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Project on : Detection of Leaf Diseases and Classification using Digital Image Processing

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ABSTRACT

Agriculture is a key source of livelihood in our nation. Agriculture provides employment to most of the citizen. Agricultural productivity is something on which the economy highly depends. This is the one of the reasons that disease detection in plants plays an important role in the agriculture field, as having disease in plants is quite natural. Currently, detecting and treating plant's disease is been a task and results in less yield of the crop and eventually most of the people depend on it. 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. Taking a look at identification of leaf disease manually is very difficult when there are a bunch of varieties among the leaf itself, and coming to the disease infected to leaf there are a lot more. To sort this out we use digital image processing technique to detect leaf disease.

The steps and the framework proposed to implement the project is as follows:

(1) Image pre-processing

(2) Segmentation of the leaf using K-means clustering to determine the diseased areas

(3) feature extraction

INTRODUCTION

The agricultural land mass is more than just being a feeding source in today's world. India is an agricultural country wherein most of the population depends on agriculture. The Indian economy is highly dependent on agricultural productivity. The aim is always towards the increase in productivity and food quality at reduced expenditure , as there are a lot of varieties that are grown such as fruits, vegetables, cereals and they all are either exported or used by us. Hence, it becomes necessary to look into productivity, quality and expenditure. Many studies show that the quality of agricultural products may be reduced due to plant disease. As diseases of the plants are unavoidable, detection of plant diseases is essential in the field of Agriculture. In plants, diseases can be found in various parts such as fruits, stems and leaves. The main diseases of plants are viral, fungus and bacterial disease like Alternaria, Anthracnose, bacterial spot, canker, etc.,.

- The viral disease is due to environmental changes
- fungus disease is due to the presence of fungus in the leaf
- Bacterial disease is due to the presence of germs in leaves or plants.

Therefore, early stage detection and treating of disease here is an important task. To do this, farmers need experts who can solve this problem manually, but to do so it takes a lot of time and is prohibitively expensive. Because 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 plants is required, which costs very high when we do with large farms. The framework we have chosen through digital image processing which can be used to identify leaf diseases solves farmers' expenditure and it does not consume time more as it is automatically able to do detection of plant diseases from the symptoms that appear on the plant leaves.

PROBLEM STATEMENT

Plant diseases have turned into a dilemma as it can cause significant reduction in both quality and quantity of agricultural products. Automatic detection of plant diseases is an essential research topic as it may prove benefits in monitoring large fields of crops, and thus automatically detect the symptoms of diseases as soon as they appear on plant leaves. The proposed system is a software solution for automatic detection and classification of plant leaf diseases. The scheme consists of four main steps, first a color transformation structure for the input RGB image is created, then the green pixels are masked and removed using a specific threshold value followed by segmentation process, the texture statistics are computed for the useful segments, finally the extracted features are passed through the classifier. In the classifier the disease can be identified and a solution for disease can be found.In this paper, segmentation of leaves is done using the K-means algorithm. Texture features are extracted using GLCM .

OBJECTIVES

- To detect unhealthy regions of plant leaves.
- Coding is used to analyze the leaf infection.

IMAGE ACQUISITION:

Firstly, the images of various leaves are acquired using a digital camera with required resolution for better quality. The input image is then resized to 256x256 pixels. The construction of an image database depends on the required application. The image database has to be carefully constructed in that it generally decides the efficiency of the classifier and performance of the proposed method.The image database itself is

responsible for the better efficiency of the classifier which decides the robustness of the algorithm.

IMAGE PRE PROCESSING:

In the second step, this image is pre-processed to improve the image data that suppress undesired distortions, and enhances some image features important for further processing and analysis tasks. It includes color space conversion and image enhancement. The RGB images of leaves are converted into L*a*b* color space. It expresses colors as three values: L* for perceptual lightness, and a* and b* for four unique colors of human vision: red, green, blue, yellow. The color transformation is done to determine the luminosity and chromaticity layers. The color space conversion is used for the enhancement of visual analysis.

IMAGE SEGMENTATION:

Image segmentation is the process used to simplify the representation of an image into meaningful form, such as to highlight object of interest from the background. The K-means clustering algorithm performs segmentation by minimizing the sum of squares of distances between the image intensities and the cluster centroids. K-means clustering algorithm, or Lloyd's algorithm, is an iterative algorithm that partitions the data and assigns n observations to precisely one of k clusters defined by centroids. The steps in the algorithm are as:

1. Choose k initial cluster centers (centroid).
2. Compute point-to-cluster-centroid distances of all observations to each centroid.
3. Assign each observation to the cluster with the closest centroid.

4. Compute the mean of the observations in each cluster to obtain k new centroid locations.

5. Repeat steps 2 through 4 until there is no change in the cluster assignments or the maximum number of iterations is reached.

FEATURE EXTRACTION:

After segmentation, the GLCM features are extracted from the image. Gray-Level Co-Occurrence Matrix (GLCM) is the statistical method of investigating texture which considers the spatial relationship of pixels [15]. The GLCM functions characterize the texture of images by computing the spatial relationship among the pixels in the images. The statistical measures are extracted from this matrix. In the creation of GLCMs, an array of offsets which describe pixel relationships of varying direction and distance have to be specified. In the proposed method, four features are extracted which include contrast, energy, homogeneity and correlation.

Healthy Leaves

Bacterial Blight

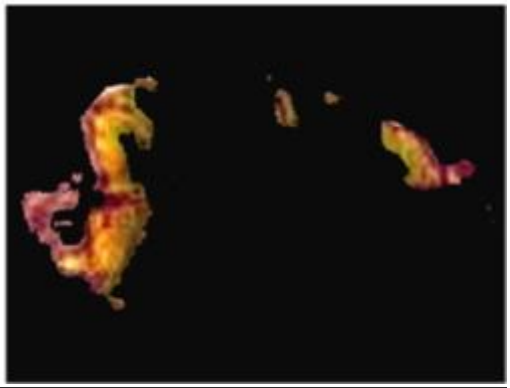
Cercospora Leaf Spot

Anthracnose

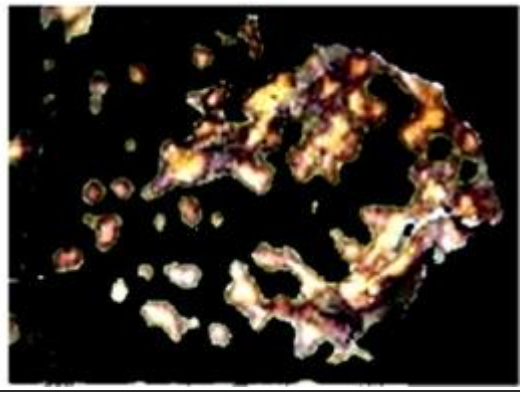
Alternaria Alternata

Experimental result

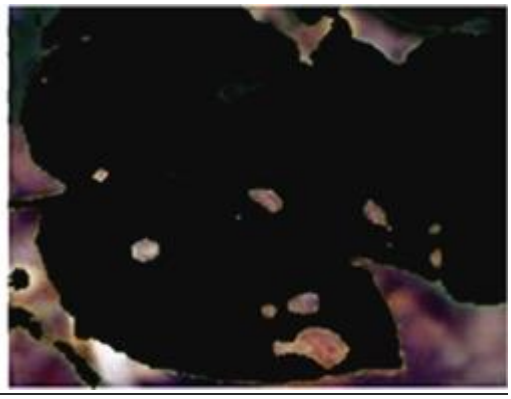
Input and output image and output diseases is early scorch disease.



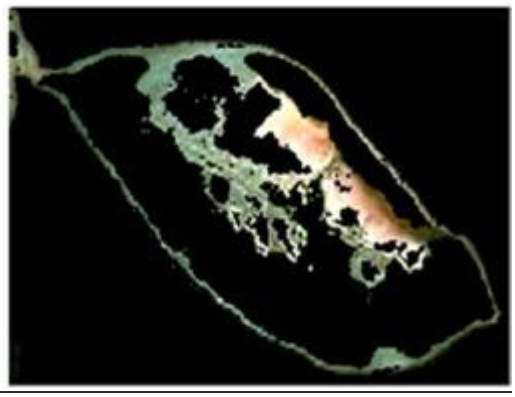
Input and output image and output diseases is bacterial leaf spot.

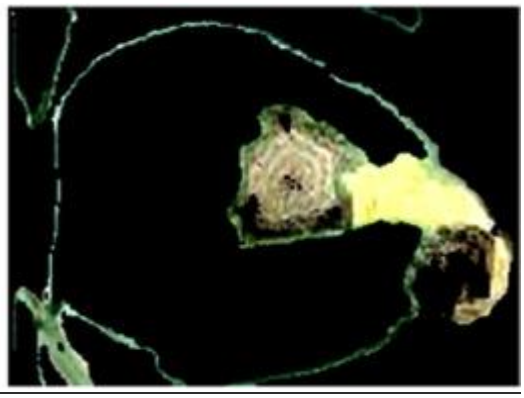
Input and output image and output diseases is bacterial leaf spot.

Input and output image and output diseases is sun burn disease.

Input and output image and output diseases is fungal disease.



Conclusion

This project summarizes image processing techniques for several leaves that have been used for recognizing leaf diseases. The major techniques for detection of plant diseases are: K-means clustering and GLCM . These techniques are used to analyze the healthy and diseased plant leaves. K-means clustering is used in segmentation, GLCM texture features are extracted . Some of the challenges in these techniques viz. effect of backgrounddata in the resulting image, automation of the technique for continuous automated monitoring of plant leaf diseases under real world field conditions. Our project suggests that thisdisease detection technique shows a good potential with an ability to detect plant leaf diseases and some limitations. Therefore, there is scope of improvement in the existing project.

References

[1] Wenjiang Huang, Qingsong Guan, Juhua Luo, Jingcheng Zhang, Jinling Zhao, Dong Liang, Linsheng Huang, and Dongyan Zhang, "New Optimized Spectral Indices for Identifying and Monitoring Winter Wheat Diseases", IEEE journal of selected topics in applied earth observation and remote sensing,Vol. 7, No. 6, June 2014

[2] Dr.K.Thangadurai, K.Padmavathi, "Computer Visionimage Enhancement For Plant Leaves Disease Detection", 2014 World Congress on Computing and Communication Technologies.

[3] Monica Jhuria, Ashwani Kumar, and Rushikesh Borse, "Image Processing For Smart Farming: Detection Of Disease And Fruit Grading", Proceedings of the 2013 IEEE Second International Conference on Image Information Processing (ICIIP-2013

[4] Zulkifli Bin Husin, Abdul Hallis Bin Abdul Aziz, Ali Yeon Bin Md Shakaff Rohani Binti S Mohamed Farook, "Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques", 2012 Third International Conference on Intelligent Systems Modelling and Simulation.

[5] Mrunalini R. Badnakhe, Prashant R. Deshmukh, "Infected Leaf Analysis and Comparison by Otsu Threshold and k-Means Clustering", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 3, March 2012.

[6] H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh, "Fast and Accurate Detection and Classification of Plant Diseases", International Journal of Computer Applications (0975 – 8887)Volume 17– No.1, March 2011

[7] Chunxia Zhang, Xiuqing Wang, Xudong Li, "Design of Monitoring and Control Plant Disease System Based on DSP&FPGA", 2010 Second International Conference on Networks Security, Wireless Communications and Trusted Computing.

[8] A. Meunkaewjinda, P. Kumsawat, K. Attakitmongcol and A. Srikaew, “Grape leaf disease detection from color imagery using hybrid intelligent system”, Proceedings of ECTI-CON 2008.