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# Plant life forecasting using Machine Learning Techniques

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## ABSTRACT

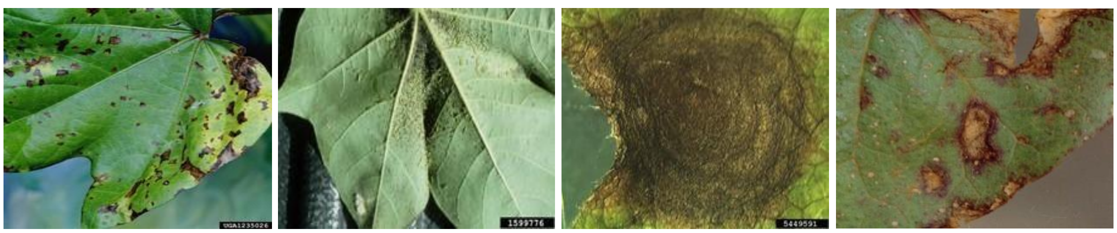
Since India's economy is predominately agricultural, timely diagnosis of plant diseases is essential to reducing financial losses. Millions of rupees are annually spent to protect crops from a variety of diseases, but this is only possible because of the antiquated techniques for identifying plant diseases. Plant disease detection by humans is, at best, unreliable. Even with the assistance of specialists in plant diseases, the time, effort, and expertise needed to detect the particular sickness, there is no assurance that the results will be accurate. Image processing and machine learning are two such technologies that have demonstrated efficacy in this area. We provide a use case of machine learning for a specific issue in plant disease diagnosis using camera-collected plant photos.

**Keywords**: “Open CV,” “SVM,” “feature extraction,” “segmentation.”

## I.INTRODUCTION

We discuss the challenge of accurately diagnosing illnesses based solely on images of plant leaves in this article. Plant diseases in the agriculture sector can lead to considerable output and financial losses. The management of diseases is a challenging task. Symptoms of disease, such vivid spots on the leaves, are sometimes the first to be noticed. Finding the cause of plant diseases may be difficult for farmers. Since the therapy for each sickness differs depending on the type of virus, fungus, or bacterium causing it, this could lead to crop loss. Currently, the majority of disease detection is done manually. When illnesses strike, farmers must regularly check on diseased plants. It takes time to identify diseases in this way, and caution must be taken when selecting plant pesticides. The main causes of plant disease include bacteria, fungi, and viruses. These organisms' diseases are accompanied by various visual symptoms. We focus on applying machine learning and image processing to detect plant diseases in this project. As part of the primary processing operations, field images must be obtained and preprocessed. After splitting up images of the sick leaf sections and extracting attributes, the disease is then categorized using machine learning techniques.

A key aspect of the system's overall performance is how successfully machine learning and image processing activities are carried out within the system. The effectiveness of machine learning algorithms can be used to gauge efficiency. We conduct a literature study of studies involving machine learning and image processing for the diagnosis of plant diseases in order to better understand the various methodologies that have been used up to this point. As a result, we can raise the caliber of the final output.



“Fig.1 cotton plant with infected leaves”

## II. LITERATURE SURVEY

The diagnosis of plant diseases requires a combination of machine learning methods and visual processing. As soon as the illnesses are discovered and diagnosed on plants, the losses may be minimized and the agricultural yield can be maximized. Researchers use a wide variety of techniques to try to pin down the source of plant diseases.

1] The author devised a Smartphone-based method to quantify the frequency and impact of plant diseases. For this they collected 7386 images of leaves of cassava plant[1]. These images are divided into different categories. This is the first of five picture categories; four depict diseases, one depict health. There are five distinct degrees of severity within each of these classes. The scale runs from 1 (healthy) to 5 (very ill). In this system user capture image and upload that image to the server. Server recognizes disease using different categories and also identify its severity level from 1to 5. The color and shape of image is mainly considered for feature extraction. They use HVC color transformation and ORB feature extraction to extract the features from leaves. Used three classifier linear SVC, KNN and Extra tree for classification and also used scikit-learn tool box for learning.

2] The author develop a method for spotting diseases in palm oil leaves[2]. The Anthracnose and chimaera are two diseases present on the palm tree. These illnesses are recognized based on the spots over the palm oil leaf. The Camera used for capturing the photographs of leaves. Any kind of camera may be utilized. The photograph is then uploaded to a computer for further analysis. Computer gets the picture and also run the matlab which is used for detecting purpose. Noise in images is reduced by contrast enhancement, which is used to improve picture quality. Following that, the picture is transformed from RGB to L*a*b[3]. The information is then clustered using K-means and assigned colors. They employ graycomatrix to extract characteristics. A co-occurrence matrix of grayscale photos might be generated in this manner. When a multiclass support vector machine (SVM) classifier [4] has been used, its accuracy is evaluated.

3] The author develop a method that uses digital image processing to identify and categorize citrus leaf diseases. These datasets are then arbitrarily split into test and training sets. One of the first things they do is take pictures with a digital camera. They downsize the picture to 256 pixels on each side after capturing it. Following this, photos are preprocessed by converting RGB colour images to the L*a*b colour space. Next, the pictures undergo a process called segmentation. The k-means clustering technique[5] is employed for this purpose. Infected areas of a picture may be discovered using this approach. Extracting features is the next stage. The texture-based Gray-level co-occurrence matrix [6] is utilized for this. The technique helps recall five qualities, including contrast, energy, homogeneity, and correlation. In this context, the SVM classifier becomes quite useful [7].

4] The author develop a method for monitoring Soybean plants for signs of illness. Specifically, they resorted to image processing because of the following factors. 1) Identifying the afflicted leaf is step one in 2) Identify the afflicted region [8]. A digital camera is used to capture the images. Since the camera captures images in the RGB colour space, the picture must be converted to the L*a*b colour mode. Using k-means clustering, we segment images to identify sick and healthy tissue. In order to determine what proportion of tissue is affected by the illness, one uses the formula “P=AD/AT*100.”

## III. METHODOLOGY for Open CV:

Open CV is a Python package intended to address issues with computer vision. Open CV is constantly growing in its support for computer vision and machine learning methods. Open CV is compatible with languages like C++, Python, Java, and others. Open CV's Python API is called Open CV-Python. Most valuable features of Open CV Open CV combines the C++ API with the Python programming language.

## IV. SUPPORT VECTOR MACHINE (SVM):

The support vector machine (SVM) is often used as a method of classification in the field of disease prognosis. This method is a kind of algorithm for learning under supervision. Mathematical programming and kernel functions are employed for the actual implementation. In two-class classification, the hyperplane is drawn such that it is exactly halfway between the two groups. The instances of data known as "support vectors" are what are ultimately employed to create the hyperplane. The margin is the distance between the hyperplane to the closest support vector. In order to achieve enough separation, the margin of error should be maximized. Large distances mean less room for mistake, while narrow margins make it more vulnerable to outside influences. It's not possible to have any points inside such a margin.

The general process of using traditional image recognition processing technology to identify plant diseases. The K-means clustering method to segment the lesions regions, and combined the global color histogram (GCH) color coherence vector (CCV) local binary pattern (LBP), and completed local binary pattern (CLBP) was used to extract the color and texture features of apple spots, and three kinds of apple diseases were detected and identified based on improved support vector machine (SVM), and the classification accuracy reached 68%. Four tomato leaf diseases, including early blight and late blight leaf mildew and leaf spot, and extracted 18 characteristic parameters such as color, texture, and shape information of tomato leaf spot images, using stepwise discriminant and Bayesian discriminant principal component analysis (PCA), respectively. Principal component analysis and fisher discriminant methods were used to extract the characteristic parameters and construct the discriminant model. The accuracy of the two methods reached 78.71% and 88.32%, respectively.

Disadvantages given below

In short, it can be concluded that studies on plant disease recognition based on traditional image processing technology have achieved certain results, with high accuracy of disease recognition, but there are still deficiencies and limitations as follow:

1) The research links and processes are cumbersome, highly subjective, time-consuming and labour-consuming;

2) It is heavily dependent on spot segmentation;

3) It is heavily dependent on artificial feature extraction;

4) It is difficult to test the disease recognition performance of the model or algorithm in more complex environment

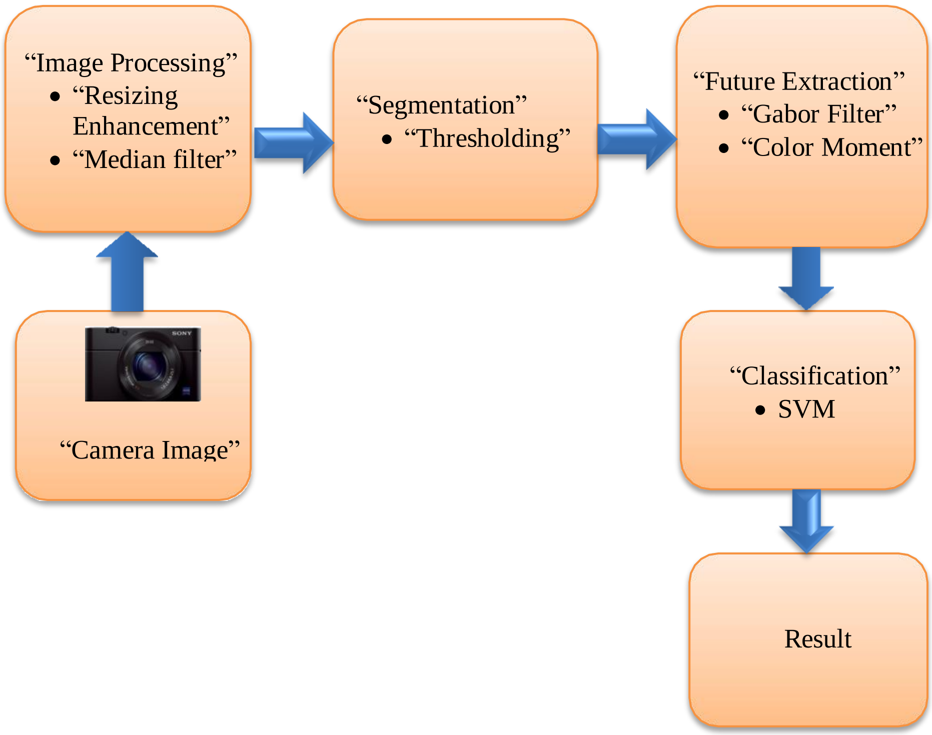
**V. PROPOSED SYSTEM**

To foretell the plant's vitality, we're coding a web app right now. The initial step will be to transmit periodic plant photos to the server, in this case of a cotton plant. The client's name and phone number will be stored in our database. Segmenting the picture upon receipt allows us to obtain the characteristics necessary for illness detection. Once the dataset has been obtained via feature extraction, the SVM technique may be used for training the model. Then, we'll put that model to the test using real-world data. Then, we'll determine whether the plant is sick by analysing real-time data (camera photos, for example). And please provide the medicines that will heal the sick plant. Indicators of a plant's vitality will be texted to the client's phone number on file.

**ADVANTAGES OF PROPOSED SYSTEM**

- Recently, the convolutional neural networks (CNN), a special of deep learning techniques, are quickly becoming the preferred methods [7].
- CNN is the most popular classifier for image recognition, and it has shown outstanding ability in image processing and classification [8]. Deep learning approaches were first introduced in plant image recognition based on leaf vein patterns [9].
- The performance of this network was compared with SVM, BP, AlexNet, GoogLeNet, ResNet20, and VGG16. The accuracy of these models were 68.73%, 54.63%, 91.19%, 95.69%, 92.76% and 96.32%, while the accuracy of the proposed AlexNet-precursor + Cascade Inception network was 97.62%

- The observations are made in terms of leaf disease prediction accuracy, model accuracy of deep learning models, time and space complexity analysis.




"Fig. 2 System Architecture"

**Proposed Algorithm:**

**Algorithm:** Cascade Inception based Deep CNN with Transfer Learning

**Inputs:**
Apple Crop Leaves as Training Data *D*
Apple Crop Leaves as Test Data *T*
batch size *m*
number of epochs *n*

**Output:**
Results of Prediction *P*

1. Initialize feature vector *A* for all features
2. Initialize feature vector *F* for selected features
3. Initialize model *M*
4. *A* = FeatureExtraction(*D*)
5. *F* = FeatureSelection(*A*)

**Deep Learning Model**

6. Add convolutional layers
7. Add max pooling layers
8. Add cascade inception
9. *M* = TrainModel(*F*)
10. For each Epoch *e* in *n*

11. For each batch *b* in *m*
12. Update M
13. End For
14. End For

**Fitting the Model**

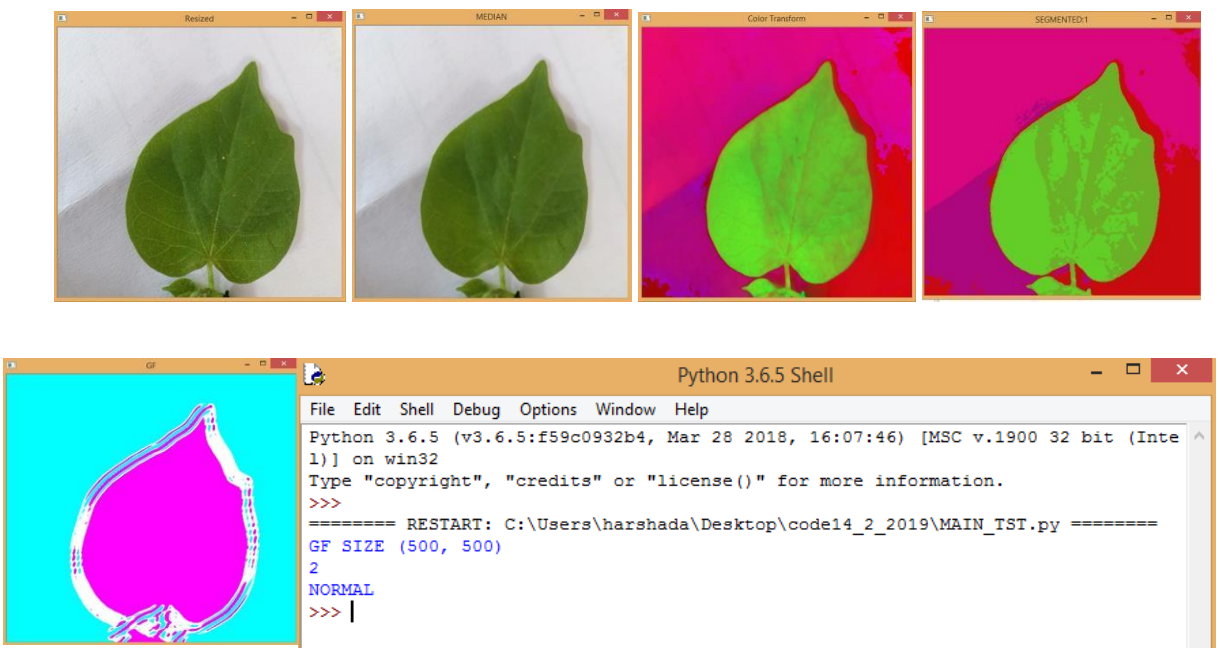
15. *M'* = FitModel(*M*)
16. *M'*=UpdateModelWithTransferLearning(*M'*)

**Prediction and Evaluation**

17. *P* = PredictionOfDiseases(*M'*, *T*)
18. *R* = ModelEvaluation()
19. Print *R*

Return *P*

## VI. RESULTS AND DISCUSSION




"Fig.3 Implications of a leaf in good health"


**"Fig.4 Evidence of leaf disease"**

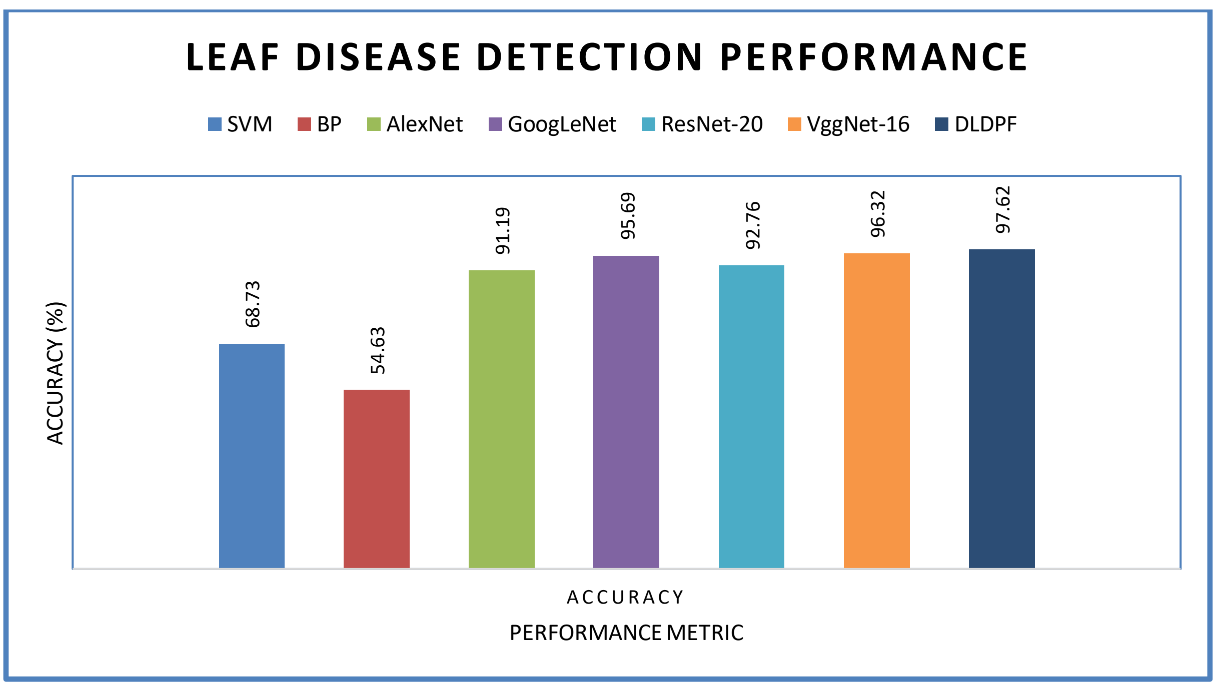



**Fig 5 Shows Leaf disease detection performance comparison**

## VII. CONCLUSION AND FUTURE SCOPE

We conduct a literature review on image processing and machine learning strategies for disease identification and classification in cotton leaves in order to pave the way for the development of an automated system to offer early warning of illness. Image processing and machine learning may help with plant disease diagnosis and classification, which is crucial for effective crop production. This initiative helps find diseases and provides suggestions for treatments.

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