Machine Learning Based Leaf Disease Detection

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Abstract: ***India is mainly known for land of agriculture. Majority of the population depends on agriculture. Farmers are unaware to find the disease of the crops which may affect their livelihood. This is one of the major problems where the farmers are facing. To overcome this problem, a device which detects the disease of the leaf using Image processing and machine learning. With the help of image processing, the affected leaf pictures are taken as reference detects the disease of the leaf. Mean Shift algorithm and SVM classifier are used for segmentation and in classification of the disease. This application is used for farmers in identifying the disease of the leaf.***

I. INTRODUCTION

India is well experienced for farming and around 60% of the group dependent on farming. The contribution towards the agriculture is majority in India. As the contributions of the crops are high, the production of the crop and the profits in agriculture is required. Therefore, disease detection in plants plays an important role in the field of agriculture. This technique is very beneficial in detecting the disease of a leaf at an initial stage.

The existing method of identification and detection of a leaf disease is based on just unaided eye perception of an expert. For this process, an expert has to monitor the leaves of the plant very often. This may costs high when considering large amount of farms. In some of the villages in India, farmers do not have proper facilities. The consulting experts are time consuming and also cost will be high. In this type of conditions, the suggested technique seems to be beneficial for the farmers.

Diseases to crop may affect the production and profit of the crop. Fungal, bacterial and spots are the main crop disease. Ethical practices used to detect disease but the large consumption of pesticide harmful leads decrease in fertility of the soil. In order to increase the fertility of the soil and identification of leaf disease, modern methods are used. This paper consisting of an application for identifying the leaf disease by using modern techniques such as machine learning and the image processing. This technique used to detect the category of the leaf disease.

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In order to enhance the quality of diagnosed image, examination and manipulation of a diagnosed image is done using image processing. Remote sensing, machine/ robot vision and color processing are various application technologies in Image processing. This simple application helps in identification of the leaf disease and also a perfect solution in curing the leaf.

II. RELATED WORK

In the first reference paper, a farming robot has utilized that walk around the agricultural field and performs the job of capturing a leaf image and detects the leaf disease. Here robotic car consists of a camera which captures the image and transfers the image wirelessly to the system by RF module technique. In order to detect the disease, the captured images are run on MATLAB lab[1]

In the second reference paper, a robot catches the picture, utilizing a computerized camera, then the captured picture is exposed to preprocessing, noise removal and distraction [2]

The third reference paper talks about an agricultural robot which is used to detect the disease and spraying pesticide. The robot keeps moving around the field for taking images in the interval of every two seconds for lucidity of image [3]

Identifying the plant disease using Histogram matching. In plants, disease appears on leaf based on the edge detection and color feature using histogram matching. Layer separation technique which includes sample training method, that is preparing the given samples. The samples separate the RGB image into red, green and blue layers and edge detection technique is used detect the edges of the layers of the images. Dependence Matrices like Spatial Grey level are utilized for building up the color co-occurrence texture analysis method.[4]

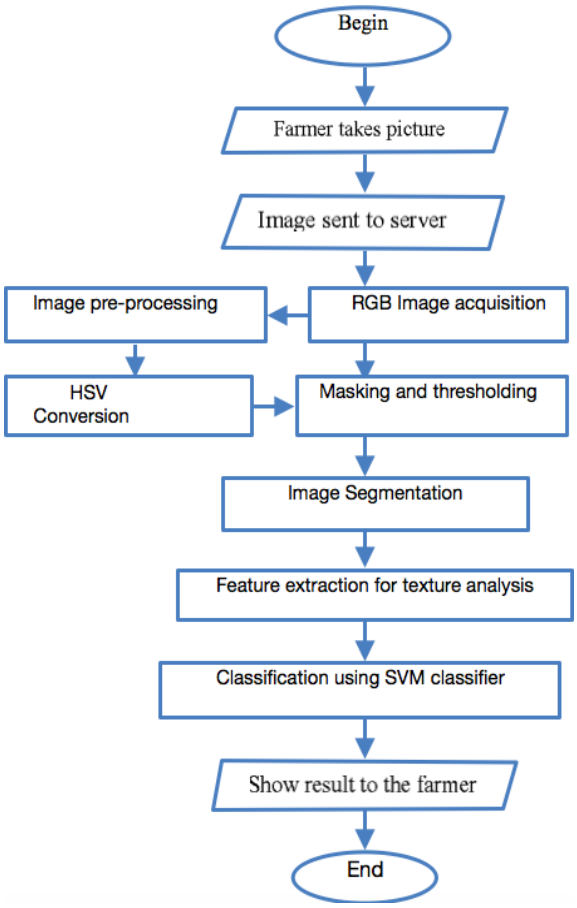
Identification of sick region of plant leaves and grouping of the these plant leaf disease using texture features disease identification which includes the process. The main steps are as follows: RGB Image taken as input, the threshold value is calculated after taking the color transformation structure. Minute green pixels are separated, further segmentation process is carried on. The disease is classified by using the Classifier. The algorithm robustness is demonstrated by utilizing the 500 plant leaves experimental results from the database. Kulkarni et al. offers the technique for an accuracy and early plant disease identification, using Artificial Neural Network (ANN) and diverse image processing. An ANN based classifier which classifies different plant disease is used for grouping of

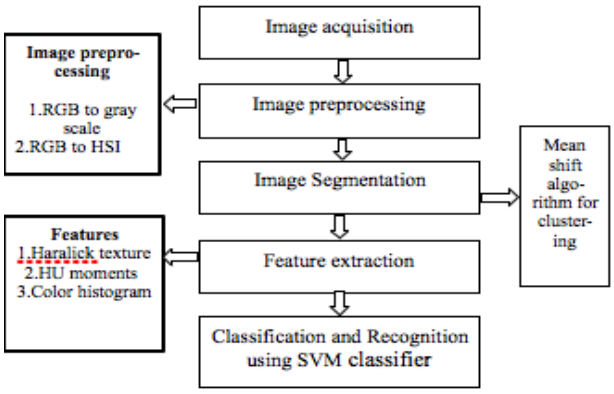
textures, color and the features to recognize those diseases.[5]

III. METHODOLOGY

MVVDM033SC, an industrial camera for image acquisition. Leaf disease identification using Open CV. In the proposed paper, leaf disease identification is done by using an OPEN CV based image processing and Machine learning model. Processing of the image is achieved through OPEN CV library, for classification and identification SVM classifier was used. Utilizing machine learning model test images were subjected for testing. The image preprocessing will takes place on the image which removes noise from the image and carries out the color transformation. Segmentation of the image will be carried out by the K-means clustering algorithm. Disease detection will take place based on the features extracted, SVM classifiers use these features to identify and classify the disease.

FLOW CHART





IV. RESULTS AND DISCUSSION

The idea utilized in our paper will detect leaf disease by making use of efficient techniques, machine learning and image processing. These are the most promising techniques used in the detection of disease in both agricultural and medical fields. Appropriate features were made to identify or detect the leaf disease. Further Images are classified by Support Vector Machine classifier algorithm and a combination of these features is taken to find distinctive features and detect the disease which the leaf is suffering from. Selecting appropriate pesticides is made feasible by identifying the type of diseases.Some of the diseases are trained in identification of the leaf disease are as follows:

1. **Bacterial Blight**:

It is an illness of barley, affected by the bacterial pathogen. The symptoms of this disease are small streaks or light green spots. The expansion of the sores and after that show up as dry dead spots. The injuries which are extended into streaks later full length of the leaf will be covered. Lesions mostly occur on the leaf sheath or culm. The bacterial Blight which formed will be developed on the upper case of the leaf; when there is a cool, wet weather. This disease mainly cause the barley leafs.

2. **Fusarium wilt**:

It is a typical vascular shrivel fungal ailment, which shows side effects like verticillium shrink. Fusarium wither resembles a vein on the youthful leaves and dangle of the more seasoned lower leaves, trailed by restrain yellowing of the lower leaves, defoliation, negligible rot and leads to death of the plant. These are some of the symptoms. This disease mainly affects sweet potato, banana, tomato and muskmelon.

3. **Grey Mildew**:

This sort of disease of a plant typically appears on the base side of the leaves, when the yield is nearing the full development. A frosty or whitish dim fine development, comprising of conidiophores of the growth, showing up on the lower surface region. At the point when a few spots

consolidate, the whole leaf surface is secured by white to dim fine development. This may happen on the upper surface moreover. The disease spreads to upper leaves and whole plant might be influenced. The influenced leaves evaporate from container internal, edge; turn yellowish darker shading and fall of preterm. These are the symptoms of the Grey Mildew. This disease mainly affects Cotton plants.

4. **Leaf Curl:** This disease is characterized by distortion and coloration of leaves which is affected by fungus. Influenced leaves typically recognized not long after they rise up out of the bud, because of their red shading and contorted shape. As the leaves develop, they become progressively misshaped, and eventually thick and rubbery contrasted with ordinary leaves. The shade of the leaves changes from green to red and purple, until a whitish sprout covers each leaf. Finally, the dried dead leaf, turns black before it cast off. These are the symptoms of Leaf Curl. This disease mainly affects the peach and almond plants.

V. BLOCK DIAGRAM

Figure 1. Block Diagram of Image Processing and machine learning model

5.1 Image Processing

- Capturing of an Image
- Preprocessing of the captures Image
- Segmentation of the image.
- Required features are extracted

5.2 Image Acquisition

The digital camera takes the picture of leafs which are affected by the disease. The camera is associated with the Lattepanda. These captured pictures are sent for future preprocessing.

Figure 2..Affected leaves from digital camera

5.3 Image Preprocessing

The images captured from the camera are subjected to preprocessing in order to increase the quality of the images. Color transformation, noise removal, histogram equalization, green masking etc are the steps which are included in the preprocessing. RGB image is transformed into a gray scale to reduce the processing time and also HIS to increase the quantity.

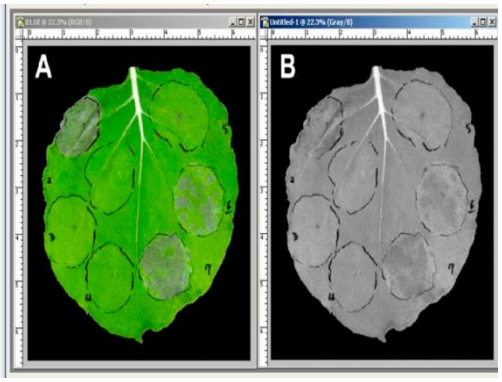


Figure 3. Conversion of RGB to Grey Scale

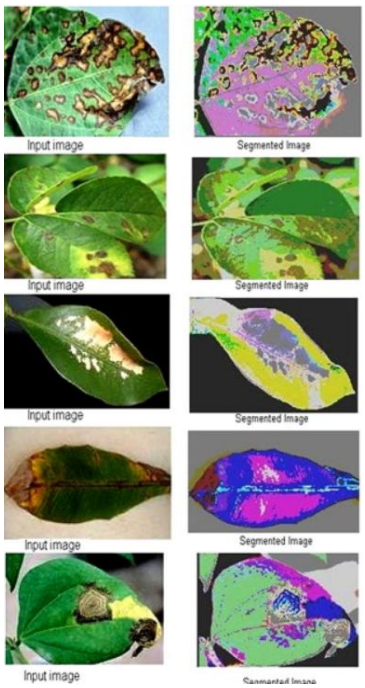


Figure 4. Conversion of RGB to HIS

5.4 Image Segmentation

There are different types of segmentation such as clustering, threshold, edge based and neural network. In this we use clustering algorithm called as mean shift clustering for image segmentation. The main advantages of this algorithm are as follows:

- The detection accuracy in converging the maximum dense region
- The estimators for the clusters are automatic initialization. So, user input time will not be utilized.
- Provides ecofriendly recovery measures in identification of the illness.

Mean Shift Clustering Algorithm

This algorithm is used for detecting highly dense regions

Step 1: Initialize Mean shift vector.
Step 2: Calculate density estimation by m(x).
Step 3: Compute the algorithm.
Step 4: Continue until the convergence.

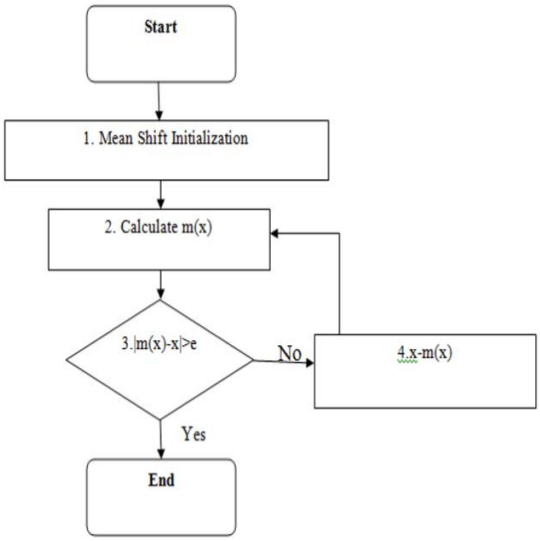


Figure 5. Mean Shift Clustering

5.5 Feature Extraction

The main features of the image are color, shape and texture. Hu moments, Harlick Texture and color Histogram are the three different features which resemble color, shape and texture.

	Harlick Texture	Hu Moments	Color Histogram
Leaf 1	0.00102153	0.0054532	0.02005432
Leaf 2	0.0002128	0.02287866	0.06454578
Leaf 3	0.03322122	0.049896	0.0545464
Leaf 4	0.00025452	0.2651594	0.000554556
Leaf 5	0.0323202	0.00012125	0.046545446

VI. CONCLUSION AND FUTURE SCOPE

In this article a review is carried out of research on the detection of diseases and pests in different crops using machine learning algorithms. The research and algorithms were compared in order to observe performance. By implementing this method disease prediction can be achieved and also pesticide selection can be achieved.

In the most advanced process we can use the android application for the future enhancement. A similar idea can be consolidated in a propelled processor known as latte panda and this is to be coordinated on the robot. The robot moves around the field catching the picture of the leaf and furthermore screens the field condition that is controlled utilizing an android application. The robot helps in early discovery of illness and screens the field condition and helps the ranchersfarmers in expanding the yield. We can also identify the leaf stages whether disease in initial stage or the final stage. To improve the quality of recognition rate in the classification process like Artificial Neural Network, Fuzzy Logic, Bayes Classifier and hybrid algorithms can also be used.

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