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An Efficient Plant Disease Leaf Image Segmentation: K-Means Clustering and Fuzzy Logic Classification

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A B S T R A C T

Identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product. The studies of the plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertise in the plant diseases, and also require the excessive processing time. Hence, image processing is used for the detection of plant diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. The work discussed the methods used for the detection of plant diseases using their leaves images. In future the entire system is to be implemented in hardware and Io T based Plant Motoring System will also be implemented. The internet of things has been employed to recognize and monitor the plant diseases, in which the key process is the plant disease leaf image segmentation. Based on K-means clustering, a plant disease leaf image segmentation method is proposed in this paper. The plant disease leaf images are collected by the Internet of Things (IOT). Select an initial partition with k clusters, and a new partition is generated by assigning each, pattern to its closest cluster. Then compute new clusters. After several iterations, the spot image is obtained. The experimental results show that the proposed method is a robust for plant disease leaf image segmentation.

Keywords: K-Means Clustering, Fuzzy Logic Classification, Segmentation

I. INTRODUCTION

The conventional method of plant disease detection using naked eye observation method is rude and is no effective.Using computer the plant disease detection is efficient and is not time consuming. On the basis of plant disease leaf symptoms and with the computer digital image processing methods, the recognizing plant disease becomes easier. Detection and recognition of plant diseases using machine learning method and compute isvery fruitful in identifying diseases by plant leaf symptoms at its earliest [1,2]. The obtained plant disease leaf images were composed of diseased regions and normal leaf regions. In order to extract effective features, it is first step to segment the disease regions from the leaf color images. Color segmentation of leaf image is a crucial operation in leaf image analysis and final plant disease recognition. Leaf image segmentation usually includes binary segmentation and color segmentation. The former is to extract shape features from the segmented images and the latter is to extract color features and texture features from the segmented images [3]. Many leaf image segmentation methods have been presented, which can be classified into the following basic concepts: edge, threshold, pixel oriented, contour-oriented, region oriented, model-oriented, color oriented and hybrid [4]. Currently, the methods used for plant disease image segmentation are edge detection method, segmentation method based on statistical pattern recognition, fuzzy C means clustering, K-means clustering, fuzzy logic , etc. [5-7]. All leaf image segmentation methods can be generally divided into two categories: supervised and unsupervised. The first category is not applicable to remote sensing because an optimum segmentation is difficult to obtain.

Moreover, available segmentation methods have not been thoroughly tested for remotely sensed data. For comparison purposes. This project work includes a literature survey about some of the existing method for Leaf decease detection and its problem identification. The developed algorithm is simulated using MATLAB for various images with different pattern; which show that proposed method is accurate, faster and robust in nature.it is possible to proceed with the plant disease classification and then indirectly assess the segmentation step through the produced classification accuracies. K-means clustering and Otsu algorithms are used to segment plant disease leaf images [8-10]. These algorithms are unsupervised real-time clustering algorithms. The basic idea of two algorithms is to identify the spot regions where the different colors belong to using the different colors in the image color space, so as to achieve the purpose of image segmentation. The implementation process of these segmentation methods has been used in plant leaf image segmentation. For image segment based disease recognition, the leaf images that need to be classified are segmented into two homogeneous areas with similar pixel information firstly, and the image segments' features are extracted based on the specific requirements of ground features classification. The color homogeneity is based on the standard deviation of the spectral colors, while the shape homogeneity is based on the compactness and we should choose a scale value as large as possible to distinguish two different regions: spot and normal; some color criterions are possibly used [11-13]. Because the pixel information is the most important in imagery data, the quality of segmentation would be reduced in high weightiness of shape criterion. The

Internet of Things (IOT) is a worldwide network of intercommunicating devices, which can integrate the ubiquitous communications, pervasive computing and ambient intelligence. IOT has three layers, namely, sensor layer, transport layer, application layer. IOT means that all appliances, furniture, clothes, vehicles, roads and smart materials and so on, are readable, recognizable, locatable, addressable and/or controllable via the Internet. This will provide the basis for plant disease recognition based on the disease leaf images. Often the farmer's hard works are destroyed by diseases and pests and they suffer huge monetary losses. To prevent such situation agriculture IOT has a system which monitors and scans the environmental parameters & plant growth, further this data is utilized by pest control sensors which is capable of predicting pest behavior. This information can be used by farmers to reduce damage done by pests on a large scale. Agriculture IOT helps in increasing crop productivity by way of managing and controlling the diseases and pests, and is also laced with monitoring plant disease tool to prevent the

Disease from spreading by smartly analyzing the disease information of crop leaf images and adopting optimal preventive treatment measure in time. In key process of plant disease recognition by agriculture IOT is the leaf image segmentation [14]. In this paper, using the K-means clustering algorithm, binary segmentation and color segmentation of the cucumber leaf images are conducted. The results show that this method could effectively segment the diseased regions from the color images of the diseases with robustness. The rest is organized as follows: Section 2 introduces agriculture IOT. Section 3 describes the method of leaf image segmentation based on color with K-means clustering. Experimental results obtained with suggested method are shown in section 4. Finally, section 5 concludes with some final remarks.

II. REVIEW OF RELATED LITTERATURE

Earlier papers are describing to diagnosis the cotton leaves using various approaches suggesting the various Implementation ways as illustrated and discussed below. Earlier paper the fuzzy feature selection approach fuzzy logic classification

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A. Image Processing

Rao (2014), is defined as the process of improving and enhancing the raw images that are taken through digital cameras, sensors, and many other sophisticated means such as Satellite, space probes and aircrafts for various applications. When someone suggested thousands of years ago that "a picture speaks a thousand words", probably the idea of computing was limited to basic number crunching. Above adage still has significance to computing with images. Most researchers in computer vision and image processing aim at deriving effective and better tools as well as proper approaches that give different ideas on the same image by providing means to comprehend not only the content of the image but also give meaning, and significance of the image. There is no way image processing can be compared or matched with the human eye in terms of accuracy, but it can outperform it easily on observational consistency, and ability to carry out detailed mathematical operations. Again, image processing can be used to compute and find solutions to simple or structured tasks by providing reliable, consistent and cheap results. Unlike some years back, researches conducted based on image processing in recent years have been broadened widen to cover a large range of information ranging from simple and basic pixel based low-level operations to high-level analysis that now includes the use sophisticated tools including techniques like artificial intelligence for the purposes of interpretation and understanding of the image. These new and modern techniques for processing images are being developed to get a better meaning and understanding of images based on the relationship between its components, its context, and its history fit is a part of a sequence, and a priori knowledge gained from arrange of images.

B. Uses of Image Processing

(Jayamala K. Patil and Rai Kumar, 2011) identified about five main uses of image processing in respect to agricultural plants and their fruits. In their research, they identified that image processing is very useful to:

Detect plant leaves, stems and fruits that are affected by diseases. Quantify the areas affected by disease in plant leaves, fruit and stems.

Detect the shape of the area of the leaves, fruits and stem that has been affected. Determine the colour of the affected areas and finally, Find out the size and shape of fruits. (K.M.M. Rao, 2014)also identified some uses of Image Processing as applied and used in various applications such as Material Science, Agriculture, Remote Sensing, Medicine, Document processing, engineering, Non-destructive Evaluation, Forensic Studies, Textiles, Military, Printing Industry, Film industry and Graphic design.

Image Processing Methods

Rao (2014) presented two main methods of image processing. In his paper, he presented Analog image processing as the first method. This method refers to the changes, modification and adjustment of image through electrical means. A typical example of this method is the image produced by the television. The television transmits signals in a form of voltage which varies in amplitude to represent brightness through the image. The writer continues with the second method which he identified as digital method of processing image. In this case, supposed image will be change or converted to digital form through a device known as scanner digitizer for further processing.

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III. METHODOLOGY

The pre-processing is used to read the input image into the MATLAB, convert the image in to Gray scale image and also to remove the noise present in the image. In this method noise is removed by using median filter. Since it reduces the variance of the intensities in the image and also it is used to preserve edge shapes and the location of the edges.

Image Thresholding refers to the process of creating a binary image (bitonal) by setting a starting point which serves as the base value of the pixel intensity of the original image. Thresholding technique is usually performed on grayscale images; however, thresholding may be applied to original (true colour) image. The threshold value of every image can either be set manually or automatically using a specific software or application. In this case, all pixels that fall below that set threshold value are converted to black which represents bit value of zero whilst any other pixels above the threshold value are changed to white representing a bit value of one. The thresholding can also be described as the process of breaking an image apart in order to get foreground values as well as background values (black and white). Thresholding can be simple or complex depending on the threshold value. Thresholding is said to be simple if there is only one threshold value set for all the pixels in the image for no matter the difference or variations in contrast. On the other hand, complex and sophisticated thresholding (adaptive thresholding) takes number of regions of the image and settle threshold value accordingly. It should be noted that, quality cannot be compromised in threshold.

Table 1: Tabular list of names of reviewed paper, their methodology and future works is presented below

Reference Paper	**Methodology**	**Future Work**
[1] Detection and Classification technique Of Yellow Vein Mosaic Virus Disease in Okra Leaf Images Using Naive Bayesian Classifier.	K-means clustering, Basic Morphological functions, Naïve Bayesian classifier, Color Co-Occurrence method.	Nil
[2]Svm Classifier Based Grape Leaf Dis-ease Detection	K-means clustering algorithm with SVM, Color co-occurrence method.	Developing combinations of more algorithms by using fusion classifica- tion technique so as to improve the detection the detection rate of the clas-sification process.
[3] Detecting Jute Plant Disease Using Image Processing and Machine Learning	Color co-occurrence methods, Multi SVM classifier.	Nil
[4] Plant disease Analysis Using Histogram Matching based on Bhattacharaya's Dis-tance Calculation	Bhattacharaya's similarity calculation	It identifies the burning and blast dis- ease of paddy. In furtherenhancement this method can be used to findall kind of diseases in various leaves. This may help the farmers inidentifi- cation of the disease in the leaf in feasible and accurate way, inshort time span.
[5] Detection Of Unhealthy Plant Leaves Using Image Processing and Genetic Algo- rithm with Arduino.	Genetic algorithm, Arduino, Masking the green pixel and color co-occurrence method.	Nil
[6] Maturity and disease detection in toma- to using computer vision.	Threshholding algorithm, K-means cluster- ing	Nil
[7] Cucumber disease detection using artifi- cial neural network.	ANN, GLCM(Gray level co-occurrence method)	Classification accuracy can be in- creased by using additional texture features.
[8] Detection and measurement of paddy leaf disease symptoms using image pro-cessing.	ANN, FUZZY classification, SVM, K- means algorithm, color co-occurrence meth- od.	It evaluates the techniques in image processing, detecting diagnosing of crop leaf disease.
[9] Recent Machine Learning Based Ap-proaches for Disease Detection and Classi- fication of Agricultural products.	K-means, GLCM, ANN, SURF, CCM, SVM.	According to this paper there is a need of system in agriculture science can combinely detects the disease on all kinds of plants, Fruits and Vegetables.

[10] Detection of leaf disease and classification using digital image processing.	GLCM, SVM, K-means	Classifying different plant disease and improve the classification accuracy.

This thesis work proposes the segmentation method that will perform segmentation of image, remove the noise and simultaneously correct the bias field. Proposed algorithm is formulated by introducing K-means clustering algorithm in level set segmentation method. A Local clustering criteria function is derived based on the images with irregular intensities. This local clustering criterion function is then integrated with respect to the neighbourhoodcentre to give a global criterion of image segmentation. In a level set formulation, this criterion defines an energy in terms of the level set functions that represent a partition of the image domain and a bias field that accounts for the non-uniform intensity of the image. The energy minimization is done based on the concept of Local intensity clustering function. This new formulation allows the bias field estimation and correct segmentation of image simultaneously. This estimated bias field is further used for the bias correction of affected image.

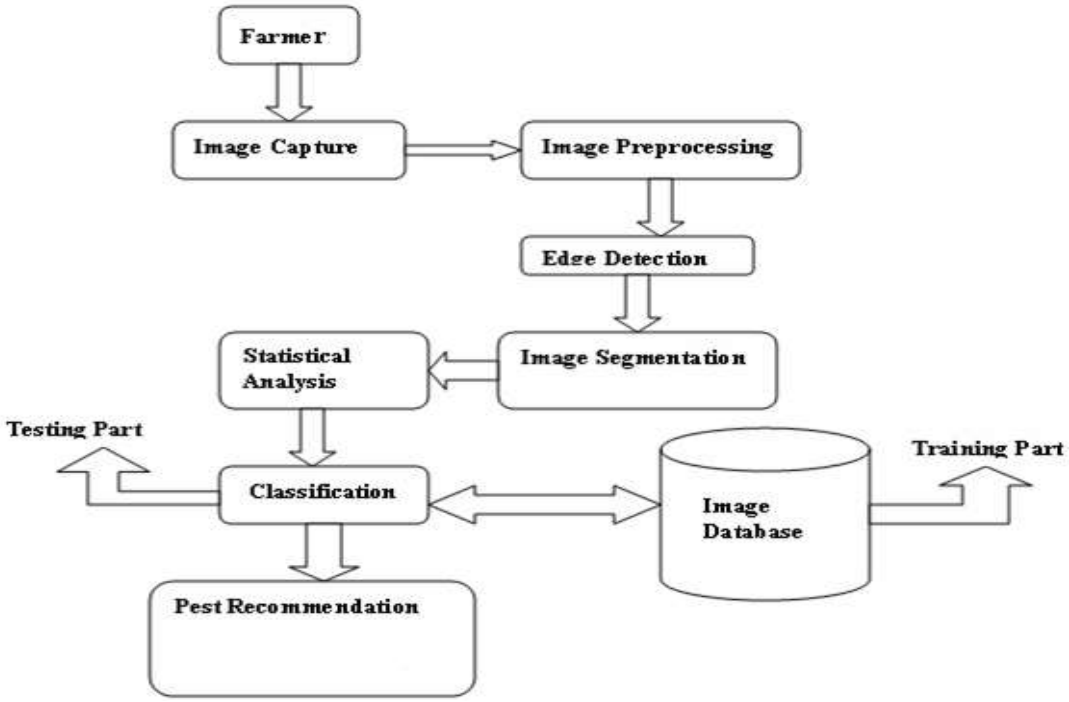

Figure 1: Advance computing diseases identification System Architecture

Initially, the digital images are acquired from the circumstances using a digital mobile camera. Then image processing techniques are applied to the acquired images to extract RGB Pixel counting features that are necessary for further analysis. After that, some analytical perceptive techniques are used to classify the images according to the specific problem at hand. In this work farmers can take decision immediately at the time. They want to get the best solution to diseases and pest recommendation, Production can be improved, the yield loss can be reduced, they minimum cost of ultimate system very useful to farmers and we can increase the economics of the country. Main aim of the project is that farmer's life protects and reduces their burden.

The following tools and materials were used for the project; Sample spot infected plant leaves, 20 samples, Digital Camera, black sheet/cloth, Light System, computer and MATLAB software Version R2015a.

Three principal stages are involved in undertaking this project. These include image acquisition, image segmentation and finally leaf region segmentation. However, other principles like conversion of image into various forms were also considered.

A. Image acquisition

Suspected plant leaves are used to carry out this project. The digital camera was used to capture images in controlled environment with the dark background. The images were stored in either JPEG or PNG format. First, the diseased leaf was placed flat on the black background (black cloth) with correct amount of light sources. This was to eliminate any reflection and get light evenly distributed everywhere in order to get a better view and brightness of the image to be processed. The object (leaf) was properly zoomed using the digital camera to ensure that the picture taken contained only the leaf and black background with the rightful image size.

B. Image segmentation

The segmentation step was used to separate the image into different regions based on similar characteristics in the image. These regions show distinct and unique characteristics from one another and should not intersect one another. Each of the regions should portray some level of consistency in the region. The segmentation stage went through two different stages in order to obtain total leaf pixels and the pixels in the leaf lesion area.

For the purposes of proper segmentation, the image is converted to grayscale from the RGB format. This can be achieved by finding the average of the three colour components in the true colour. First get the supposed image, extract the red, green and blue values of pixel using their corresponding numbers and finally replace the original RGB values with the new values. The conversion is done by computing the average of the three.

To perform the segmentation process, the image was first converted into grayscale from the true colour. This helped in differentiating due to the variation in the gray values of the two (background and actual image). The background colour if the image was represented as black whiles the actual image was represented as white. After image segmentation, the binary image containing leaf region is obtained by region filling and removing every hole in the white region. The image is then scanned from top to bottom and from left to right using the MATHLAB software to determine the total the number of pixels in the leaf. varied, then the boundaries between the lesion and the healthy parts are also varied and creates a weak edge. That called for the triangle thresholding method as the best approach for achieving the desired results for this project.

C. Extraction of Features

When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduce drepresentation instead of the full size input. Classification based on a classifier: We are using Artificial Intelligence Techniques to solve the problem. We are going to classify it with the original existing work. Artificial Neural Network and Fuzzy Logic can be used to classify the plant diseases.

D. Statistical Analysis

By comparing the classification results of ANN and Fuzzy Logic Technique. These analyzes , which system is better in sense of Accuracy, Speed, User friendly, easily adaptable topology of the network changes, a new sequence number is necessary before the network re-converges; thus, DSDV between nodes by sending full dumps infrequently and smaller incremental updates more frequently. Whenever there is not suitable for highly dynamic networks. (As in all distance-vector protocols, this doesnot perturb traffic in regions of the network that are not concerned by the topology change.

Algorithm

1. *Check to ensure that the user has installed Image processing Toolbox inMATLAB.*
2. *Load the image into MATLAB (with full filelocation)*
3. K-Means Clustering Fuzzy Logic Technique
4. *Get the dimensions of theimage*
5. *Convert the image to HSV Colorspace*
6. *Calculate the blackpixels*
7. *Find only the black that is outside the leaf, not inside theleaf*
8. *Mask the H, S, and Vimages*
9. *Plot the histogram of the huearea*
10. *Call anything with a hue of between 0.15 and 0.5"healthy".*
11. *Call anything else (that is not background)"diseased."*
12. *Compute the diseased areafraction*
13. *end*

IV. RESULT AND ANALYSIS:

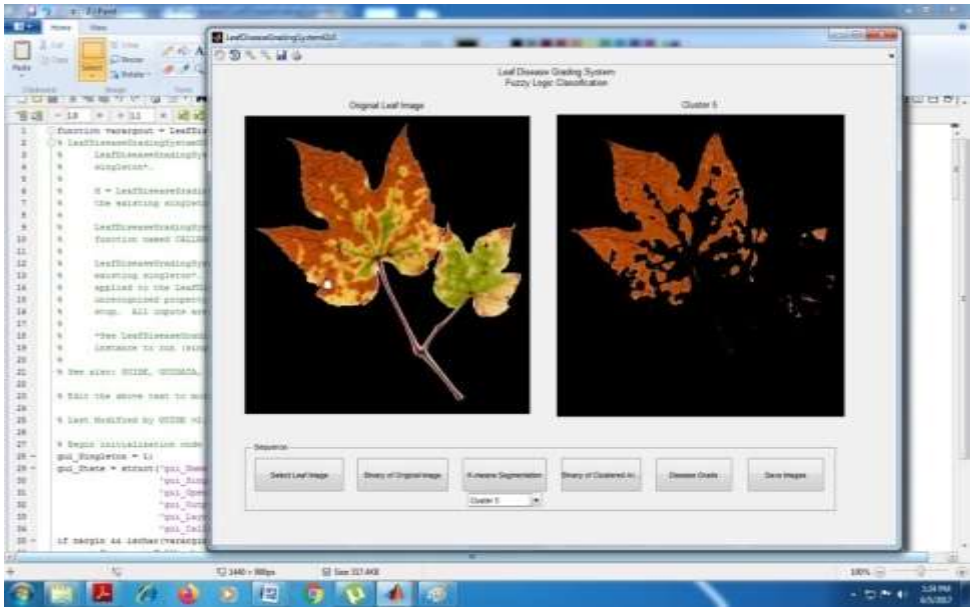

Figure 2 : Label every pixel in the image withItsCluster_index

Create Images that Segment the Image by Color.Using pixel labels, we have to the pixels can be separatedin image by color, which will result in five images. Segment the Nuclei into a Separate Image. Thenprogrammatically determine the index of the clustercontaining the blue objects because K means will not return the same cluster_idx value every time. We can dothis using the cluster center value, which contains themean 'a*' and 'b*' value for each cluster.

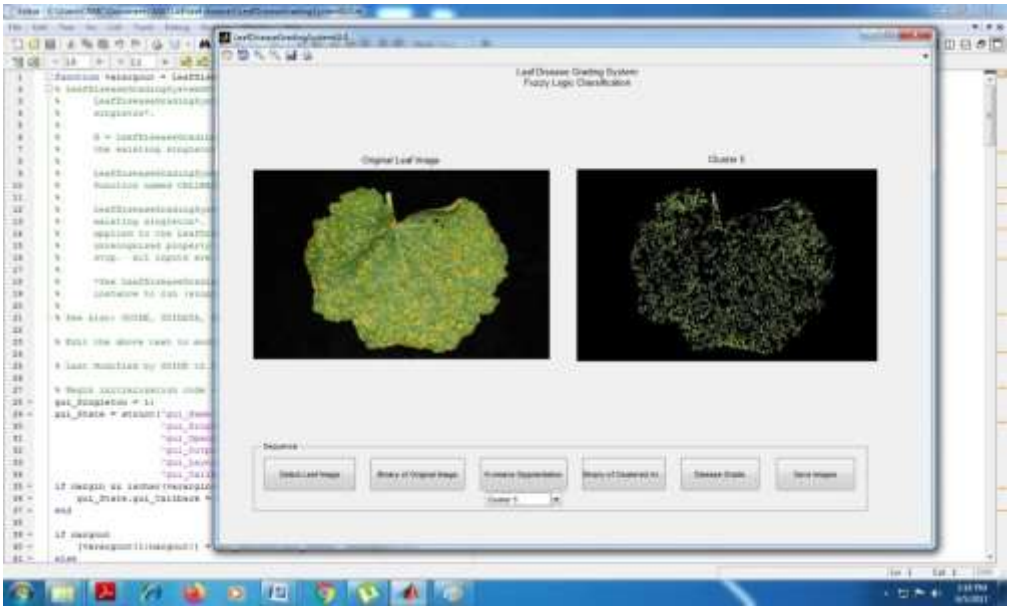

Figure 3: Use k-means to cluster the objects into chromaticity layer'a*' cluster using the Euclidean distance metric

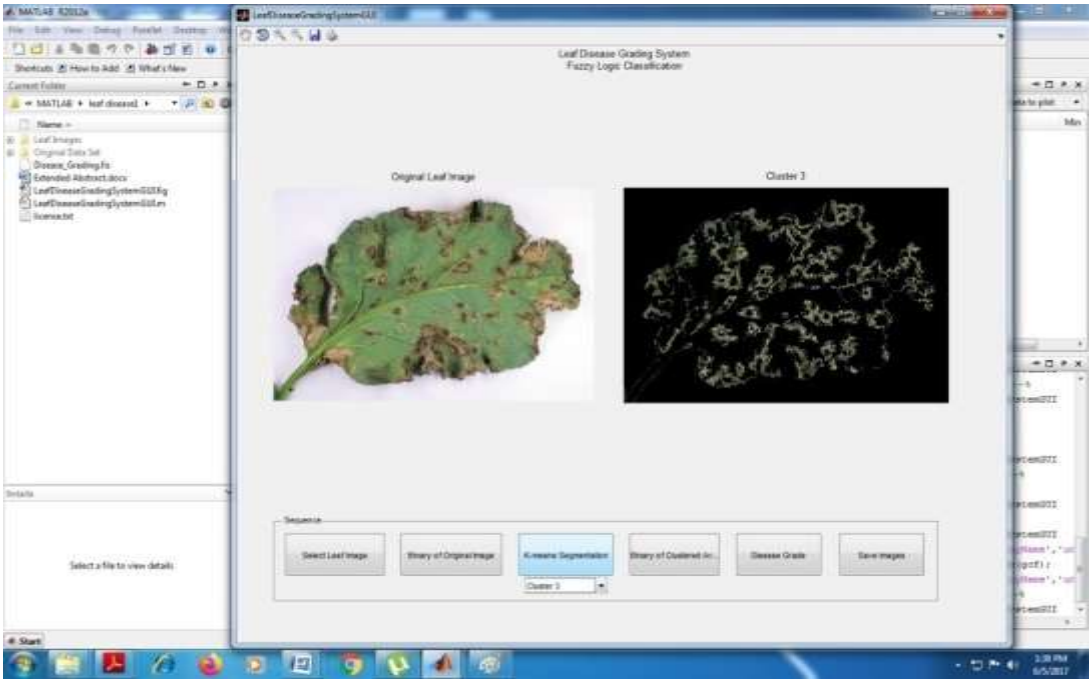

Figure 4:Use k-means to cluster the objects into luminosity layer 'L*' cluster using the Euclidean distance metric

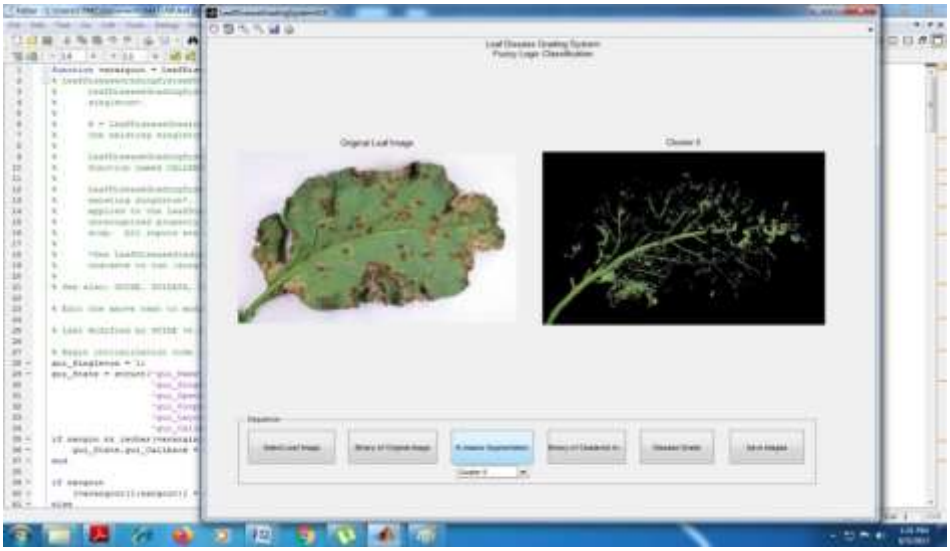

Figure 5: Use K-means to cluster the objects into luminositylayer 'L*' cluster using the Euclidean distance metric

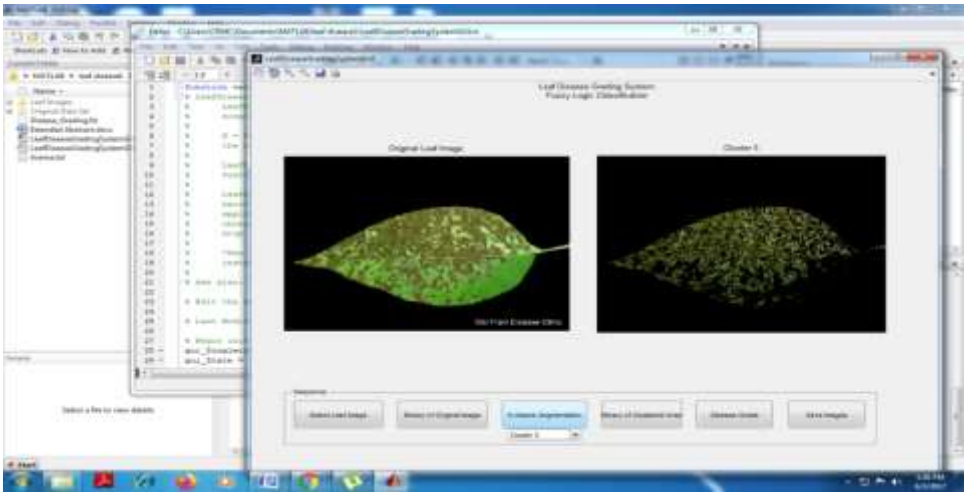

Figure 6: Corn and cucumber disease leaf images aresegmented by K-means clusting into three clusters usingthe Euclidean distance metric

V. CONCLUSION

A fundamental task in agricultural computer graphics vision is plant leaf picture segmentation. Despite the numerous approaches that have been suggested, it is still challenging to effectively segment an arbitrary image using just one technique. It is feasible to lower the computing cost by skipping feature calculation for each pixel in the image by using color-based image segmentation. Although the colour is not typically employed for image segmentation, it delivers a highdiscriminative power of regions contained in the image. In general, but not specifically, this type of picture segmentation can be used to map changes in land use and cover over time. This activity comprises of 2 parts to spot the affected a component of the ailment. At first Edge detection based Image segmentation is finished, then eventually picture analysis and categorization of diseases is performed victimisation our projected algorithm. The purpose of this analytical effort is to create an advanced automatic data processing system that will use image analysis to identify the disease that has impacted a specific area of a cotton leaf spot. The diseases' predictions and cussing advice are complete. The manufacturers will reduce the loss and change the Yield. The strain on farmers has been lessened and their lives have been saved thanks to this proposed strategy.

References

[1] Al-Bashish, D., M. Braik and S. Bani-Ahmad, 2011. Detection and classification of leaf diseases using K-means-based segmentation and neural networks based classification

[2] Alexander A. Doudkin , Alexander V. Inyutin, Albert I. Petrovsky, Maxim E. Vatkin[2007] Three Level Neural Network for Data Clusterzation on Images of Infected Crop Field, Journal of Research and Applications in Agricultural Engineering,Vol.52(1).

[3] Brendon J. Woodford , Nikola K. Kasabov and C.Howard Wearing[1999] Fruit Image Analysis using Wavelets, Proceedings of the ICONIP/ANZIIS/ANNES.

[4] ChaohulLu,HuiRen (et.al) “Leaf area measurement based on image processing,”IEEE,2010,580-582.

[5] DaeGwan Kim, Thomas F. Burks, Jianwei Qin, Duke M. Bulanon, Classification of grapefruit peel diseases using color texture featureanalysis, International Journal on Agriculture and Biological Engineering, Vol:2, No:3,September 2009. Open access at http://www.ijabe.org. Digital Image Processing - A Remote sensingperspective, Jhon R. Jenson, 3rdEdition, Prentice - Hall, 2003.Digital Image Processing - Kenneth R. Castleman, Prentice-Hall, 1996.

[6] Fundamentals Of Digital Image Processing- Anil K. Jain, Prentice-Hall, 1989. HiroyaKondou, HatuyoshiKitamura,”Shape evaluation by digital camera for grape leaf.”Science and Technology promotion center, 2002, 586-590.

[7] fuzzy surface selection technique, 5thInternational Conference ON Technology and Automation ICTA’05, Thessaloniki, Greece, pp.365-370,15-16 .

[8] HemalathaM , “Advance Computing Enrichment Evaluation of Cotton Leaf Spot Disease Detection Using Image Edge detection” , IEEE-20180, ICCCNT'12 ,26t _28t July 2012, Coimbatore, India.

[9] Hu CH, P.P. Li," Application of computer image processing to extract color feature of nutrient deficiency leaves," Computer Measurement & Control, vol.9, pp.8S9-862, Dec.2004 Pico F.X and N. J. Ouborg [2003] A Comparison of Stereomicroscope And Image Analysis For Quantifying Fruit Traits, SEED Technology, Vol.25no.1.

[10] Li, G.M. Zhou, "Research on image feature extraction of crop disease," Transactions of the CSAE, vol.2S, pp.213-217, 2009.

[11] Maliappis, K. P. Ferentinos, H. C. PassamAnd A. B. Sideridis [2008] Gims: A Web based Greenhouse Intelligent Management System, World Journal of AGRICLTURAL Sciences 4(5):640-647.

[12] Mohammed El.Helly, Ahmed Rafea and Salwa-El-Gammal, An Integrated image Processing System for Leaf Disease Detection andDiagnosis

[13] MorlonMarcon, Kleber Mariano (et.al),"Estimation of total leaf area in perennial plants using imageanalysis",R.Bras.Eng.Ambiental,2011,v.15,96-101.

[14] Muhammad Hameed Siddiqi1, SuziahSulaiman, Ibrahima Faye and Irshad Ahmad, A Real Time Specific Weed Discrimination System PanagiotisTzionas, Stelios E. Papadakis and DimitrisManolakis[2005] Plant leaves classification based on morphological features and

[15] Prasad Babu and B. SrinivasaRao[2007] Leaves Recognition Using Back Propagation Neural Network-Advice For Pest and Disease Control On Crops, IndiaKisan.Net: Expert Advissory System.

[16] Rafael C, Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB," Pearson Publication,2008. [10]Jain A K, Image Analysis and Computer Vision. PHI, New Delhi,1997.

[17] RakeshKaundal, Amar S Kapoor and Gajendra PS Raghava[2006] Machine learning techniques in disease forecasting: a case study on rice blast prediction, BMC Bioinformatics.

[18] RamanjaneyuluM, KMM Rao , A Novel technique to Resample High resolution remote Sensing Satellite Images,Proc. Ofigrass-02, Colorado.

[19] Rao et al., Design and Fabrication of Color Scanner, Indian Journal of Technology, Vol15, April 1997.

[20] Rao KMM, Image Processing for Medical Applications, Proc. Of 14thworld conference onndt, 8th

[21] Rao KMM, Medical Image Processing, Proc .of workshop on Medical Image Processing and Applications, 8thOctober 1995 @ NRSA, Hyderabad-37.

[22] Sabine D. Bauer , FilipKorc, Wolfgang Forstner, The Potential of Automatic Methods of Classification to identify Leaf diseases from Multispectral images, Published online: 26 January 2011,Springer Science+Business Media, LLC 2011., Precision Agric (2011) 12:361-377, DOI 10.1007/s11119-011-9217-6.

[23] Sanjay B. Patil et al. / International Journal of Engineering and Technology Vol.3 (5), 2011, 297-301

[24] Sanjay B. Patil, Dr. S.K.Bodhe,"Betel leaf area measurement using image processing,"IJCSE,2011,pg.2856-2660.

[25] SantanuPhadikar& Jaya Sil[2008] Rice Disease Identification Using Pattern Recognition Techniques, Proceedings Of 11thInternational Conference OnComputer And Information Technology,25-27.

[26] Wang, S.K. Li, CT. Wang," Acquired chlorophyll concentration of cotton leaves with technology of machine vision," ActaAgronvol.l,pp.34-40, Sin.2006