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Advances In Digital Image Processing For Detection Of Agriculture Plant Diseases

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Abstract: Every year farmers are experiencing large amount of losses because of diseases that are occurring on leaves of various crops. Leaf diseases leads to reduction in both quality and quantity of agricultural products. Detection of diseases occurring on plant leafs automatically is an essential topic as it may prove beneficial for monitoring large field of crops. Identification of plant disease is very difficult in agriculture field. If identification is incorrect then there is a huge loss on the production of crop and economical value of market. Also the main challenge is to reduce the usage of pesticides in the agricultural field and to increase the quality and quantity of the production rate. Various image processing techniques are used to detect diseases occurring on plant leafs. The given system is software solution for automatic detection and classification of plant leaf diseases. This system consists of four steps, first step includes formation of colour transformation structure of input RGB image, in the second step masking of green pixels is done & those green pixels are removed using specific threshold value followed by segmentation process, third step includes computing of texture statistics for useful segments and finally those extracted features are passed through classifier. So we can use image processing for identification of leaf disease in MATLAB.

Keyword: Image processing, feature extraction, Disease Detection, infection region, production rate

1. INTRODUCTION

India is eminent for Agriculture that means most of the people are engaged towards agriculture industry [1]. The agriculture industry act as a significant role in the economic sectors. Most of the plants are infected by variant fungal and bacterial diseases. Due to the exponential inclination of population, the climatic conditions also cause the plant disease. The major challenges of sustainable development are to reduce the usage of pesticides, cost to save the environment and to increase the quality. Precise, accurate and early diagnosis may reduce the usage of pesticides.

Some diseases can be easily detected by human since they are visible to human eyes, while some diseases need powerful microscopic or specific electromagnetic spectrum. Identification of plant species has many advantages including identification of medicinal plants used in Ayurveda as well as poisonous plants. This process is bald because human senses are limited and hence identification becomes very difficult especially when there is large number of species. So it has become necessary to train the computer system using algorithm and develop a system in such a way that it can identify species by capturing images of different parts of plants. Images are captured using mobile digital camera and then processed and identified part of leaf spot is being used for classification purpose of train and test [2].

An identification of variety of leaf diseases using various data mining techniques is the potential research area. The diseases of different plant species has mentioned. Classification is done for few of the disease names in this system. The concept SVM for classification is used in this system. The agricultural land mass is more than just being a feeding sourcing in today's world. Indian economy is dependent of agricultural productivity. Therefore in field of agriculture, detection of disease in plants plays an important role. To detect a plant disease in very initial stage use of automatic disease detection technique is beneficial. For instance a disease named little leaf disease is a hazardous disease found in pine trees in United States [3]. The affected tree has a stunted growth and dies within 6 years. Its impact is fund in Alabama, GeorGia parts of southern US. In such scenarios early detection could have been fruitful.

The existing method for plant disease 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 plant is required, which costs very high when we do with large farms.at the same time, in some countries, farmers do not have proper facilities or even idea that they can contact to experts even cost high as well as time consuming too. In such conditions, the suggested technique proves to be beneficial in monitoring large fields of crops. 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. 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 become more accurate. In plants, some general diseases seen are brown and yellow

spots, early and late scorch, and others are fungal, viral and bacterial diseases. Image processing is used for measuring affected area of disease and to determine the difference in the colour of the affected area [4].

Image analysis can be applied for following purposes, to quantify affected area by disease, detect diseased leaf, stem & fruit, determine the color of affected area and determine size & shape of leaf. Management of disease is very challenging task since most of the disease are seen on the leaves or stems of plants. Hence there has been increasing demand for more specific and sophisticated image pattern understanding.

2. LITERATURE REVIEW

An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques by KiranR. Gavhale, and U. Gawande, Gavhale and Gawande (2014) presented reviews and summarizes image processing techniques for several plant species that have been used for recognizing plant diseases. The majortechniques for detection of plant diseases are: back propagation neural network (BPNN), Support VectorMachine (SVM), K-nearest neighbor (KNN), and Spatial Gray-level Dependence Matrices (SGDM). Thesetechniques are used to analyses the healthy and diseased plants leaves. Intelligent Diagnose System of Wheat Diseases Based on Android Phone by Y. Q. Xia, Y. Li, and C. Li , In 2015, Xia and Li have proposed the android design of intelligent wheat diseases diagnose system. In this process, users collect images of wheat diseases usingAndroid phones and send the images across the networkto the server for disease diagnosis. After receiving disease images, the server performs image segmentationby converting the images from RGB color space to HIS color space. The color and texture features of thediseases are to be determined by using colour moment matrix and the gray level co-occurrence matrix. Thepreferred features are input to the support vector machine for recognition and the identification results arefed back to the client[10]. Implementation of RGB and Gray scale images in plant leaves disease detection –comparative study by Padmavathi and Thangadurai (2016) have given the comparative results of RGB and Gray scale images inleaf disease finding process. In detecting the infected leaves, color becomes an important feature to find thedisease intensity. They have considered Grayscale and RGB images and used median filter for imageenhancement and segmentation for extraction of the diseased portion which are used to identify the diseaselevel. The plant disease recognition model, based on leaf image classification, by the use of deep convolutionnetworks have developed. 13 kinds of diseases are identified from the healthy leaves with the capability todifferentiate leaves from their surroundings [5].

3. PROPOSED METHODOLOGY

Images of various leafs is acquired using digital camera. After acquiring those images further image pre-processing techniques are applied followed by segmentation and extraction. After that several analytical techniques are used to classify images according to specific problem at hand.

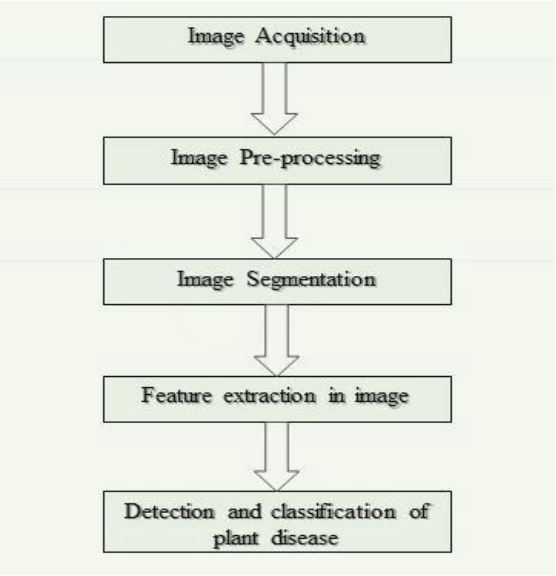

Fig 1: Steps to be followed for disease detection

Image Acquisition

The initial process is to collect the data from the public repository. It takes the image as input for further processing. We have taken most popular image domains so that we can take any formats like .bmp, .jpg, .gif as input to our process

Image Pre-processing

As the images are acquired from the real field it may contain dust, spores and water spots as noise. Thepurpose of data pre-processing is to eliminate the noise in the image, so as to adjust the pixel values. It enhancesthe quality of the image

Image Segmentation.

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. In general, the more accurate the segmentation, the more likely recognition is to succeed. Segmentation step find out the infected region. Segmentation mostly can be done by k-mean clustering, edge detection algorithm. Here we had done segmentation using k-means clustering. First RGB image is converted into lab format. Then after that reshaping of image. And then k-means clustering is applied to the images. The next step is to extract the useful segments.

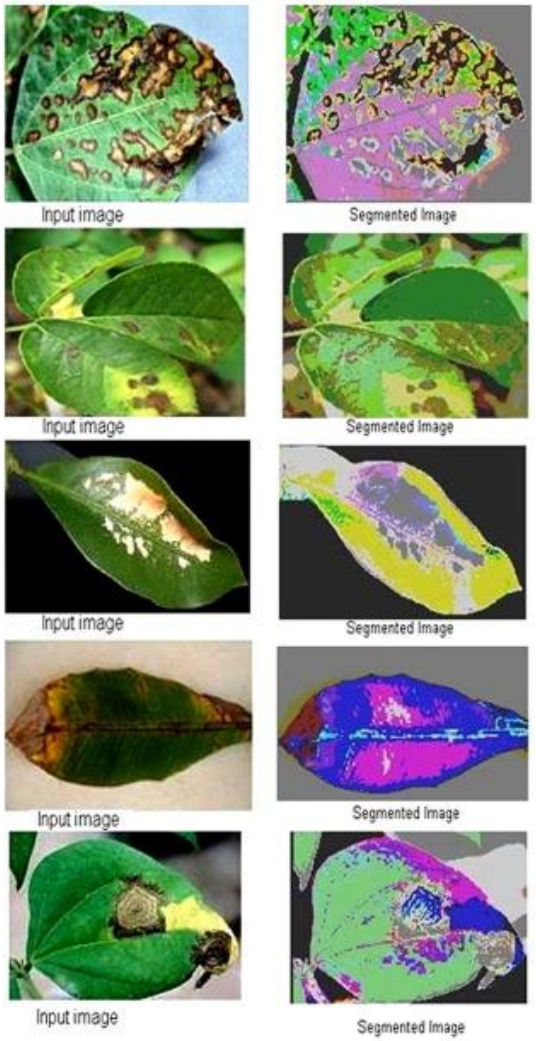

Fig 2: Different Steps of Leaf Diseases

Feature Extraction

Different texture features of images are extracted as given below Mean= Mean is defined as simple average of the numbers. If there are 5 numbers as num1, num2, num3, num4 & num5 then mean is Mean= num1+num2+num3+num4+num5 5 Variance=The variance is defined as average of the squared differences from the Mean. Standard Deviation= The Standard Deviation is a measure of how numbers are spread. Its symbol is σ (the greek letter sigma). The formula is easy: it is the square root of the Variance. Contrast= contrast is the difference in luminance or colour that makes an object (or its representation in an image or display) distinguishable. In visual perception of the real world, contrast is determined by the difference in

the color and brightness of the object and other objects within the same field of view. The human visual system is more sensitive to contrast than absolute luminance; we can perceive the world similarly regardless of the huge changes in illumination over the day or from place to place. The maximum contrast of an image is the contrast ratio or dynamic range.

Classifier

In the classification phase, co-occurrence features for the leaves are extracted and compared with the corresponding feature values stored in the feature library. The classification is first done using Minimum Distance Criterion. Classification gain can be calculated as G(%)= (Corr/M)*100 Where Corr is the number of images correctly classified and M is the total number of images belonging to the particular texture group.

4. RESULTS AND DISCUSSION

Various plant leaves from different plant species have been collected for our approach. The acquired leaf images are converted into HSI format. Various texture features like mean, entropy, smoothness, contrast, kurtosis, homogeneity etc. are derived. With these set of features plant diseases are detected. The classification is first done using Minimum Distance Criterion. The leaf images are divided into training and testing set. After analysis is being done various clusters of images are being observed and whether the leaf is healthy or unhealthy is seen. For those results we had took 2 leafs out of which one is healthy and other is unhealthy as shown in following fig.

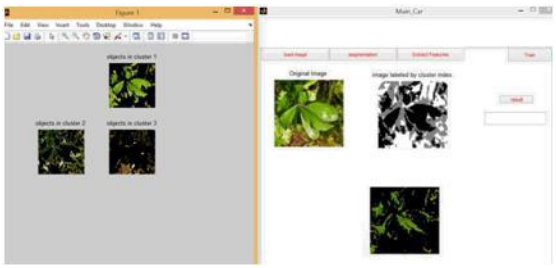

Fig: 3 Cluster Healthy Leaf

Fig: 4Cluster Healthy Leaf Identification

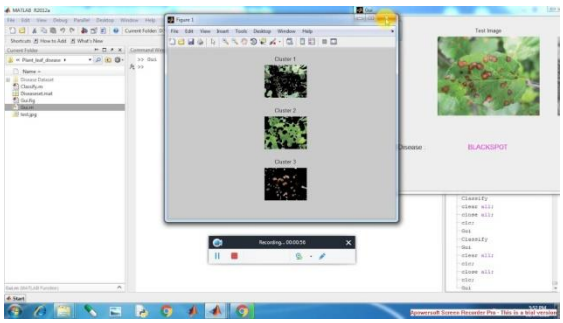

Fig: 5 Plant leaf Classification using Proposed method

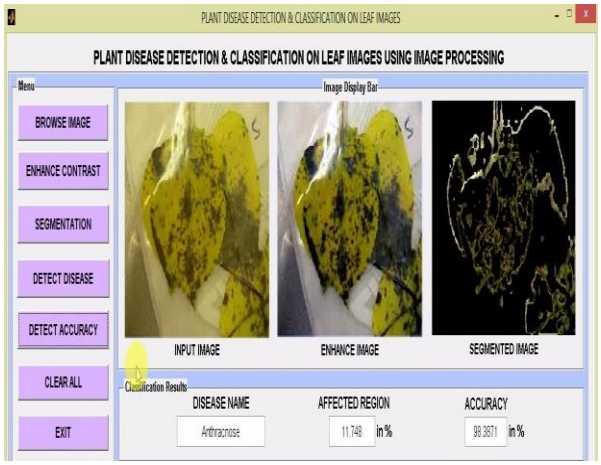

Fig: 5Plant Disease detection & Classification on Leaf Image Processing

5. CONCLUSION

These plant diseases can be identified at the initial stage itself and the pest control tools can be used to solve pest problems while minimizing risks to people and environment. The reasons for misclassification are as follows: the symptoms of diseased plant leaves vary, also the taken feature identification vectors need to further optimized. In order toimprove disease identification rate at various stages, the training samples can be increased and shape feature and color feature along with optimal features can be given as input condition of disease identification.

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