Detection of unhealthy region of plant leaves using Image Processing and Genetic Algorithm

Vijai Singh
Asst Professor
IMS Engg college
Ghaziabad, UP ,India
vijai.cs@gmail.com

Varsha
Asst Professor JSSATE Noida,
Uttar Pradesh, India

Prof. A K Misra
Professor, MNNIT
Allahabad, Uttar Pradesh,
India

***Abstract* -Agricultural productivity is that thing on which Indian Economy highly depends. This is the one of the reasons that disease detection in plants plays an important role in agriculture field, as having disease in plants are quite natural. If proper care is not taken in this area then it causes serious effects on plants and due to which respective product quality, quantity or productivity is affected. Detection of plant disease through some automatic technique is beneficial as it reduces a large work of monitoring in big farms of crops, and at very early stage itself it detects the symptoms of diseases means when they appear on plant leaves. This paper presents an algorithm for image segmentation technique used for automatic detection as well as classification of plant leaf diseases and survey on different diseases classification techniques that can be used for plant leaf disease detection. Image segmentation, which is an important aspect for disease detection in plant leaf disease, is done by using genetic algorithm.**

Keywords: Image processing, Genetic algorithm, plant disease detection

I. INTRODUCTION

The existing method for plant disease detection is simply naked eye observation by experts through which identification and detection of plant diseases is done. For doing so, a large team of experts as well as continuous monitoring of experts is required, which costs very high when farms are large. At the same time, in some countries, farmers don't have proper facilities or even idea that they can contact to experts. Due to which consulting experts even cost high as well as time consuming too. In such condition the suggested technique proves to be beneficial in monitoring large fields of crops. And automatic detection of the diseases by just seeing the symptoms on the plant leaves makes it easier as well as cheaper. This also supports machine vision to provide image based automatic process control, inspection, and robot guidance [2][4][5].

Plant disease identification by visual way is more laborious task and at the same time less accurate and can be done only in limited areas. Whereas if automatic detection technique is used it will take less efforts, less time and more accurately. In plants, some general diseases are brown and yellow spots, or early and late scorch, and other are fungal, viral and bacterial diseases. Image processing is the technique which is used for measuring affected area of disease, and to determine the difference in the color of the affected area [1][2][6].

Image segmentation is the process of separating or grouping an image into different parts. There are currently many different ways of performing image segmentation, ranging from the simple thresholding method to advanced color image segmentation methods. These parts normally correspond to something that humans can easily separate and view as individual objects. Computers have no means of intelligently recognizing objects, and so many different methods have been developed in order to segment images. The segmentation process in based on various features found in the image. This might be color information, boundaries or segment of an image [11][13].

Genetic algorithms belong to the evolutionary algorithms which generate solutions for optimization problems. Algorithm begins with a set of solutions called population. Solutions from one population are chosen and then used to form a new population. This is done with the anticipation, that

978-1-4673-6911-4/15/$31.00 ©2015 IEEE

the new population will be enhanced than the old one. Solutions which are selected to form new solutions (offspring) are chosen according to their fitness - the more appropriate they are the more probability they have to reproduce [12][14].

II. Literature Review

Savita N. Ghaiwat et al. present survey on different classification techniques that can be used for plant leaf disease classification. For given test example, k-nearest-neighbor method is seems to be suitable as well as simplest of all algorithms for class prediction. If training data is not linearly separable then it is difficult to determine optimal parameters in SVM, which appears as one of its drawbacks [1].

In paper [2] there are mainly four steps in developed processing scheme, out of which, first one is, for the input RGB image, a color transformation structure is created, because this RGB is used for color generation and transformed or converted image of RGB, that is, HSI is used for color descriptor. In second step, by using threshold value, green pixels are masked and removed. In third, by using pre-computed threshold level, removing of green pixels and masking is done for the useful segments that are extracted first in this step, while image is segmented. And in last or fourth main step the segmentation is done.

The paper [3] presents the technique to classify and identify the different disease through which plants are affected. In Indian Economy a Machine learning based recognition system will proves to be very useful as it saves efforts, money and time too. The approach given in this for feature set extraction is the Color Co-occurrence Method. For automatic detection of diseases in leaves, neural networks are used. The approach proposed can significantly support an accurate detection of leaf, and seems to be important approach, in case of steam, and root diseases, putting fewer efforts in computation.

According to Paper [4] disease identification process include some steps out of which four main steps are as follows: first, for the input RGB image, a color transformation structure is taken, and then using a specific threshold value, the green pixels are masked and removed, which is further followed by segmentation process, and for getting useful segments the texture statistics are computed. At last, classifier is used for the features that are extracted to classify the disease. The proposed algorithm shows its efficiency with an accuracy of 94% in successful detection and classification of the examined diseases. The robustness of the proposed algorithm is proved by using experimental results of about 500 plant leaves in a database.

Anand H. Kulkarni et al. presents a methodology for early and accurately plant diseases detection, using artificial neural network (ANN) and diverse image processing techniques. As the proposed approach is based on ANN classifier for classification and Gabor filter for feature extraction, it gives better results with a recognition rate of up to 91%. An ANN based classifier classifies different plant diseases and uses the combination of textures, color and features to recognize those diseases [5].

The paper [6] presents disease detection in Malus domestica through an effective method like K-mean clustering, texture and color analysis. To classify and recognize different agriculture, it uses the texture and color features those generally appear in normal and affected areas. In coming days, for classification purpose given classifiers can also be used, like K-means clustering, Bayes classifier and principal component classifier.

According to [7] histogram matching is used to identify plant disease. In plants, disease appears on leaf therefore the histogram matching is done on the basis of edge detection technique and color feature. Layers separation technique is used for the training process which includes the training of these samples which seperates the layers of RGB image into red, green, and blue layers and edge detection technique which detecting edges of the layered images. Spatial Gray-level Dependence Matrices are used for developing the color co-occurrence texture analysis method.

Paper [8] presents the Triangle threshold and simple threshold methods. These methods are used to lesion region area and segment the leaf area respectively. In final step, categorization of disease is done by calculating the quotient of leaf area and lesion area. According to the research done, the given method is fast and accurate for calculating leaf disease severity and leaf area calculation is done by using threshold segmentation.

For disease spot segmentation an algorithm is used, that is image processing techniques in plant leaf is implemented [9]. In this paper, process of disease spot detection is done by comparing the effect of HSI, CIELAB, and YCbCr color space. For Image soothing Median filter is used. In final step,

by applying Otsu method on color component, calculation of threshold can be done to find the disease spot. There is some noise because of background which is shown in the experimental result, camera flash and vein. CIELAB color model is used to remove that noise.

The paper [10] presents state of art review of different methods for leaf disease detection using image processing techniques. The existing methods studies are for increasing throughput and reduction subjectiveness which comes due to naked eye observation through which identification and detection of plant diseases is done

III. Proposed Methodology

To identify the affected area, the images of various leaves are taken with a digital camera or similar device. Then to process those images, various image-processing techniques are applied on them to get different and useful features required for later analyzing purpose.

TABLE1AJARA REVIEW

Paper	Methodology	Future Work
[1] Detection and Classification of Plant Leaf Diseases Using Image processing Techniques: A Review	Review of ANN, SVM, PNN,SELF ORG MAPS AND FUZZY LOGIC	In neural network it's difficult to understand structure of algorithm and to determine optimal parameters when training data is not linearly separable
[2] Agricultural plant Leaf Disease Detection Using Image Processing	vision-based detection algorithm with Masking the green-pixels and Color co-occurrence Method	NN's can be used to increase the recognition rate of classification process
[3] An Application of K-Means Clustering and Artificial Intelligence in Pattern Recognition for Crop Diseases	K-means clustering algorithm with Neural networks for automatic detection of leaves diseases	Artificial Neural Network and Fuzzy Logic with other soft computing technique can be used to classify the crop diseases
[4] Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features	Color co-occurrence method with SVM classifier	The training samples can be increased and shape feature and color feature along with the optimal features can be given as input condition of disease identification
[5] Applying image processing technique to detect plant diseases	Gabor filter for feature extraction and ANN classifier for classification	Recognition rate can be increased
[6] Remote Area Plant Disease Detection Using Image Processing	Texture segmentation by co-occurrence matrix method and K-means Clustering Technique	Bayes classifier, K-means clustering and principal component classifier can be used to classify various plant diseases.
[7] Advances In Image Processing For Detection Of Plant Diseases	The color co-occurrence texture analysis method was developed through the use of Spatial Gray-level Dependence Matrices	Better result of detection can be obtained with the large database and advance feature of color extraction
[8] Leaf Disease Severity Measurement Using Image Processing	Simple threshold and Triangle thresholding segmentation methods	Nil
[9] Color Transform Based Approach for Disease Spot Detection on Plant Leaf	Median filter is used for image smoothing and threshold can be calculated by applying Otsu method	Disease spot area can be computed for assessment of loss in agriculture crop. Disease can be classified by calculating dimensions of disease spot.
[10] Image Processing Techniques for Detection of Leaf Disease	survey of different techniques for leaf disease detection	development of hybrid algorithms & neural networks in order to increase the recognition rate of final classification process

In the first step, all the leaf samples were taken as the RGB images:

The step-by description of the procedure of proposed system is as follows:
1) Image acquisition;
2) Preprocessing of input image
3) Segment the components using genetic algorithm
4) Obtain the useful segments to classify the leaf diseases;

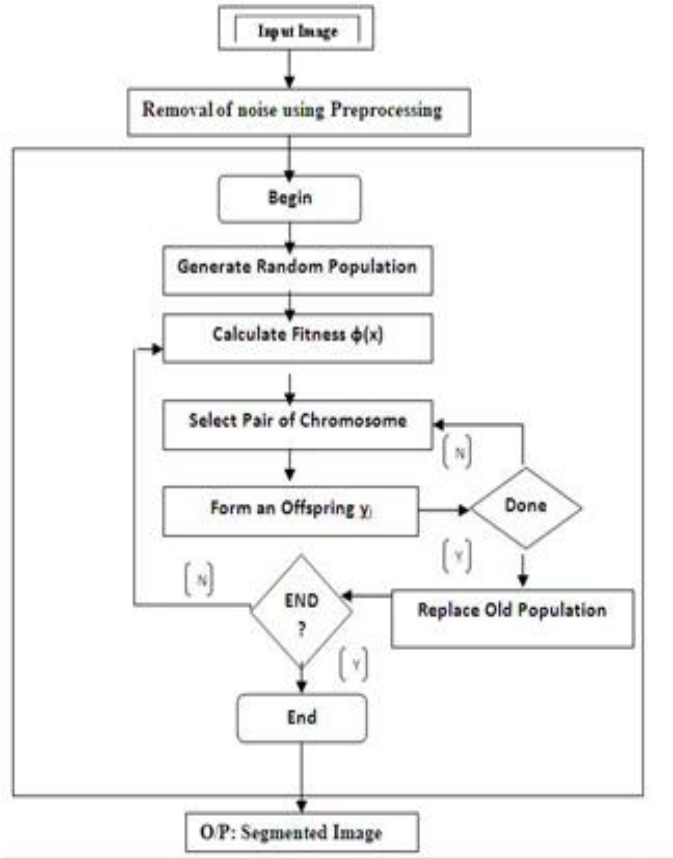

Fig.1.Flow chart of Proposed Methodology

IV. RESULTS

We perform all the experiment in MATLAB. For input data disease samples of plant leaves like rose with bacterial disease, beans leaf with bacterial disease, lemon leaf with Sun burn disease, banana leaf with early scorch disease and fungal disease in beans leaf. Figure shows the original images which are followed by output segmented images. Segmented image can be classified into different plant deseases.

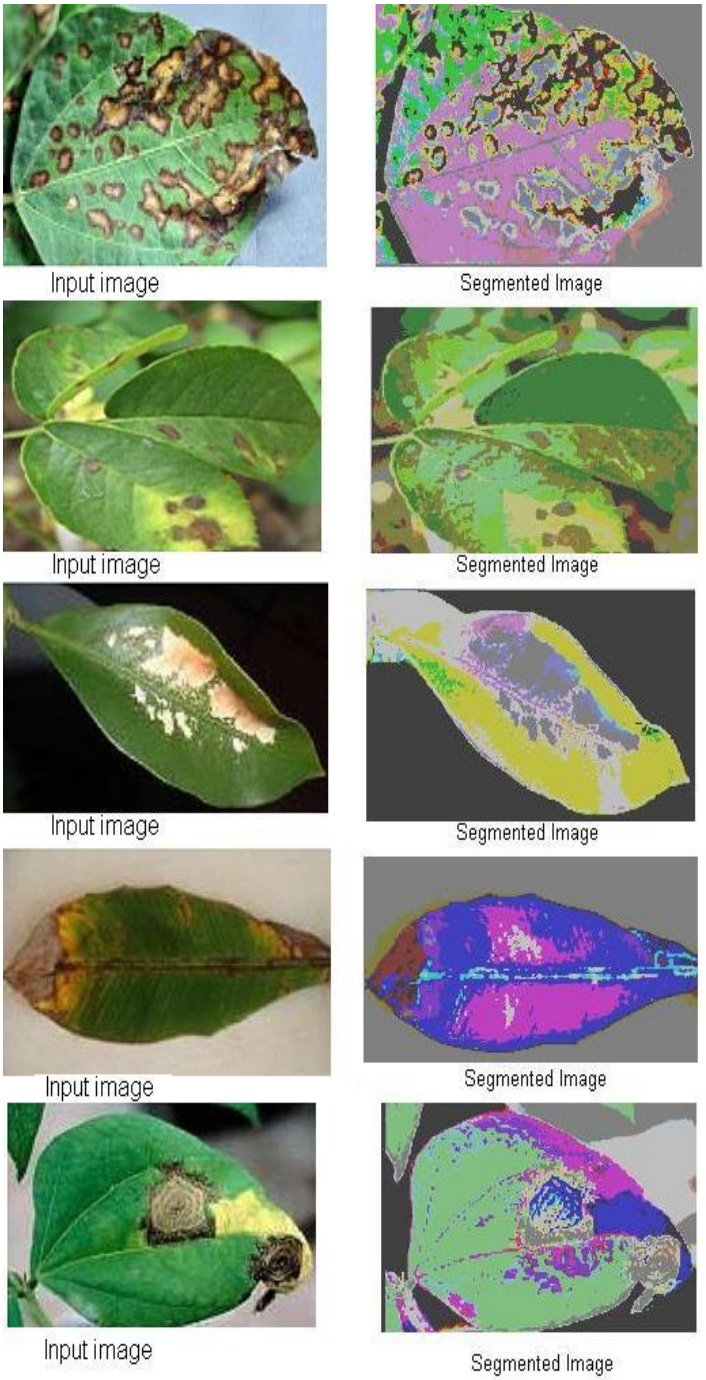

Fig.2. Input and Output Images

V. CONCLUSION

This paper gives the survey on different diseases classification techniques that can be used for plant leaf disease detection and an algorithm for image segmentation technique used for automatic detection as well as classification of plant leaf diseases has been described later. Banana, beans, jackfruit, lemon, mango, potato, tomato, and sapota are some of those ten species on which proposed algorithm was tested. Therefore, related diseases for these plants were taken for identification. With very less computational efforts the optimum results were obtained, which also shows the efficiency of proposed algorithm in recognition and classification of the leaf diseases. Another advantage of using this method is that the plant diseases can be identified at early stage or the initial stage. To improve recognition rate in classification process Artificial Neural Network, Bayes classifier, Fuzzy Logic and hybrid algorithms can also be used.

REFERENCES

[1] Savita N. Ghaiwat, Parul Arora "Detection and Classification of Plant Leaf Diseases Using Image processing Techniques: A Review", International Journal of Recent Advances in Engineering & Technology, ISSN (Online): 2347 - 2812, Volume-2, Issue - 3, 2014

[2] Prof. Sanjay B. Dhaygude, Mr.Nitin P.Kumbhar "Agricultural plant Leaf Disease Detection Using Image Processing" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 1, January 2013

[3] Mrunalini R. Badnakhe and Prashant R. Deshmukh" An Application of K-Means Clustering and Artificial Intelligence in Pattern Recognition for Crop Diseases", International Conference on Advancements in Information Technology 2011 IPCSIT vol.20 (2011)

[4] S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features" Agric Eng Int: CIGR Journal, 15(1): 211—217 2013

[5] Anand.H.Kulkarni, Ashwin Patil R. K." Applying image processing technique to detect plant diseases", International Journal of Modern Engineering Research, Vol.2, Issue.5, Sep-Oct. 2012 pp-3661-3664

[6] Sabah Bashir, Navdeep Sharma "Remote Area Plant Disease Detection Using Image Processing", IOSR Journal of Electronics and Communication Engineering , ISSN : 2278-2834 Volume 2, Issue 6 2012, PP 31-34

[7] Smita Naikwadi, Niket Amoda" ADVANCES IN IMAGE PROCESSING FOR DETECTION OF PLANT DISEASES" , International Journal of Application or Innovation in Engineering & Management , Volume 2, Issue 11, November 2013

[8] Sanjay B. Patil et al. "LEAF DISEASE SEVERITY MEASUREMENT USING IMAGE PROCESSING", International Journal of Engineering and Technology Vol.3 (5), 2011, 297-301

[9] Piyush Chaudhary et al. "Color Transform Based Approach for Disease Spot Detection on Plant Leaf", International Journal of Computer Science and Telecommunications ,Volume 3, Issue 6, June 2012

[10] Arti N. Rathod, Bhavesh Tanawal, Vatsal Shah" Image Processing Techniques for Detection of Leaf Disease", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 11, November 2013

[11] S.Beucher, F.Meyer. "The morphological approach to segmentation: The watershed transform", in Mathematical Morphology Image Processing, E. R. Dougherty, Ed. New York Marcel Dekker, 1993, vol. 12, pp. 433–481.

[12] B. Bhanu, S. Lee, J. Ming. "Adaptive image segmentation using a genetic algorithm", In IEEE Transactions on Systems, Man and Cybernetics, volume 25, pages 1543–1567, Dec 1995.

[13] B. Bhanu, J. Peng. "Adaptive integrated image segmentation and object recognition", In IEEE Transactions on Systems, Man and Cy- bernetics, Part C, volume 30, pages 427–441, November 2000.

[14] Keri Woods. "Genetic Algorithms: Colour Image Segmentation Literature Review", July 24, 2007.