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# Plant Leaf Disease Detection Using Image Processing

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**Abstract- The major cause for decrease in the quality and quantity of agricultural production in plant diseases. A farmer faces very high difficulties in identifying and controlling plant diseases. So, a very huge importance for leafs in order to diagnose the plant diseases at early stages so that the accurate and the suitable action can be done by the farmers to avoid further losses. The project focuses on the approach based on image processing using machine learning for identification of plant diseases. In this project we use machine learning algorithms to test and train the data. The data set contains both healthy and unhealthy leaf images. At last by comparing the input image and trained image we can detect the disease. By this we can control the loss of the crops.**

**Keywords- Machine learning, Image processing, CNN, Plant leaf disease detection.**

## INTRODUCTION

India is among the country where most of the people depend on agriculture. And the major area which decides economy of the nation is agriculture. The agricultural yield's quality and production quantity is affected by ecological parameters like temperature, rain and other climate related parameters which are out of control of human beings.

Another major factor which affects productivity of the yield isthe disease; in this factor we can have control to improve the productivity for quality as well as for quantity of yield. The main threat for pomegranate cultivation is diseases and insect pests. Therefore timely correct diagnosis and careful treatment essential to defend the yield from severe damage and severe loss. Plants diseases may be found in stem, leaves and fruit.

Bacterial Blight, Alternaria and Scab are major diseases that affect the pomegranate fruits. The diseases affects to neighbor healthy pomegranate plants via wind, sprayed rain and through infected cuttings. In destructive diagnosis methods first the fruit is removed from plant and then measured. In non destructive methods dimensions of fruit are measured without removing the fruit.

The technology makes farmers to check the possibility of diseases at primary stages and make possible treatment. A methodology is developed to determine the type of disease the fruit is affected. The traditional approach of recognition of fruit infections is using the bare eye analysis from the professional specialists. Consulting professional experts is costly and time taking because to the unavailability of expert in nearby locations. Classification of fruit diseases and automatically detecting the symptoms as earliest as possible is very important. For prevention of disease, it is required to be detected at early stage so that treatment can be done properly and avoid spreading of the disease.

Advances technologies make it possible to use the images of diseased fruit and detect the type of disease. This achieved by using image processing technology, where features extracted from the images and further used with classification algorithmsto make identification. The leaf infections may occur due to environmental condition changes such as huge rain fall, drastic changes in temperature or may be due to improper maintenance and some insects and pesticides. Once the disease-causing organisms such as bacteria, virus etc. entered into the leaf tissue, they starts multiplying and decreases the strength of the leaf and degradation starts. For instance, it is seen that the outbreak of diseases which leads to large scale death and famine.

The traditional methodology for disease detection is a just optic observation by specialists through that identification and detection of plant diseasesis completed. For doing thus, an oversized team ofspecialists still as continuous watching of specialists are needed, that prices terribly high once farms are massive. At an equivalent time, in some countries, farmers don't have correct facilities or maybe concept that they'll contact specialists.

Because of that consulting specialists even price high still as time overwhelming too. In such condition, the advised technique proves to be helpful in watching massive fields of crops. The automatic detection of the diseases by simply seeing the symptoms on the plant leaves makes it easier still as cheaper.

## II. LITERATURE SURVEY

**Tejas Deshpande, Sharmila Sengupta, K.S. Raghuvanshi** published a paper in the year 2014 on classifying pomegranate plant leaves diseases. They have considered Bacterial blight disease for the diseases classification work. In this work K-means clustering was used for image making segmentation of affected area. First Total pomegranate leaf area calculated say total area and then total affected (i.e. diseased) area calculated say total off. After that disease severity has been found using total_0ff/total area. This is useful for plant pathologists, as according to 7 severity pathologist scan suggest the preventive action. This is not directly useful for farmers.

**In 2018, Saradhambal.G, Dhivya.R, Latha.S, R.Rajesh,** proposed a research paper "Plant Disease Detection and itssolution using image classification" This paper proposed an enhanced k-mean clustering algorithmto predict the infected area of the leaves. The color-based segmentation model is defined to segment the infected region and placing it to its relevant classes. Experimental analysis was done on sample images in terms of time complexity and the area of infected region. Otsu classifier and k-means clustering algorithm is used in this paper. Disease detection contains steps like image acquisition, pre-processing, image segmentation, feature extraction and classification. Alternaria Alternata and Bacterial Blight diseases detected in this paper.

**In 2017, Vishal Mani Tiwari, Tarun Gupta** proposed a research paper "Plant leaf disease analysis using image processing technique with modified SVM-CS classifier" Here, dataset of disease affected leaves is considered for experimentation. The data set contains the plant leaves affected by Alternaria Alternata, Cercospara leaf spot, Anthracnose and Bacterial Blight along with some healthy leaf images. It uses SVM classifier, concept of cuckoo search and image processing techniques using MATLAB.

**In 2015, S. Khirade et Al.** tackled the problem of plant disease detection using digital image processing techniques and back propagation neural network (BPNN). Authors have elaborated different techniques for the detection of plant disease using the images of leaves. They have implemented Otsu's thresholding followed by boundary detection and spot detection algorithm to segment the infected part in leaf. After that they have extracted the features such as color, texture, morphology, and edges etc. for classification of plant disease. BPNN is used for classification i.e., to detect the plant disease.

**Shiroop Madiwalar and Medha Wyawahare** analyzed different image processing approaches for plant disease detection in their research. Authors analyzed the color and texture features for the detection of plant disease. They have experimented their algorithms on the dataset of 110 RGB images. The features extracted for classification were mean and standard deviation of RGB and YCbCr channels, grey level co-occurrence matrix (GLCM) features, the mean and standard deviation of the image convolved with Gabor filter. Support vector machine classifier was used for classification. Authors concluded that GCLM features are effective to detect normal leaves. Whereas color features and Gabor filter features are considered as best for detecting anthracnose affected leaves and leaf spot respectively. They have achieved highest accuracy of 83.34% using all the extracted features.

**Peyman Moghadam et Al.** demonstrated the application of hyperspectral imaging in plant disease detection task visible and near-infrared (VNIR) and short-wave infrared (SWIR) spectrums were used in this research. Authors have used k-means clustering algorithm in spectral domain for the segmentation of leaf. They have proposed a novel grid removal algorithm to remove the grid from hyperspectral images. Authors have achieved the accuracy of 83% with vegetation indices in VNIR spectral range and 93% accuracy with full spectrum. Though the proposed method achieved higher accuracy, it requires the hyperspectral camera with 324 spectral bands so the solution becomes too costly.

**Sharath D. M. et Al.** developed the Bacterial Blight detection system for Pomegranate plant by using features such as color, mean, homogeneity, SD, variance, correlation, entropy, edges etc. Authors have implemented grab cut segmentation for segmenting the region of interest in the image. Canny edge detector was used to extract the edges from the images.

**Garima Shrestha et Al.** deployed the convolutional neural network to detect the plant disease [5]. Authors have successfully classified 12 plant diseases with 88.80% accuracy. The dataset of 3000 high resolution RGB images were used for experimentation. The network has 3 blocks of convolution and pooling layers. This makes the network computationally expensive. Also, the F1 score of the model is 0.12 which is very low because of higher number of false negative predictions.

## III. PROPOSED SYSTEM

Our aim is to develop software that finds and classifies diseases, ultimately providing its preventive measures and cure. So, we a developing a web-based application and an android app for the plant disease detection using image processing and machine learning. The image of the plant will be provided as an input to the system and this image will be further processed using image processing steps.

For this we are using the OpenCV and then the image classification is done using machine learning which will detect the disease of plant. The main algorithm used in the

system is CNN (Convolution Neural Network). All of the system would be implemented using Python Language.

## IV. BLOCK DIAGRAM

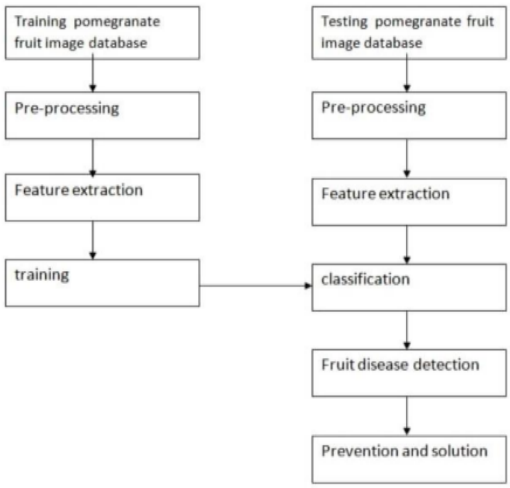


Fig 1. Block Diagram.

## V. DESIGN

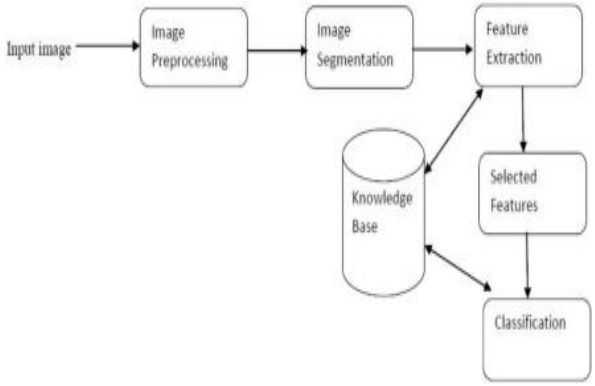


Fig 2. Architecture of diagnosis of pomegranate plant diseases.

Figure show architecture of diagnosis of pomegranate plant diseases using supervised classification system which is capable of recognizing type of the diseases. This approach is based on mainly 4 steps: Image Acquisition (Image Collection), image pre-processing and segmentation, extraction of features and classification in which fruit disease is predicted. Proposed work starts with creation of a dataset (i.e. image set) with all the images for training the system and then for testing.

The image in dataset can have different formats such as *.bmp, *.jpg etc. Images can be read with the help of digital camera. Initially the images were preprocessed for better and clear image Segmentation was applied to mark the region of interest and extract from the input image. The segmentation output is used for the feature extraction the feature set obtained is fed as input to Classification stage for training and classification in order to recognize the fruit disease.

## VI. ALGORITHM

**Input**: Testing image.
**Output**: Identification of fruit disease
**Step1:** Capture images of healthy and defective sample of fruits from the digital camera and store the images in dataset.
**Step2**: The sample images are read form stored training dataset; enhancing the image by making pre processing.
**Step3**: Appropriate features extracted and training file is generated.
**Step4**: Train the CNN using training data and then make detection/classification of image. **Step5**: End.

## VII. ARCHITECHTURE OF CNN

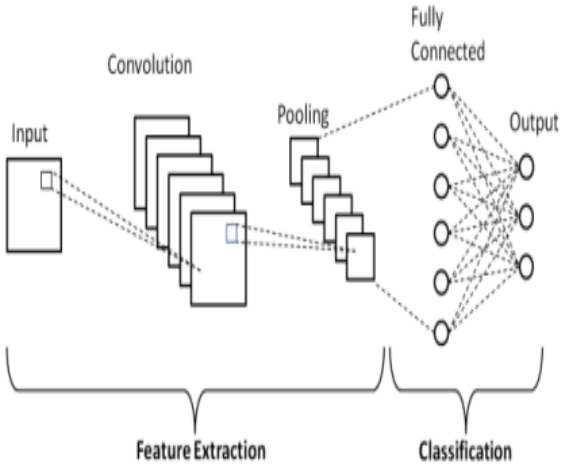


Fig 3. Architecture of CNN.

## VIII. DATASET

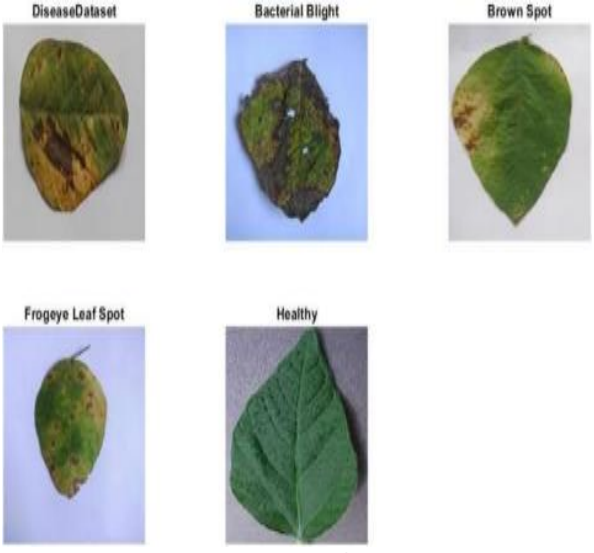


Fig 4. Data Set.

## IX. RESULT

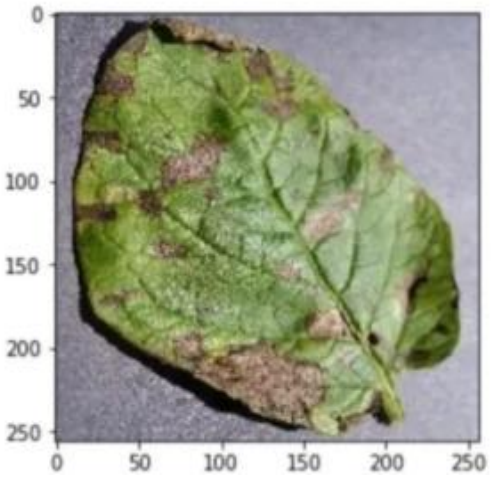

Fig 5. Bacterial Blight.

## IX. CONCLUSION

This paper deals with the application of Convolution Neural Network for recognizing the plant disease. One of the vital applications of image processing is to identify the image which is a vital tool of early disease detection for growth in crop production. This tool will help to lessen the time and cost consumed during manual prediction.

From the results obtained above we can conclude that Convolution Neural Network (CNN) provides a remarkable accuracy in detecting the diseases. This work can be further extended to building a real time application which can identify further species of plants instead of just pomegranate.

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