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# PLANT LEAF DISEASE DETECTION USING CONVOLUTION NEURAL NETWORK

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## ABSTRACT

The major problem that the farmers around the world face is loss due to pests, diseases or a nutrient deficiency. Usually, farmers or experts perform visual inspection for identification of disease. But this method is often time consuming and inaccurate. This paper may be an approach in detecting plant diseases using the deep Convolutional Neural Network. CNN is tutored in detecting plant leaf diseases accurately and within no time. The proposed system uses the MobileNet model,VGG16, a type of CNN for classification of leaf disease. Several experiments are performed on the dataset to get the precise output. This system ensures to give more accurate outcomes.

**Keywords: Deep learning, Convolution neural network, VGG16 model.**

## INTRODUCTION

By 2050, crop production must increase globally by a minimum of 50% to support the anticipated demand. The bulk of crop production currently occurs in Africa and Asia, where 83% of farmers run their families with little to no horticultural expertise. Because of this, yield failures are greater than 50%; as a result, pests and diseases are fitting common. Within the classification of plant crop diseases, the formal method of human estimation by visual analysis isn't any longer feasible. The advancement of computer vision models offers a quick, standardized and valid solution to the current issue . Once trained, a classifier also can be deployed as an application. CNN structures have changed dramatically and refined functions such as ReLu (nonlinearity), padding and overlapping pooling became prominent features in modern architecture. Such developments have helped to scale back training period and also the error rate. Data preprocessing is crucially important to a prototype's performance. Viral, bacterial and fungal infections can be difficult to discern, often sharing an overlap of symptoms. These symptoms

can be any measurable variation in color, shape or function which result as the plant responds to the pathogen. Thanks to this complexity, it's preferable to use RGB data.

## LITERATURE SURVEY

Eftekhar Hossain et al., [1] proposed a system for recognizing the plant leaf diseases with the appropriate classifier K-nearest neighbor (KNN). The features that were extracted through the images of diseased image were used to execute the classification. In the paper, the system KNN classifier classified the diseases commonly found in plants like bacterial blight, early blight, bacterial spot, leaf spot of various plant species. This method exhibited an accuracy of 96.76%. Sammy et al., [2] proposed a CNN for the classifying the disease types and in this paper the author used 9 different varieties of leaf diseases of tomato, grape, corn, apple and sugarcane. In this paper the training is conducted on the system for nearly about 50 epochs and they used 22 size of batch. In this model with the help of categorical cross- entropy, Adam optimizer is conducted. Accuracy obtained is 96.5%. Ch Usha Kumari et al., [3] developed a system that deploys the methods of K- Means clustering and Artificial Neural Network and performs computation of various features like Contrast, Correlation, Energy, Mean, Standard Deviation and Variance were performed. The major limitation was that accuracy of four different diseases was analyzed and the average accuracy is comparatively low.
Merecelin et al., [4] put forward a detailed study of identification of disease in plant (apple and tomato leaf) using the concepts of CNN. The model was trained on leaf image dataset containing 3663 images of apple and tomato plant leaf achieving an accuracy of 87%.

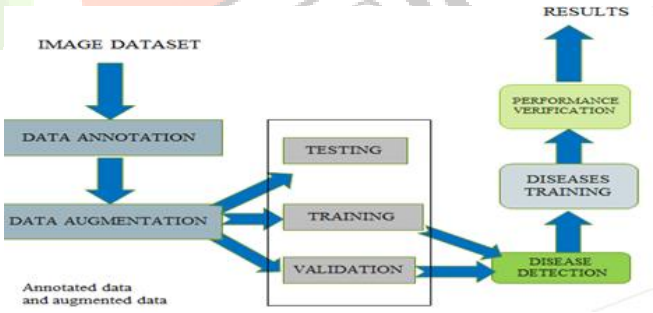
## PROBLEM DEFINITION

Plant diseases have turned into a dilemma as they can cause a significant reduction in both the quality and quantity of agricultural products. Automatic detection of plant diseases is an essential research topic as it may prove beneficial in monitoring large fields of crops, and thus automatically inspect the symptoms of disorders as soon as they appear on plant leaves. The proposed system is a software solution for the automatic detection and classification of plant leaf diseases. This proposal consists of four main steps.First,a colour transformation structure for the input RGB image is developed, then the green pixels are masked and removed using a specific threshold value followed by a segmentation process, and the texture statistics are computed for the user's segment and finally, the extracted features are passed through the classifier. In the classifier, the disease can be identified and a solution for the illness can be found.

## OBJECTIVES

- To design such system that can detect crop disease and pest accurately.
- Apply CNN algorithm to data set and generate model for prediction.
- Detect plant disease from given input and image and display disease.

## BLOCK DIAGRAM




## SOFTWARE REQUIREMENTS

| | |
|---|---|
| Operating system | : Windows 7/10 |
| Coding Language | : Python |
| Development Kit | : Visual Studio |
| Dataset | : Plant village dataset |
| Front End | : Html , CSS, JS |
| Framework | : Flask, Django |
| RAM | : 1GB |

**Python** is used as the **development platform**. It includes libraries which is

necessary to run the code. The libraries used are- Tensor Flow, NumPy ,Pandas, Keras .

## METHODOLOGY

**DATA COLLECTION**: The Dataset that has been attained from the kaggle plant village dataset contains images of several illnesses in many plants. The dataset consists of quite 32,000 plant leaf images with both healthy and diseased. During this system, we consider a number of commercial/cash crops, cereal crops, vegetable crops and fruit plants like sugarcane, cotton, potato, carrot, chilly, brinjal, rice, apple, banana and guava. . The proposed model designed and developed an automatic system which is employed for identification of plant diseases that helps to work out if the plant is infected by a disease or not. The subsequent are the steps during which the method is carried out:

1. Acquiring of the plant image dataset 14 different kinds of plant images containing 38 different classes of plant diseases.

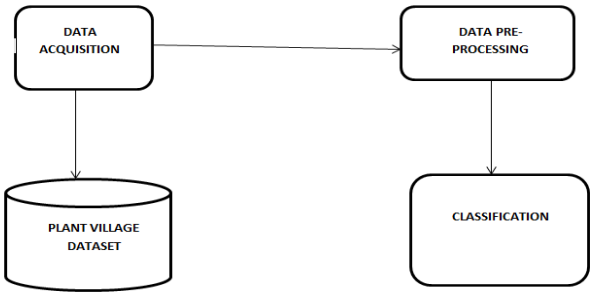
2. Pre-processing of the image in different convolutional layers.

3. Classification of plant diseases stating if the given plant leaf image is diseased or healthy

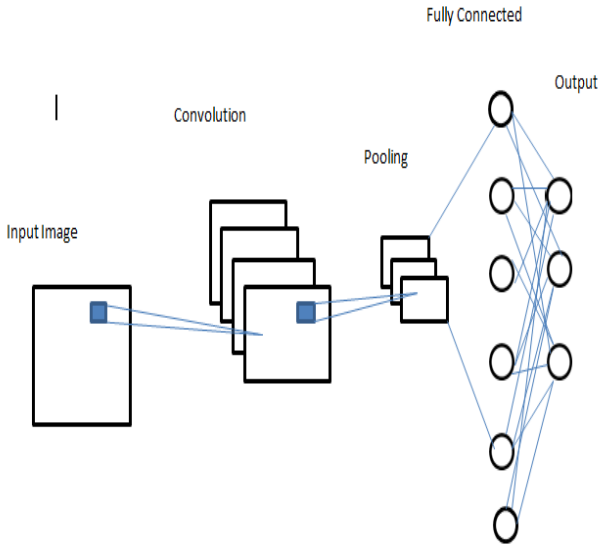
**IMAGE PRE-PROCESSING**: The images in the data are processed by performing data augmentation and data annotation.

**IMAGE ANALYSIS**: Our system's main goal is to detect and identify the class disease within the image. We need to accurately detect the object, as well as identify the class to which it belongs. We enlarge the concept of an object detection framework to adapt it with different feature extractors that detect diseases within the image.

## SYSTEM ARCHITECTURE




## CNN ARCHITECTURE




### CNN Model Steps:

- **Conv2D**: It is a 2D Convolution Layer, where the number of kernel filters are convolved with the input image by moving the kernel by stride of size =2 or 3.
- **Max Pooling**: Max pooling may be a pooling process that chooses the very best element from the region of the feature map covered by the filter. Thus, the output after max-pooling level would be a feature map comprising the foremost important features of the previous feature map.
- **Flattening**: In between the convolutional layer and therefore the fully connected layer, there is a 'Flatten' layer. Flattening transforms a

two-dimensional matrix of features into an array form which is given to the fully connected layer .

- **Epochs**: An epoch may be a term utilised in machine learning and indicates the amount of passes of the whole training dataset the machine learning algorithm has completed. Datasets are usually grouped into batches (especially when the quantity of knowledge is extremely large).
- **Training and Testing Model**: The dataset is preprocessed like Image reshaping, resizing and conversion to an array form. Similar processing is additionally done on the test image. A dataset consisting of about more than 32,000 different plant leaf images obtained, out of which any image is often used as a test image for the software.In this system 70% is given for Training and 30% for Testing and Validation.

## RESULTS


**Figure 1:The tested leaf is diseased and the output displays the disease name "Apple Scab"**

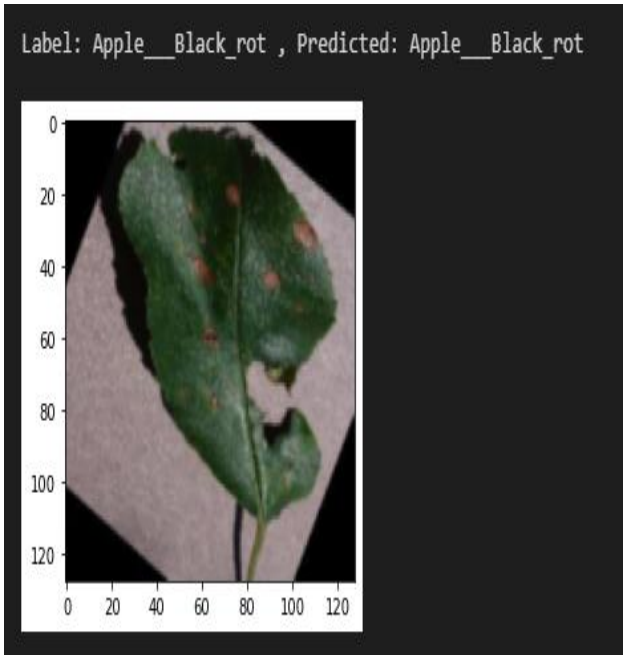
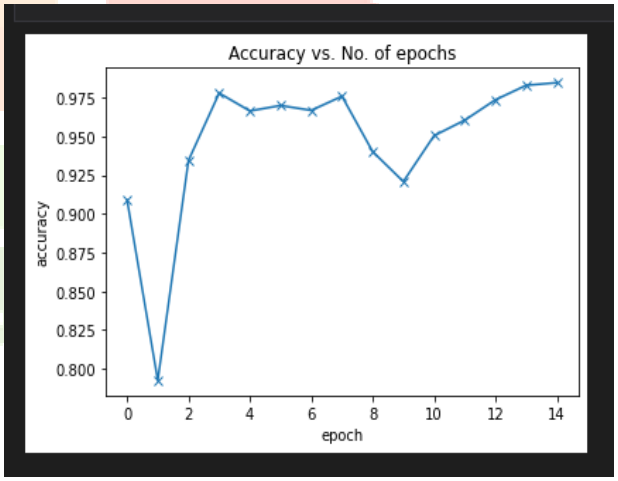



**Figure 2:The tested image is diseased and the output displays the name of the disease as "Apple Black Rot"**

## ACCURACY VS EPOCHS GRAPH:




**Graph**

## APPLICATIONS

1. Detection of plant leaf disease within a short time.

2. Knowing the remedies of the diseased plant .

3. Isolating the diseased plant from other healthy crops or plants.

4. Classifying the nutrient deficiency plants.

## CONCLUSION

Food is the basic necessity of human being. Farmers suffer yield losses due to pests, diseases which lead to agricultural losses. Accurate plant leaf disease detection is necessary for reducing the yield losses due to diseases. The approach of detecting the plant leaf diseases using Convolution Neural Network can be significant. The dataset being obtained from Kaggle Plant Village Dataset consists of more than 32,000 images of both healthy and diseased leaves. By the concept of Deep Learning ,image recognition, image preprocessing, we could detect the plant leaf diseases within short time. This system not only provides accurate output but also gives the remedies for the diseases.

## FUTURE SCOPE

By using new different technologies and methods we can make more faster and efficient applications for user. The pre-trained CNN model can perform image recognition and classification accurately giving 98%accuracy .By increasing the scope of CNN for classification we can get the results within a short time.

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