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A Review on Leaf Disease Detection and Classification Using Image Processing

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Abstract - *Agricultural products are a primary need for every country. In agriculture, farmers facing a lot of problems in disease identification in plant leaves. Sometimes late identification of diseases in plants causes economic losses to the farmer which affects the economy of the country on a large scale. It is very difficult to monitor plant diseases manually. It requires a tremendous amount of work and requires the excessive processing time. Hence, image processing is used for the detection of plant disease. In this project, we focused on the classification of plants as a different type of disease which represents an algorithm for image segmentation technique that is used for detection and classification of plant leaf diseases. In Disease detection there are steps like image acquisition, image preprocessing, image segmentation, feature extraction, classification, and mail of detection report. The research that has been done, can be proven by the classification of leaf diseases which get an average accuracy rate of 98.349%.*

Key Words: Image Processing, Segmentation, Feature Extraction, K-means Clustering, GLCM, SVM.

1.INTRODUCTION –

In India, about 70% of the population depends on farming for their living. Due to loss in production, many farmers attempt suicides which is a serious issue. This issue can be controlled to some extent by using new technologies that will help the farmer to improve harvesting. Many farmers want to adopt modern agriculture, but they can't due to several reasons like lack of awareness about the latest technology, high cost of the technology, etc. It has been observed many times that plant leaf diseases are difficult to control as its population is varied according to environmental conditions. Plants are often affected by various diseases such as leaf spot, dryness, color changes, etc and some of them can destroy the whole crop, if not diagnosed and treated in time. This may cause huge loss to the farmer and would also result in less yield of staple crops leading to price rise and burden on the economy. The major challenges of sustainable development are to reduce the usage of pesticides, cost to save the environment, and to increase the quality. Image Processing is an effective technique in solving a number of real-life problems related to medical, science, weather, etc. Detection of leaf spot disease using the following techniques such as image acquisition, image preprocessing, disease classification was carried out by various works. Proposed methodology like K-mean clustering, texture, and color analysis for plant disease detection. The present work has been carried out for the automatic disease detection of plant leaf using image processing.

1.2 LITERATURE SURVEY –

According to Coley-Smith, 2008[1], plant diseases are defined as abnormal growth. The cause of plant disease can come from biotic and abiotic diseases. Biotic diseases are caused by living organisms, such as fungi, bacteria and, viruses. Examples of leaf disease are Alternaria Alternata, Anthracnose, Bacterial Blight and, Cercospora Leaf Spot.

According to Sollapure, Karadiguddi, Hanasi, Daddi, and Kale,2018[2], explains that leaf disease can affect productivity, and efficiency so that it can affect the growth of plants. To overcome the disease of the leaves must be done at an early stage, then the method used is SVM which has a linear kernel that is used to identify diseases.

Vidyashanakara and Kumar, 2018[3] classify leaves using the Gray Level Co-Occurrence Matrix (GLCM) to extract features based on the leaves and the Support Vector Machine (SVM) are used to improve the accuracy of the leaf classification.

Muchtar and Cahyani,2018[4], researched the classification of leaves using image processing

techniques because it can facilitate the classification. The classification uses SVM with a 5-fold cross-validation system which shows that goal of the Gabor Co-Occurrence method can achieve an average accuracy of up to 89.83%.

2. PROPOSED WORK -

2.1 FLOWCHART-

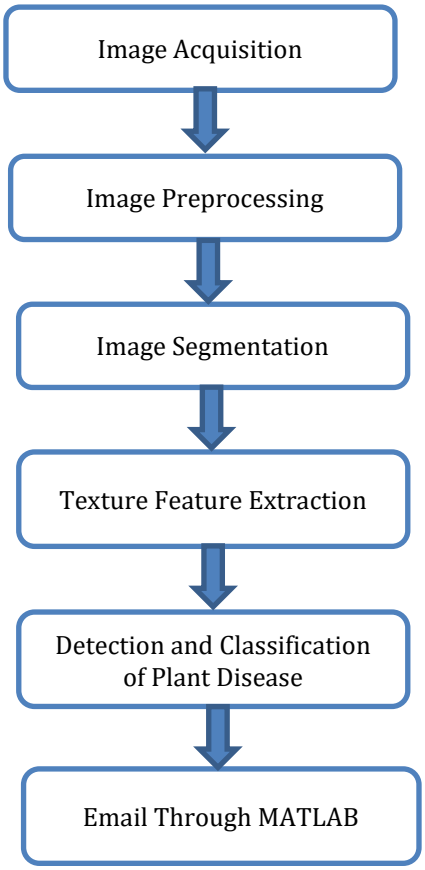

Fig -2.1.1: Flowchart

As we all know that the flowchart is a diagrammatic representation of the algorithm of any system Fig -2.1.1 is the flowchart of the project in which you see that how one process initiates the other process. The image acquisition process is the initial stage to take or obtain digital images using a certain additional device or tool. The images used in this study are leaf images in JPG format. Then Preprocessing is applied to the images to improve the perceptual qualities and improve the brightness of the images. Segmentation is used to divide a region into several parts with the same characteristics or have some similarities so that it is easily analyzed. Fig. 2.1.2 shows the segmentation of diseased leaf images. Segmentation is done to classify the leaves that are affected and those that are not affected. For that, we used the K-Means clustering method to partition images into clusters, where at least one part of the cluster contains an image with the main area of the affected part. Based on this, the image is segmented into various regions containing diseased parts and non-diseased parts. we use the K-means clustering algorithm because it improves efficiency and gives accurate output.

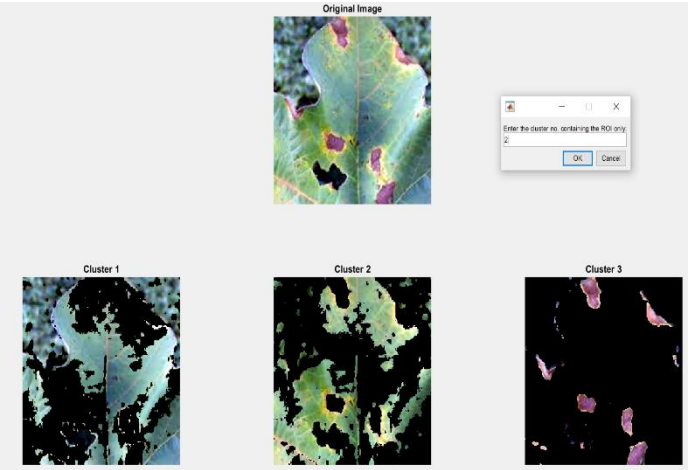

Fig -2.1.2: Segmentation of Diseased Leaf Image

So, after segmentation of the infected area, various features are extracted to provide information about the infected area. The texture feature is used to describe the region. Then Gray Level Co-occurrence Matrix (GLCM) is a feature extraction method used for textures that produce statistical calculations. Texture features can be calculated from the resulting GLCM, such as contrast, correlation, energy, entropy, homogeneity, mean, standard deviation, RMS, variance, smoothness, kurtosis, skewness, and IDM. After extracting the texture features, we used the Support Vector Machine (SVM) for the classification. SVM is supervised learning that supports hyperplane in high dimensional space with an algorithm that can analyze data and recognize patterns. Then training and validation process is an important step in developing using SVM. The dataset for the training and validation process consists of two parts, namely the training feature used to train the SVM model and the test feature used to verify the accuracy of the trained SVM model. Then, the results of the type of disease with accuracy and percentage of the area affected by the disease are evaluated by the ratio of leaf disease data, Min and Htun, 2018,[5]. SVM has a kernel that can provide accurate values. From the research that has been done, it can be proven by the classification of leaf diseases which get an average accuracy rate of 98.349%. In this project at the last, we tried to send an email of leaf detection report to the respective person through MATLAB. So that they can get accurate information

of plants health and according to that they provide a better solution to the Plants.

2.2 SOFTWARE USED –

MATLAB R2020b
MATLAB tool is used for solving the disease detection problem. This provides strong support for the implementation of advanced algorithms. MATLAB also allows users to test and training of the data. Users can set various cut-offs for all the attributes and train the data on a given dataset and also using testing tools we can verify the data. In our problem, we measure various parameters such as mean, correlation, contrast, variance, smoothness. All of these parameters can be easily calculated using existing methods in MATLAB. Being a general programing language MATLAB is best fitted for digital image processing. MATLAB allows users replication as it makes sure that whatever steps the user has implemented in the image processing they are properly documented by it. moreover in MATLAB users can create an interface very easily using the guide command. There is no need to write code for the GUI as MATLAB automatically writes the coding modularities for the GUIs.

2.3 RESULT -

The results of trials from research conducted produce images of the results of the classification of leaf diseases along with the level of accuracy of the detection in the image. The test material is the leaf image. There are four types of leaf image diseases tested, namely Alternaria Alternata, Anthracnose, Bacterial Blight, and Cercospora Leaf Spot with 98.349% accuracy.

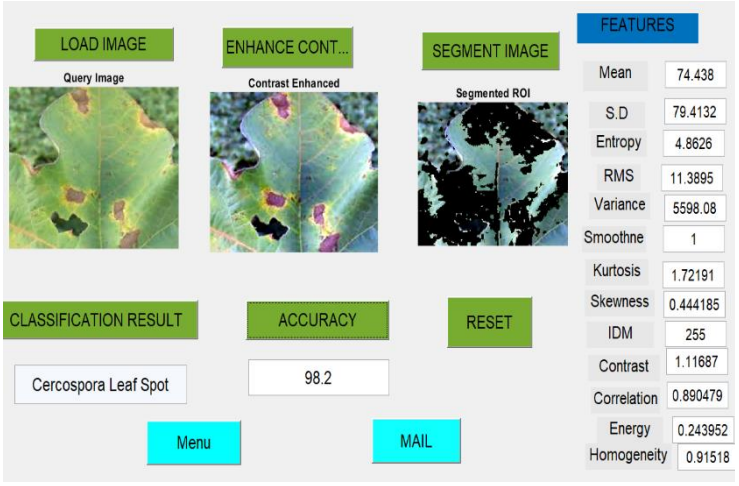

Fig -2.3.1: Main GUI to perform the entire Project

We provided the Mail option in the Main GUI. For that, we need to put an email of that person to whom you want to send the detection report. And after clicking on the mail option it will send the mail.

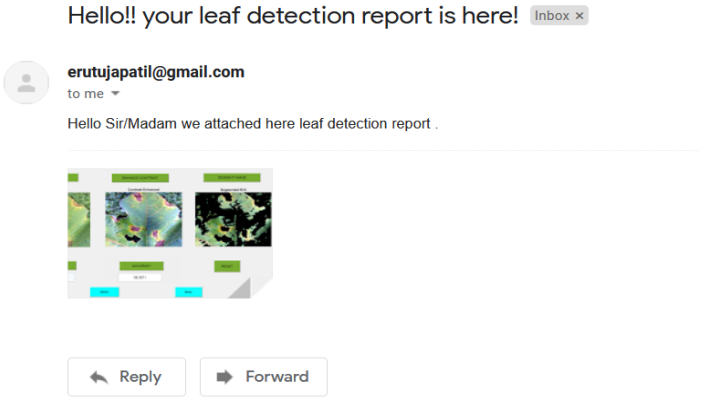

Fig- 2.3.2: Email

After clicking on the Menu option in Main GUI, there are three more options like Image processing, More help, Exit.

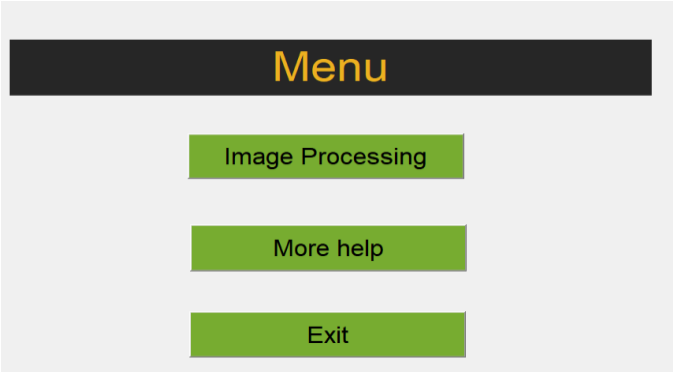

Fig -2.3.3: Options in Menu GUI

In Menu GUI, we provided one more option like More help. In that, there are some guidelines for how to use the app.

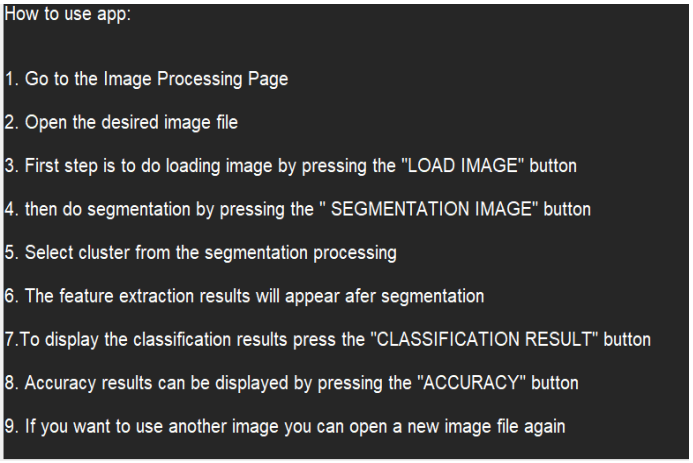

Fig -2.3.4: How to use the app

3. ADVANTAGES –

1) Improved accuracy with the help of k means clustering algorithm.

2) Use training data to solve complex problems and easily detect errors.

3) Our system is very fast as compared to others because segmentation makes the processing time less.

4) Efficient and User friendly.

4. APPLICATIONS -

This project can be implemented at –

1) Bio-farm
2) Bio- Pesticides

5. CONCLUSION –

To detect and classify diseases of various plants, an accurate and successful method should be used and this can be done with the help of image processing. From these methods identification and classification of various, the leaf disease has been accurately done. And with the help of the performance classification Support Vector Machine managed to get an average high level of accuracy of 98.34%.

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