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Approach for Plant Disease Detection based on Image Segmentation Techniques: Review

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Abstract: In this research, an algorithm for disease segmentation using an image processing technique in plant leaf is implemented. Normally plant diseases are caused by fungi, bacteria, virus, etc. The developed image processing consists of four main steps, for color transformation structure RGB image is created, RGB is converted into HSI. Then green pixels are masked and removed using a specific threshold value, the image is segmented and useful segments are extracted, finally, feature extraction is done. This processing may prove benefits in monitoring the large field of crops, thus automatically detect symptoms of the disease. The disease detected before the disease appears on plant leaves. The term usually used for destruction of a live plant.
Keywords: Plant Disease, Image processing, Threshold, SVM.

I. INTRODUCTION

The purpose of agriculture is not only a growing population. It is an important source of energy and a solution to solve the problem of global warming. Plant diseases effect on both the quantity and quality of crops in agriculture production. Generally, the naked eye method is used to identify plant diseases. In this method, experts are involved to detect plant disease they have the ability to detect the changes in leaf color. This method involves lots of efforts to take a long time and expensive. Many times different expert got the same disease as a different disease. This method requires continues monitoring of experts. Here in the way want to look for the fast, automatic, Less expensive and accurate method to detect, classify, identify the plant disease.

The old and classical approach for detection and recognition of plant diseases is based on naked eye observation, which is a very slow method also gives less accuracy.In some countries, consulting experts to find out plant disease is expensive and time-consuming due to the availability of expert. Irregular check-up of plant results in the growth of various diseases on the plant which requires more chemicals to cure it also these chemicals are toxic to other animals, insects, and birds which are helpful for agriculture.Automatic detection of plant diseases is essential to detect the symptoms of diseases in early stages when they appear on the growing leaf and fruit of the plant.

The basic needs of plant leaf disease detection are listed below:

For increasing growth and productivity of the crop field, farmers need automatic monitoring of disease of plants instead of manual.

Manual monitoring of disease do not give satisfactory result as naked eye observation is old method requires more time for disease recognition also need expert hence it is non-effective.

So in this project, we introduced a modern technique to find out disease related to leaf. To overcome the disadvantages of traditional eye observing technique, we used digital image processing technique for fast and accurate disease detection of the plant. In our proposed work, we developed a k-means clustering algorithm with SVM classification algorithm & multi thresholding segmentation in MATLAB software for disease identification and classification.

II. LITERATURE SURVEY

In [1].Mrunalini R. Badnakhe, Prashant R. Deshmukh has presents the technique to classify and identify the different disease through which plants are affected. In the Indian economy, a machine learning based recognition system will prove to be very useful as it saves money, time and efforts too. In this paper two techniques for feature extraction and comparison of two techniques. The first technique is Otsu Threshold: This thresholding technique creates a binary image from gray level ones by turning all pixels below some threshold to zero and all pixels about that threshold to one. Another technique is K-means clustering: It is an unsupervised learning task where one seeks to identifty a finite set of categories termed clusters to describe the data. For feature set extraction is the Color Co-occurrence Method is given in this approach.Neural networks are used for automatic detection of diseases in leaves. The proposed approach can significantly support anaccurate detection of leaf and seems to be an important approach, in case of steam, and rootdiseases, putting fewer efforts in computation.

In [2].Savit N. Ghaiwat, ParulArora describes a different classification technique that can be used for plant leaf disease classification. For a given test example, K-nearest-neighbor is suitable as well as the simplest of all algorithms for class prediction. The drawback of K-nearest-neighbor algorithm, if training data is not linearly separable then it is difficult to determine optimal parameters in SVM.

In [3]. Sanjay N. Dhaygude, Nitin P. Kumar describes developed processing scheme four steps, the first step is color transformation structure is used for the input RGB image, because the RGB is used for color generation and transformed or converted an image of RGB that is, For color descriptor, HSI is used. In the second step, green pixels are masked and removed by using a threshold. In the third step, Removing of green pixels and masking is done by using precomputed threshold level for useful segments that are extracted first in this step, while the image is segmented. And segmentation is done in last of fourth main step.
In [4], PiyushChaudhary, Anand K. Chaudhari presents the algorithm for disease spot detection in plant leaf using image processing techniques. By comparing the effect of HIS, CIELAB, YCbCrcolor space the process of disease spot detection is done. In the final step, To find the disease spot Otsu method is used on a color component, calculation of threshold. In experimental results, camera flash, vein there is some noise is shown because of background. To remove that noise CIEAB color model is used. In Method 1: On RGB image Otsu method is applied for disease spots are segmented. In Method 2: Using color transform formula RGB image is first converted into YCbCrcolor space. Then Median Filter is used for Image Soothing. The disease spot is detected by applying the Otsu threshold on 'Cr' component of filtered YCbCrcolor space. Method 3: this is the same as method 2. The only difference is that RGB is transformed into an HSI color space instead of YCbCrcolor space. The disease spot is detected by applying the Otsu threshold on 'H' component of filtered HSI color space. In Method 4; Using CIELAB color spaceagain the same process is repeated. The disease spot is detected by applying the Otsu threshold on 'A' component of filtered CIELAB color space. All thesecolor model are compared and finally 'A' component of CIELAB color model is used.
In [7], Detects and differentiates two diseases affecting rice crops, converting the image to the HSI color space, entropy-based thresholding is used for segmentation this method is proposed by Phadikar and Sil. An edge detector is applied to the segmented image and then by using the intensity of green component spots are detected.

In [8], Dheeb AL Bashish& et al. proposed image processing based work consists of following main steps: The acquired images are segmented using k-means techniques this happened in the first step and then in the second step segmented images are passed through a pre-trained neural network. The images of leaves are captured in AI-Ghor area in Jordan. There are five diseases that are prevalent in leaves were selected for this research; they are Early scorch, Cottony mold, Ashen mold, late scorch, tiny whiteness. The final results indicate that the neural network classifier that is based on statistical classification support accurate and automatic detection of leaf diseases with a precision of around 93%.

III. BASIC STEPS FOR DISEASE DETECTION

In this section, the basic hierarchy for plant disease detection and classification using image processing as shown in Figure

A] Image Acquisition

The digital images of plant leaf are acquired through the camera. The image is in the form of RGB (Red, Green, and Blue).

B] Image Pre-processing

In this step, noise in the image of the plant leaf is removed by preprocessing phases.
There are three steps of preprocessing phases: clipping, smoothing, and enhancement.

- Image clipping: The digital images were captured by a camera, always with a complex background. By using the tool of VC, all the closed areas were clipped down from an image and the region of interest were gotten successfully from the background.

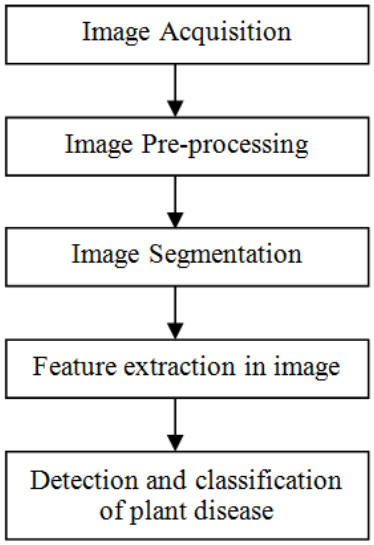

Figure 1: Basic Steps for Disease Detection

- Image Smoothing: The process of noise removal in the mages is called as image smoothing. To remove the noise filter is used. Noise may be brought from the process of collecting the images.

- Image Enhancement: One of the most interesting and important issues in digital image processing field is image enhancement. Bring out the details of hidden images or increase contrast in a low contrast image these are the main purpose of image enhancement.

C] Image Segmentation

The process of the segment the image into different parts according to the region of interest is known as image segmentation. In image segmentation, the image is separate the object from the background.

D] Feature Extraction

Transforming the input data into the set of features is known as feature extraction. Color, texture, edges, morphology can be used to detect plant disease.

Features Extraction Process:-
1) Energy
2) Contrast
3) Entropy
4) Correlation coefficient
5) Homogenity

E] Classification

The Stage of the system is classification. This technique is used for both training and testing process. In the classification technique, the feature extracted from the training leaves is compared with the feature extracted from testing leaves. Based on the matched feature the images are classified.
So Support Vector Machine classifier is used for classification of plant leaves disease. SVM is binary classifier so SVM uses a hyperplane. The hyperplane is a line dividing into two parts. One class containing target training vector which is labeled as +1 and another containing training vector which is labeled as -1. SVM finds a hyperplane that will then maximizes the margin of separation of two classes as shown in bellows figure 2.

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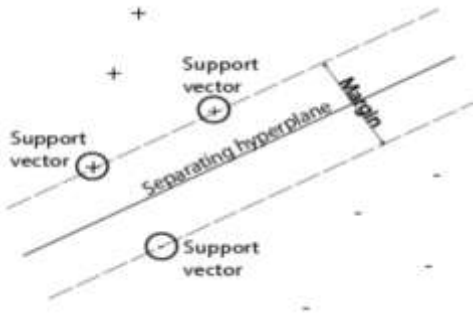

Figure 2: Overview of SVM

IV. GENETIC ALGORITHM

Genetic Algorithm is a search technique used in computing to find true of approximate solutions to optimization and search problems.
It maintains a population of candidate solutions for the problem at hand, and makes it evolve by iteratively applying a set of stochastic operators.

Fitness Function (also known as the **Evaluation Function**) evaluates how close a given solution is to the optimum solution of the desired problem. It determines how fit a solution is.
Stochastic operators:-

1] Selection
It replicates the most successful solutions found in a population to their relative quality.
It is used to select elitist individuals as parents in current population, which can generate offspring. As criteria to judge whether individuals are elastic fitness values are used. How to select the best chromosomes there are many methods.
Boltzman selection, tournament selection, rank selection, steady-state selection, elitismselection and others. Some are given below in shortly.

2] Crossover
It decomposes two distinct solutions and then randomly mixes their parts to form novel solutions.
The generation of a successors in Genetic Algorithm is determined by set of operators that recombine and mutate selected members of the current population. In crossover step, It produces to new offspring from to parent string, by coping selected bits from each parent.
There are three types of crossover opeators:-
i) Single point Crossover
ii) Two point Crossover
iii) Uniform Crossover

3] Mutation
It randomly perturbs a candidate solution.
It produces offspring form single parent instead of produce offspring by combining parts of two parents. Mutation is performed after crossover.

Basics steps of genetic algorithm:-
1] Initialize population
2] Selection according to fitness
3] Crossover between selected chromosomes
4] Perform Mutation
5] Repeat cycle till the condition is true.

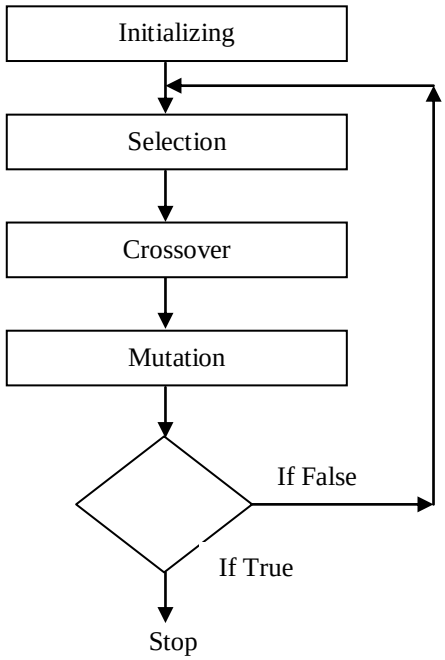

Figure 3: Flow chart of genetic algorithm

V. FUTURE ENHANCEMENT

To improve accuracy and recognition rate in segmentation and classification process Artificial Neural Network, Bayes classifier, Fuzzy Logic and hybrid algorithms can also be used.

VI. CONCLUSION

Based on the analysis of research, For plant leave disease the proposed work is giving better technique to do classification and detection. We can develop an application easily. In experimental results indicate how much leaf is affected and what is the accuracy of a leaf to grow the plant. In the future, the proposed approach is a valuable approach.

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