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## Plant Leaf Disease Detection Using Machine Learning

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### Abstract

The Plant production is severely affected due to various kinds of diseases which if accurately and timely detected, could raise health standards and economic growth significantly. By using disease detection methods, diseases caused by bacteria, viruses and fungi are often avoided. Some of the diseases affected by plants are Rust, Black rot, Downy mildew, Powdery mildew, Gray spot, Black spot, Early blight, etc. For a successful farming system, one of the essential things is disease identification. Different types of disease kill leaves in a plant. For identifying these diseases, farmers get more difficulties. For disease detection, the image processing methods are suitable and efficient with the help of plant leaf images. The various machine learning algorithms used to determine whether a plant is infected or not with a disease, are discussed in this study. Techniques of Machine Learning are often used to identify the affected leaf images. It also, after detection of the illness, says the name of fertilizer to be used. To ensure good quality and high production, it is necessary to have accurate disease diagnosis and control actions to prevent them in time.

**KAYWORDS:** Image Processing, machine learning, Object Detection

### Introduction

Agriculture played key role in development of India economy. If there is decrease in farming, then total economy of a country will get affected. In today era farmers are facing many problems regarding fungal infection or bacterial disease. The causes of leaf disease due to climate changes or due to soil and air pollution causes by humans. The plant disease become important factor which causes significant reduction in the quality and quantity of the crops. The detection and classification of disease is important task in plant disease detection, here we proposed a novel method of the using the CNN algorithm for the detection and provide remedies. Our naked eyes can't detect the which fertilizer used to prevent the crop from disease, so we use computer-based programming data to detect the disease and provide remedies. Plant disease diagnosis is extremely essential in earlier stage in order to prevent and control them, using computer programming system it is easy to detect the disease for larger area and it provides exact detection of disease and remedies because if this process is check by our naked eyes it takes more time and cost to detect the disease and may be not accurately. As

you know small farmer borrow money to purchase basic things like seed, fertilizers and pesticides. Often they borrow money from moneylenders. If the crop get effected and they use pesticides without knowing the proper causes of disease, the plant leaf get damaged due to which the quality and quantity of the crop not good. Due to which they can't return money to the moneylender which causes farmers comes to suicide..

### Objectives

- To detect unhealthy regions of plant leaves.
- Forecasting of plant leaf disease (Quantification) as soon it appears on plant leaves.
- To analyze the leaf infection.
- To give remedy information to the user.
- To make this services available on Mobile App which can run on low level configuration devices.
- To design such system that can detect crop disease and pest accurately.
  - Create database of insecticides for respective pest and disease.
  - To provide remedy for the disease that is detected

### Literature Survey

#### 1. Machine Learning Techniques for Plant Disease Detection

Author : Divyanshu Varshney,  
Burhanuddin Babukhanwala

Published in IEEE : August 2022

Plant diseases may have a major impact on food safety, also a considerable decline in agricultural product output. The great majority of automated systems developed thus far are based on digital pictures, allowing for the rapid deployment of algorithms. The difficulty of autonomous illness identification in plants has been solved using traditional machine learning approaches such as (SVM) support vector machines, Multilayer Perception Neural Networks, and Decision Trees. The focus of this article was on leaf plant disease. A new plant leaf disease detection technique has been

developed that is based on a transfer learning methodology such as deep learning, where CNN is employed as a feature extractor and SVM is used for classification. A benchmark dataset called PlantVillage was used to assess the evaluation of the proposed model. The suggested model was examined and compared to current methodologies, and it outperformed previous work, achieving an 88.77 percent training accuracy.

#### 2. Black Rot Disease Detection in Grape Plant (Vitis vinifera) Using Colour Based Segmentation & Machine Learning

Author : Kirti, Navin Rajpal.

Published in IEEE : 2020

Black Rot is a fungal disease which affects the yield as well as the wine quality and can also cause complete crop loss. It can be identified as brown/tan coloured circular spots/lesions distributed unevenly on the leaf of the plant. A proper detection of the disease is required which can be further helpful in taking active measures like Spraying of Fungicides, Pruning, etc. can be done on time. The PlantVillage Dataset is used, which contains images of grape plant leaves affected from Block Rot Disease as well as the pictures of healthy leaves. HSV and L\*a\*b\* colour models are used for the segmentation purposes. The healthy part and the diseased part of the leaves are separated using colour-based techniques and the features are stored for each leaf. The color of diseased part is very much different from the healthy part of the leaves which makes it easier to detect the disease on the basis of color. The machine learning is done using the Support Vector Machine Classifier and the results are analysed on different Kernels of SVM. The highest accuracy achieved is 94.1%.

### 3. **KrishiMitr (Farmer's Friend): Using Machine Learning to Identify Diseases in Plants**

Author : Parul Sharma, Yash Paul Singh  
Berwal,

Published in IEEE : 2018

Automatic disease detection using visible symptoms on leaves High accuracy (>93%) was obtained with very noisy images, different backgrounds and different disease coverage. Implementation is Automatic. It doesn't provide any expert advice for remedial measures about the disease.

### 4. **Mango Leaf Deficiency Detection Using Digital Image Processing and Machine Learning.**

Author : Mustafa Merchant, vishwajeet  
paradkar

Published in IEEE: 2018

Mango known to a national fruit of India, its leaves are exorbitantly affected by various nutrient deficiencies like nitrogen, iron, potassium and copper. These nutrients can change the natural color of mango leaves. Such leaves are considered to be deficient. The main purpose of this work is to detect various nutrient deficiencies of mango leaves. Initially a data set is created by extracting the different features of mango leaves using digital image processing. The extracted features include the RGB values and the texture of the leaves. This dataset is then used in the unsupervised machine learning model like clustering to cluster the various deficiencies which will help in further detection.

### 5. **Plant Disease Detection Techniques: A Review**

Author : Gurleen Kaur Sandhu

Published in IEEE: 2019

Plant diseases cause major losses in terms of production, economy, quality and quantity of agricultural products. Since, 70% of Indian economy is dependent on agricultural yield, there is a need to control the loss incurred by plant diseases. The plants need to be monitored from a very initial stage of their life-cycle to avoid such

diseases. The traditional method being followed for this supervision is naked eye observation which is more time-consuming, expensive and a lot of expertise is required. So, in order to speed up this process there is a need to automate the disease detection system. The disease detection system needs to be developed using image processing techniques. Many researchers have developed systems based on various techniques of image processing. This paper reviews the potential of the methods of plant leaves disease detection system that facilitates the advancement in agriculture. It includes various phases such as the image acquisition, image segmentation, feature extraction and classification.

#### **Problem Statement**

**“To Detect diseases on leaves of plant and recommend the pesticide As per the types of disease to Farmer.”**

The symptoms of plant diseases are conspicuous in different parts of a plant such leaves.

In order to detect a plant disease at very initial stage, use of automatic disease detection technique is advantageous.

Manual detection of plant disease using leaf images is a tedious job. Hence, it is required to develop computational methods which will make the process of disease detection and classification using leaf images automatic.

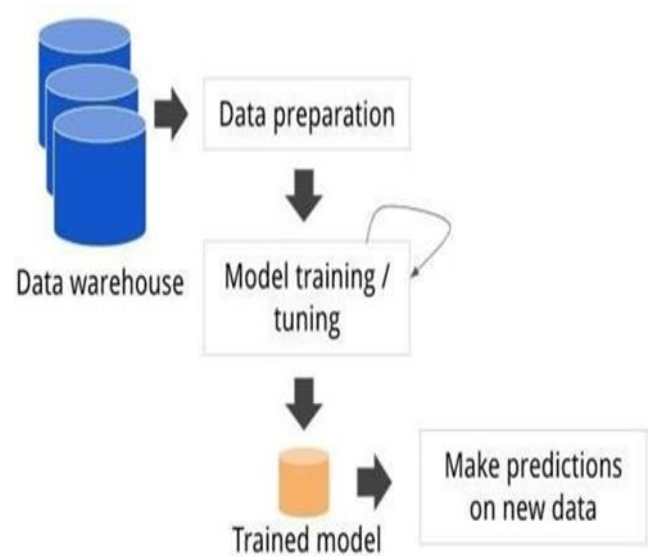
#### **Methodology**

In order to develop accurate image classifiers for the purposes of plant disease diagnosis, we use a large, verified dataset of images of diseased and healthy plants. Then we build CNN (convolutional neural network) model Deep neural networks are trained by tuning the network parameters in such a way mapping improves during the training process. Then this model

will be measured for its performance and we keep tuning neural network model to improve its performance by applying machine learning algorithms.

**Algorithms :**

1. Histogram Calculation:
2. Back Propogation
3. Loss Function

**System Architecture****Disease Name**

CommonRust/healthy

**Disease Precautions Steps**

[1]. Plant disease-resistant corn varieties [2]. Rotate crops to avoid planting corn in the same area for multiple years [3]. Use good cultural practices, such as fertilizing and weeding appropriately [4]. Practice good sanitation by removing infected leaves and debris [5]. Monitor the plants regularly for signs of disease or insect damage.]

**Future Scope**

Automated diagnosis using machine learning can reduce the need for manual inspection, saving time and labor costs. By automating the process, farmers can focus on other aspects of crop management. One of the key benefits of machine learning is that it can learn and improve its accuracy over time. As more data is collected, machine learning algorithms can better recognize and diagnose diseases, reducing the likelihood of misdiagnosis.

**Conclusion**

Disease different stages of the disease so to the accuracy with which the severity of the disease measured is depends upon segmentation of the image. Simple threshold segmentation is used to symptoms of the plant vary significantly under the calculate the leaf area but this method is not suitable to calculate the area of the lesion region because of varying characteristics of the lesion region. Triangle method of the thresh holding used here to segment the lesion region. The average accuracy of the experiment is 98.60 %. Thus image processing technology to measure plant disease severity is convenient and accurate. This eliminates subjectivity of traditional methods and human induced errors. It will helps to farmers to decide the specific quantity for pesticide application which reduces the cost and environmental pollution.

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