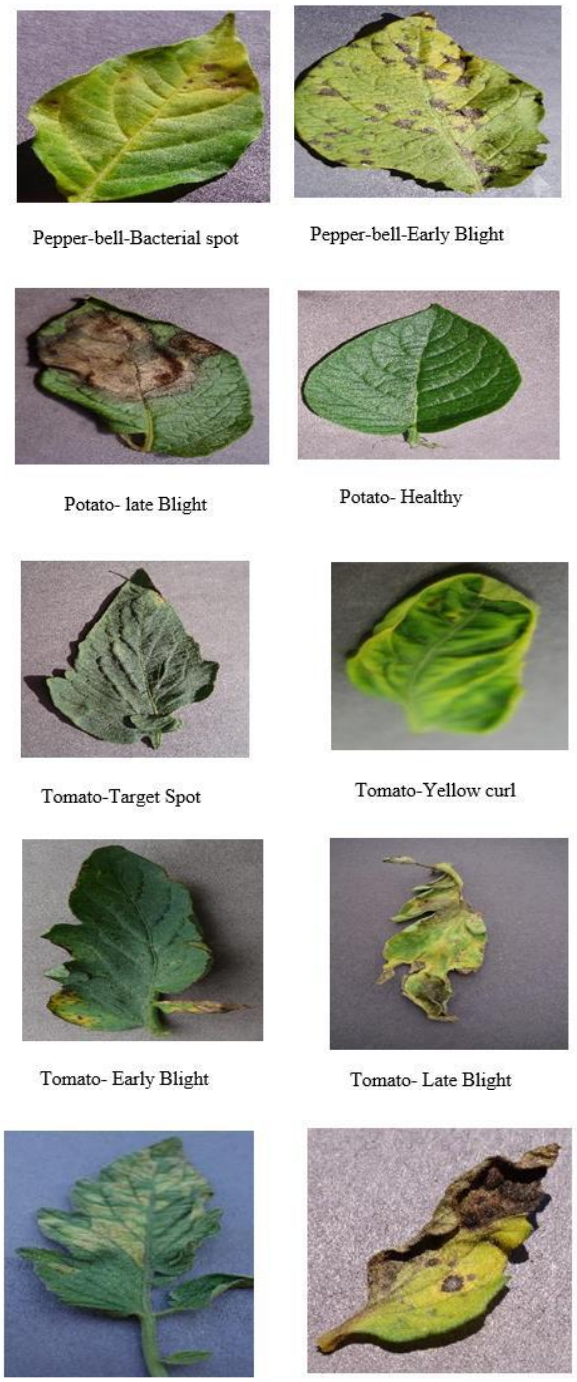


*Fig.1 Different Types of Plant Disease*

## IV. METHOD APPROACH

Our Project on "Smart plant disease detection" is working on the Principle of CNN algorithm. We have designed and tested algorithm on "Anaconda 3 python software: Stages of system designs are:

*4.1 Data Preprocessing:*

Data pre-processing is crucially important to a model's performance. Viral, bacterial and fungal infections can be difficult to distinguish. The dataset should be taken as large as possible. If the Dataset being small then it may be difficult to take out accurate estimation of Image classification. The dataset should contain atleast 15000 image of leaves out of which that is divided into train data set and test data set. If the dataset is small then we have to use Augmentation Technique so that accuracy can be maintained without disrupting any compromises in the efficiency. Augmentation Techniques includes various type of functionalities like rotation, zoom, adding color changes. We have formed village dataset of around 15000 images in which 11378 images in train set and around 4348 images in data set.

*4.2 CNN Algorithm:*

In this deep learning convolution neural network is implemented. We have designed a five layers neural network having dense layer, convolutional layer, batch normalization, activation function layer of increasing domain. The primary purpose of convolution in case of a ConvNet is to extract features from the input image. Convolution preserves the spatial relationship between pixels by learning image features using small squares of input data. Non-linearity Relu layer used to changes the negative pixels into zero order pixel. Spatial Pooling layer is used to reduce the dimensionality of the feature pixel map.

## V. RESULTS

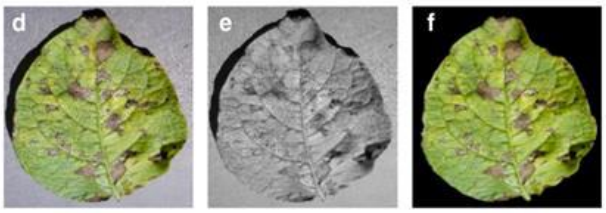


*Fig.2 Segmented and Gray Scale Image*

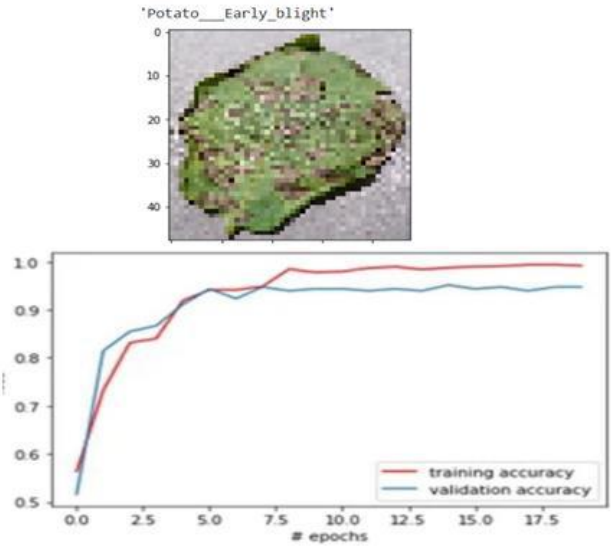


*Fig.3: Result and model accuracy Vs epoch*

## VI. CONCLUSION

This complete study discloses the enhanced performance of the implemented CNN algorithm which is used for detection of different types of plant disease efficiently.

*Table 1. List of reviewed papers and their respective accuracy achievement.*

| **Paper Number** | **Methods** | **Accuracy Value** |
|---|---|---|
| Paper 7 | Discussed hybrid clustering method, used super pixel clustering. | 89% |
| Paper 8 | Two types of fungus in cucumber plant leaves, ANN model with 3 layers were utilized. | 87% |
| Paper 9 | Deep learning method, proposed the Occlusion concept. | 85% |
| Paper 10 | Detection of disease using Automation and ANN. | 88% |
| Paper 11 | Multi feature and genetic algorithm BP neural network, Otsu Method. | 86% |
| Paper 12 | Image recognition and segmentation process, Color co-occurrence method. | 88% |
| Self | Deep neural network using CNN. | 91% |

This paper gives the survey on different diseases classification techniques that can be used for plant leaf disease detection and an algorithm for image segmentation technique used for automatic detection as well as classification of plant leaf diseases has been described. Tomato, Potato, Pepper-bell are some of those species on which the algorithms and methods were tested. Therefore, related diseases for these plants were taken for identification. With very less computational efforts the optimum results were obtained which also shows the efficiency of algorithm in recognition and classification of the leaf diseases.

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