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Digital Image Processing Techniques For Detecting And Classifying Plant Diseases

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Abstract: ***One of the biggest revolutions of modern history is the invention of agriculture for a healthier lifestyle. It significantly changed the human culture and played an important role in the development of the population and biological improvements in food production and domestication. Study into agriculture is then planned by improving the disease diagnostics method with the use of newer information technology to enhance efficiency and quantity for agricultural production and its allied operation. This project focuses on the identification and diagnosis of plant leaf diseases of tomatoes and pomegranate based on visual symptoms, anthracnose, and powdery mildew. Machine learning and image processing using SVM, KNN require many steps to identify and distinguish disease signs.***

Keywords: Machine learning, image processing, plant disease,SVM.

1. INTRODUCTION

In the Indian economy, the agriculture industry has played a significant part. The distribution of food surpluses to an expanding population, contribution to the formation of resources, supplying raw material to factories, the consumer sector, and significant contributions to foreign trade play an important role in agriculture. Agriculture is also important. Although the contribution of agriculture continually declines, with the growing population, it remains the principal division of employment with a number of variations.

The image processing techniques have shown themselves to be one of the exact and economic processes used to calculate the parameters of different plant diseases. In-plant pathology, the basic definition is illustrated by the triangle of diseases, as seen in Figure.1

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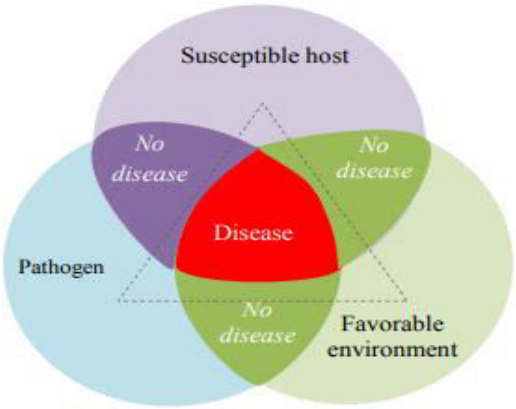

Figure 1 Disease triangle

2. Implication of Image Processing in Agriculture

Agriculture is the production of essential food crops from time immemorial. Today, farming has not only been a way to satisfy the ever-growing food demand, but it is also a cornerstone of the nation's economy. There are many challenges in agriculture in India in optimizing crop production. New agricultural innovations are being investigated for the success of cultivated crops, but farmers still have great results. India has a range of experience in agriculture and technical expertise. Since farmers are competitive and profitable, they require proper guidance. In agriculture, machine learning systems for object recognition, fruit degree, kernel classifications, weed detection, medicinal plant recognition, etc., have been developed. This method includes the acquisition of digital images in the respective field with the help of digital devices like cameras, cell phones, and necessary characteristics, using image processing technology, from images for further study. The classification and identification process is important to the achievement of machine learning techniques.

3 Algorithm for the Study of Leaf Disease

The image processing technique has many important and effective agricultural uses in the area of foliar disease detection. For starters, in the detection of the disease types, the form of the infected region is found, the edges of the diseased leaf are noticed, the ratio of diseases is measured, the target layers are divided, and the affected areas are coloured. The block diagram of the algorithm with image processing is seen in Figure.2 to define and distinguish different leaf diseases.

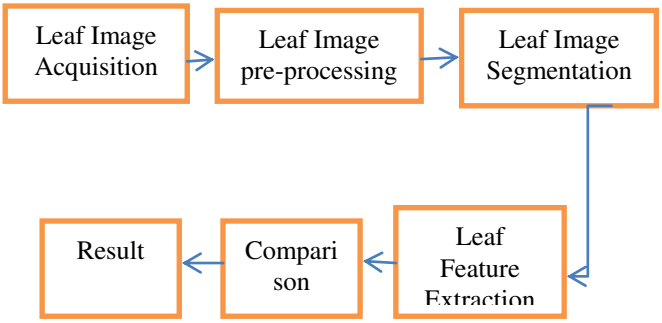

Figure 2 Generalized flow diagram for leaf disease detection

4 AIM AND OBJECTIVE OF RESEARCH

The main goal of this proposal is that the main diseases in leaf be identified and recognized using image recognition and machine learning techniques by designing and developing an automated method. The aim of this work consists of many phases-

- Build a practical data collection for standard leaf images.
- Create a new segmentation algorithm and
- Create and deploy image extraction techniques.
- Build a smart disease recognition device.
- Establish a method of classification with computer training to classify diseased leaf sections into the disease class.
- To design a treatment guidance framework to discourage the use of pesticides and other knowledge required in order to support growers, pathologists, and farmers in improving the accuracy of major crop diagnoses for diseases.

5 LITERATURE ON LEAF BASED DISEASES DETECTION

The automated method for the classification of Alternaria, myrothecium, and the bacterial bacteria cotton foliage diseases was developed by Rothe et al. [1]. For the segmentation of the diseased element, a graphic cut approach was used to obtain color characteristics to train the adaptive fuzzy inferencing algorithm.

Jafari et al.[2] applied thermal imaging for identifying fungal diseases on rose plants. To discern between uninfected and diseased plants, two neuro-fuzzy classification methods were employed. The research and training of the dataset were performed to identify leaves contaminated with powdery mildew by approximating rates of 92.5% and 92.3 %. With images taken from an automatic imaging system, the output of neuro-fuzzy classifiers was determined. The pre-symptomatic arrival identification of the grey mold and powdery mildew disease, individually, reached the maximum precision estimated rates of 69% and 80%.

A technique to remove diseased cotton leaves was proposed by Rothe et al. [3]. The Gaussian filter has been applied earlier to segmentation to eliminate the noise of the videos. In addition to the form variables, a colour layout descriptor has been used for a sequence of restructuring and simulation. Myrothecium, bacterial bacteria, and Alternaria were the diseases selected for the study.

The neural net of systems for plant disease identification using leafy images from un-diseased and unhealthy plants has been developed by Konsantinos et al. [4] through deep learning. The system has an open database of twenty-five different plants in fifty-eight different types of plants, disease mixtures, and non-diseased plants. The system used a wide variety of photographs. A number of models were eligible and performed at a maximum rate of 99.53% in the classification of harmful or safe plants.

The method for the section of the leaf, fruit, and branch of apple picture taken from a garden was suggested by Jidong et al. [5]. The fruit image was obtained by extracting the R G portion from the image, and by using threshold segmentation, the ROI image. In order to get a view of the leaf of the fruit image, R G B was deduced before two R G B images were deleted. Dynamic threshold division

was used to obtain a branch image.

6 Proposed Methodology

Segmentation constitutes the fundamental and essential step of the image process; it guarantees that a stronger recognition method can be quickly differentiated. This study has suggested a model optimize the productivity of plant disease storage and detection.

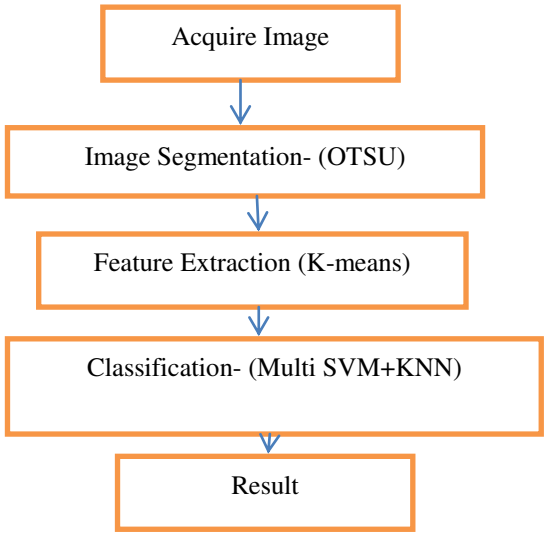

Figure.3 Proposed Methodology

Figure 3 presents the overall block diagram of the of this work. The left side of the diagram demonstrates the exercise. Both the pictures of the training plant with the accompanying photographs of the disease masks are present in the sample database. Mask pictures demonstrate the same form and shape of all diseases on pictures of the leaf. Functionalities are then removed from the disease sections. Finally, the classifier model is conditioned and saved for use by using the derived functions.

7 Result

Data sets are taken from UCI Repository in this research. 22 pomegranate images of Alternaria Alternata disease, 23 images of Anthracnose disease, 6 images of Bacterial Blight disease, 9 images of Cercospora Leaf Spot disease, 15 images of Healthy Leaves.

60 Tomatoes Leafs in which Alternaria Alternata disease images 13, Anthracnose disease images 11, Bacterial Blight disease images 12, Cercospora Leaf Spot disease images 13, Healthy Leaves disease images 11.

All are in in JPEG format. Below Figure 4 display the sample image of data sets.

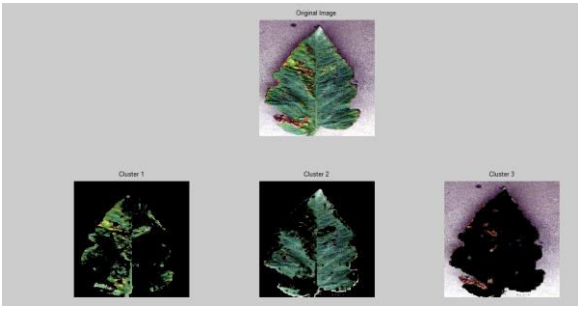

Figure. 4 Sample of Image datasets.

Table.1 a&b Algorithm Comparison Accuracy

(a)

KNN Algorithm	Accuracy(percent)
Pomegranate Leafs	79.32
Tomatoes Leafs	72.46

(b)

Multi class SVM Algorithm	Accuracy(percent)
Pomegranate Leafs	60.33
Tomatoes Leafs	56.2

Table 2 Classification Results As Confusion Matrix.

Leaf Disease	Healthy	Alternaria Alternata	Anthracnose	Bacterial Blight	Cercospora Leaf Spot	Accuracy in %
Healthy	18	0	0	0	2	90
Alternaria Alternata	0	18	0	0	2	91
Anthracnose	0	0	17	0	3	85
Bacterial Blight	1	0	0	16	3	81
Cercospora	0	0	0	3	17	85

Leaf Spot						
Average						88

Table 3 Accuracy Comparison of machine learning algorithms

Machine Learning Approach	ACCURACY in%
[6]. SVM +KNN	53.33%
Proposed Approach	88%

8 Conclusion & Future Work

The image processing and machine learning techniques are applied to Agriculture field for comprehensive study of the research. The recognition and classification of disease symptoms with use of Image process and machine learning techniques are effectively performed for the Pomegranate Leafs and Tomatoes Leafs, for this research work. The algorithms for pre-processing, segmentation, feature extraction, classification and recognition based on image processing and machine learning are designed and implemented using Matlab.

The classification and recognition of disease is achieved using Multi SVM and KNN algorithem. Further the Multi SVM,KNN is also implemented and obtained the disease recognition of 88% leaf images and compared with the previous results. The study can be set up as a kiosk for farmers to focus on by reducing the needs of farming experts.

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