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Disease Detection in CardamomLeaves using SVM Algorithm

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Abstract – India is a farming country, and the farming assistance is the largest contributor(about 14) of GDP ahead of other artificial sectors. Agriculture is one of the pillars of our frugality. Thus, husbandry assistance is the main source of gaining. Still, due to some factors similar to factory conditions, pests, climate change, the yield of the husbandry assiduity decreases, and the productivity decreases as well. The discovery of factory conditions is pivotal to forestall the losses in the productivity and in theyield. It isn't obvious to cover the factory conditions manually as the act of complaint discovery is veritably critical. Thus, image processing technology is used to describe the factory complaint, this is done by landing the input image that undergoes the process and is compared with the dataset. The purpose of this design is to help and give effective support to the monoculture growers. In this paper, we propose a system that will use the different ways of the image process to both dissect and describe the factory conditions. The results of the perpetration show that the designed system could give a successful result by detecting and classifying the factory conditions. In this paper, we're fastening on three common factory conditions: Bacterial scar, chirkey, and Alternaria Alternata. In this study, K- means was used to remove the unwanted background of an input image by opting multiscale features. This work proposes a cardamom factory complaint discovery approach using the SVM model. A comprehensive set of trials was carried out to ascertain the performance of the proposed approach and compare it with other models similar as EfficientNet and Convolutional Neural Network(CNN). The experimental results showed that the proposed approach achieved a discovery delicacy of 98.26.

Keywords: Image Processing; K-Means; GLCM; SVM; Plant Disease Detection; Standalone Application.

I. INTRODUCTION

Agriculture is the backbone of the Indian economy. A big part of our country's economy depends on agriculture in the first place. Farmers have a big range of options to select the crops and choose the convenient chemicals and pesticides to use. Thus, crop damage could result in generating unexpected losses that will impact the productivity of the farming industries which will directly affect the economy. Therefore, taking care of the plants is necessary to maintain an excellent quality of agriculture and guarantee the efficient productivity along with the high profit.Plants are sensitive to diseases especially the plant leaves as symptoms of the disease appear first on the leaves. Due to the bad impacts of plant diseases on the both the economy and the environment, the farmers should consider monitoring the crops in such a way that they may mitigate losses.However, lately, crop monitoring is being developed to be digital and semi-automatic, meaning that only from the symptoms that are shown on the leaf, the disease could be detected in an easier, quicker, cheaper way. Therefore, this digitized method will be beneficial for the farmers as well since it will facilitate for them

the detection of the diseases because most of the farmers do not have a sufficient background and knowledge about monitoring the crops and dealing with the variety of diseases that could affect them. The proposed system that we are suggesting in this paper could be used by the farmers to increase the yield with no need to consult experts. The digitalization of the agriculture field has known the intervention of the latest technologies namely the image processing. As a result, our system that is designed to be an automated system is implemented using an image processing technique using MATLAB.

Literature survey

Modern image processing and deep learning-based techniques are widely used for the detection of plant leaf disease.Many diagnostic methods use a Convolutional NeuralNetwork (CNN) and a pre-trained model to detect and classify healthy and unhealthy plants. "Rice disease detection & Pattern recognition techniques" karthi mohan(2020) here the method used is to depict a product model framework for the discovery of malady in rice plants based on different pictures of the rice plants. Pictures of the tainted piece of the rice plant are taken using a computerized camera. With the end goal to identify the abandoned piece of the plant different procedures like picture division, picture developing and so forth."Detection of plant leaf diseases using image segmentation and soft computing techniques."Philippe george(2021) This paper monitors the crop growth using the image segmentation techniques. Noise filtering is done and features are extracted and then the image is further classified to detect the diseased part."Remote Area Plant diseases detection using Image Processing. Published in IOSR Journal of Electronics and Communication Engineering" Mohan Mathew (2021) Different pixel information is extracted and Green leaves pixel and diseased leaf pixel are compared by finding the ratio of pixel corresponding to the healthy leaf to the pixel corresponding to the infected leaf. Background is removed and different regions of the images are formatted after the image acquisition. "A digital image processing based algorithm which detects and recognizes plant diseases and various symptoms" Manu Joseph(2020). The proposed methodology is applied to twenty different kinds of images and the result is made on the basis of white and black colors in the resulting image. Black color is used to represent the symptom of disease and for unaffected regions."Cardamom Plant Disease Detection Approach Using EfficientNetV2"

Sunil CK (2021) In this study, U2-Net was used to remove the unwanted background of an input image by selecting multiscale features. This work proposes a cardamom plant disease detection approach using the EfcientNetV2 model. A comprehensive set of experiments was carried out to ascertain the performance of the proposed approach and compare it with other models such as EfficientNet and Convolutional Neural Network (CNN).

II.PROPOSED METHOD

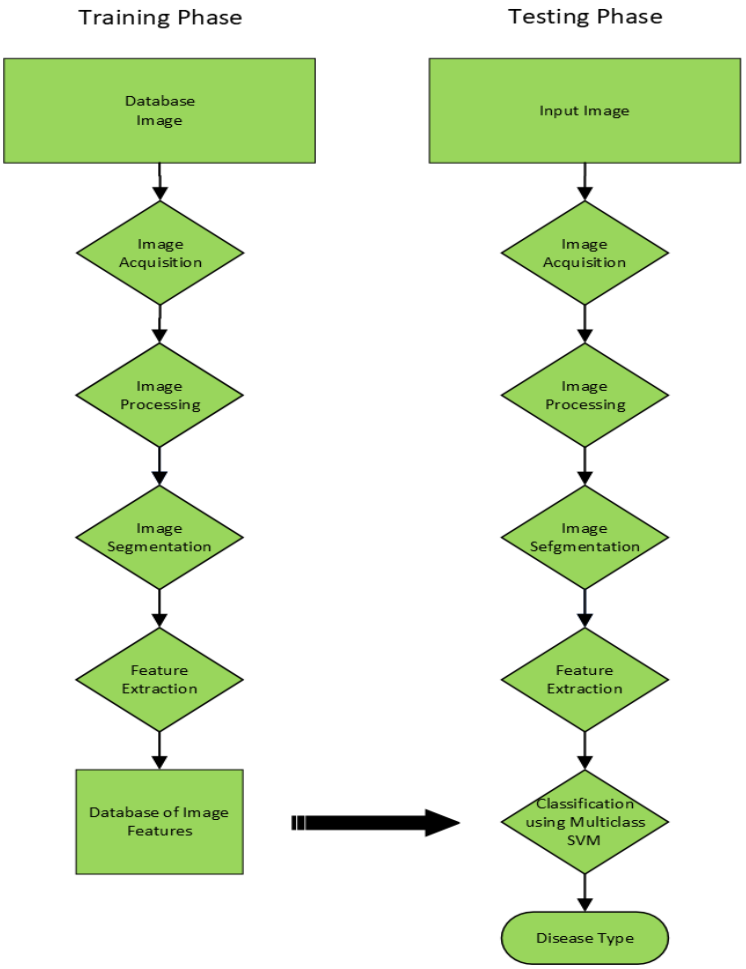
As a proposed solution for this problem that every farmer is facing, we are proposing the use of the latest technologies to detect the plant disease detection which is image processing. The idea is to create a standalone application using MATLAB that will be used by the farmer. He will be uploading the picture of the leaf of cardamom to the application, once the image is processed and the detection is executed, the application will display to the farmers the type of disease along with the affected region, and the accuracy. The image that is uploaded to the standalone application will undergo the process of MATLAB throughout its image processing tools. By using MATLAB, features related to the area affected by the disease, the accuracy and many other features are analyzed. After MATLAB continues the processing of the given image, the type of disease is classified and detected. The core idea behind this system is to remedy the disease with minimum impact on the environment, and to guarantee for the user or the farmer a fast and economical way in detecting leaf disease and categorizing it.

III.METHODOLOGY

In the figure below (figure), the block diagram summarizes the methodology that is used in our system. First, we can distinguish between two parts, the training part, and the testing part. In the training part: the first step in this phase concerns training the SVM classifier from the dataset that we collected from the internet. We have different classes of diseases that contain many leaves. We label every disease by assigning it to an integer value. After that, the segmentation is executed in order to get the region of interest (ROI). We can get this region of interest by removing all unwanted or undesired information like distortion. After getting the ROI, we will extract the features that were calculated for processing. At this stage, we create our database that will be the backup of the testing phase. In the testing part: we input to the system an image of a plant leaf that is unknown, and after getting the ROI by segmenting the image, we could extract the features of the region of interest. Then, the information is transferred to the SVM classifier for detection. The main

purpose of this SVM classifier (in our system we used a multi SVM classifier due to the large set of data that we are working with) is to compare the features extracted from the input of image with the database that we already built in the training part. Finally, the system will be able to detect the type of the disease based on this comparison, meaning that it compares the values of the vector features of the testing image and see to what vector feature it corresponds in the database. Therefore, it could predict the disease depending on the values that are matching.

Diagrammatic Representation:



It causes different types of diseases that affect the plants. The most common diseases between the plants are Alternaria alternate (fungal), Anthracnose, Bacterial Blight (bacteria), and Cercospora Leaf Spot, Downy Mildew, Alternaria Leaf Spot, Frogeye Leaf Spot, White Spot, Powdery Mildew [5]. Inour system we focused only on three types of plant diseases which are the following:

Alternaria Alternata:
It is one of the common plant diseases, it is a fungus thatcause spots on the plant's leaf, it hasbad impacts on both the health of the plant and the human asit may cause asthma [5].

Bacterial Blight:
It is one of the dangerous diseases that can affect a plant'sleaf, one of its initial symptoms that could be visually seen on the plant's leaf is the dark andyellow spots other symptoms could be
necrotic blotches [5].

Cercospora Leaf Spot: This type of disease appears and spreads in high temperaturesand humidity. It is characterized by small grey spots on the plant's leaf [5].

Chirke disease:
The virus consists of polyhedral particles measuring 40 nm diameters. It has a thermal inactivation point of 50-60°C for 10 min, withstands a dilution up to 1:5000 and the longevity in vitro is about 4-8 days. A new virus species large cardamom chirkey virus (LCCV) under the genus Macluravirus, family Potyviridae has been characterized.

IV.IMAGE PROCESSING SYSTEM

1. Image Processing:
Image processing is a method that uses computerizedalgorithms to analyze the images and
process them. Image processing has been used in the field of agriculture in many applications and more specifically in the detection of plant diseases. The processing of image goes through many steps that are listed below:

2. Image Acquisition:
The first step in the image processing is the image acquisition. In this step the leaves of the plant are captured using a digital camera or a mobile phone. These images are used as an input to the system, and they must be stored in the computer.

3. Image Pre-processing:
This step is mainly about enhancing the input images for the processing. This preprocessing helps to improve the quality of the images by removing undesired distortion including the spores, dust. Also, it could be used to adjust the images' colors. The objective of this step is to provide clear images for further analysis. Basically, in this step the input image is
from the RGB image to L*a*b* color space (L* = Luminosity layer, a* & b* chromaticity layers).

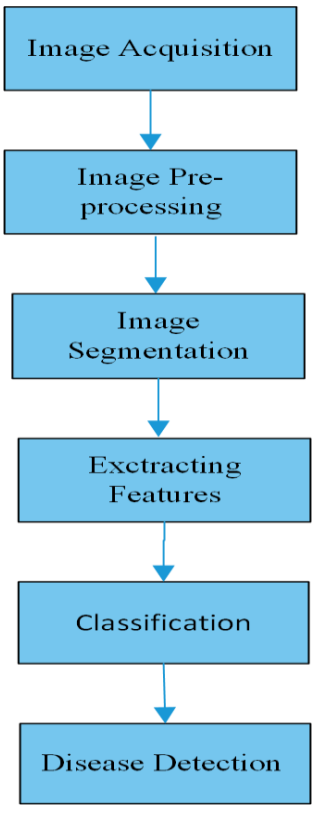


Figure 8: Block Diagram of The Image Processing Steps

4. Image Segmentation:

In this stage, an image is divided into sub images, or we are converting the input image into segments. There are a variety of methods that are used for segmentation: K -mean clustering, region-based segmentation, edge detection segmentation [8]. However, the most commonly used one is the K-mean clustering. The main purpose of this method is to divide n observations into k clusters with each observation belonging to the cluster with the closest mean. Based on the k-means results, each pixel in the image that is uploaded is labeled, after that,the results of clustering are stored in a blank cell array. One of the important things in this step is to choose the convenient cluster. We select this cluster based on the one that shows the big part that is affected by the disease. Then, the features of the chosen cluster are to be extracted in the following phase which is the feature extraction. Basically, segmentation serves to separate the region that the disease allocates on the leaf image from the non-disease region.

5. Feature Extraction:

In this phase, it is time to extract the needed information from the image. The dimensions of the region of interest (ROI) are smaller compared to the original image. It exists a lot of methods that are used for the feature extraction, but the commonly used one is the Gray Level Co- occurrence Matrix. The GLCM is known for its ability to extract the texture features that will ease any further analysis. This method calculates the pixel with a specific intensity with the image. The chosen image will be converted to grayscale as it is originally in RGB format. In the table below lists the thirteen features and their expressions, an array is used to store these features.

	Feature	Expression
1	Mean =M	$\sum_{i=0}^{N-1} g(i) P(g(i))$
2	Standard Deviation =S	$\sqrt{\sum_{i=0}^{N-1} (g(i)-M)^2 P(g(i))}$
3	Entropy	$\sum_{i=0}^{N-1} P(g(i)) log_2 (P(g(i)))$
4	RMS	$\sqrt{\frac{1}{NxN} \sum_{i=0}^{N-1}\sum_{j=0}^{N-1} (g(i,j)-I)^2}$
5	Variance	$\sum_{i=0}^{N-1} (i-\mu)^2 p(i)$
6	Smoothness	$\sum_i \sum_j \frac{1}{1+(i-j)^2} g_{i,j}$
7	Kurtosis	$\frac{1}{S^k} \sum_{i=0}^{N-1} (g(i)-M)^3 P(g(i))$
8	Skewness	$\frac{1}{S^3} \sum_{i=0}^{N-1} (g(i)-M)^3 P(g(i))$
9	Inverse Difference	$\sum_{i=0}^{N-1}\sum_{j=0}^{N-1} \frac{p_{i,j}}{1+(i-j)^2}$
10	Contrast	$\sum_i \sum_j (i-j)^2 g_{i,j}$
11	Correlation	$\frac{\sum_i \sum_j (ij) g_{i,j} - \mu_x \mu_y}{\sigma_x \sigma_y}$
12	Energy	$\sum_i \sum_j g2_{i,j}$
13	Homogeneity	$\sum_i \sum_j \frac{1}{1+(i-j)^2} g_{i,j}$

Figure: Extracted Features & Their Expressions [16]

6. Classification:

The common diseases that could affect the leaves are fungi, bacteria, and viruses or even the insects' impact that is usually shown as spot on the leaves of the plants. Based on the method SVM the disease could be classified. The support vector machine is to be trained with images of different diseases with their extracted features, and these images that are part of the training process are stored in the dataset, it is referred to as training images. This table below shows the dataset that was trained using the SVM classifier and it

represents at the same time the database reference to which the SVM classifier relies on to compare the vector features.

V. CONCLUSION

Detecting plant diseases through image processing is the most convenient way to proceed with an efficient harvest. The main goal of this work was to show how the image processing tool provides accurate results in detecting plant diseases and how it can help farmers increase yields. At the end of this project, we managed to achieve the set goal, ie. the application of image processing in the detection of plant diseases. In addition, building a stand-alone application makes this technology easier and more practical for farmers. As a result, a separate application was developed to identify diseased and healthy plants. In addition, future work aims to create a mobile application that greatly facilitates the process of farmers, and to use drones to expand the dataset of training images and improve the accuracy of our proposed system.

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