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Remote Area Plant Disease Detection Using Image Processing

Sabah Bashir[1], Navdeep Sharma[2]
[1, 2]*(Amity School of Engineering and Technology, Amity University Uttar Pradesh, India)*

ABSTRACT :*India being an agro-based economy, farmers experince alot of problem in detecting andpreventing diseases in fauna. So there is a necessacity in detecting diseases in fauna which proves to be effective and conviennent for researchers. Relying on pure naked-eye observation to detect and classify diseases can be very unprecise and cumbersome. The color and texture features are used to recognize and classify different agriculture/horticulture produce into normal and affected regions. The combinations of features prove to be very effective in disease detection. The experimental results indicate that proposed approach significantly enhances accuracy in automatic detection of normal and affected produce. This paper presents an effective method for detection of diseases in Malus Domestica using methods like K-meanclustering, color and texture analysis.*

Keywords-*CCM method, color & texture segmentation, K-mean clustering, Malus Domestica, nuclei segmentation*

I. INTRODUCTION

The conventional method of disease detection in plants using naked eye observation method is cubersome and is non effective. Using computer vision toolbox the disease detection in plants is efficient and is not time comsuming.The process of diagnosis used in plants (i.e. recognition of symptoms and signs of diseases) is completely based on the use of scientific techniques. On the basis of symptoms of particular diseases and with the help of agricultural scientists, identification of diseases becomes easier. Plant pathologists can analyze the digital images using digital image processing toolbox in matlab for diagnosis of plant diseases. Detection and recognition of diseases in plants using machine learning is very fruitful in providing symptoms of identifying diseases at its earliest[1][2].In context with reference[3] A CLASE (Central Lab. of Agricultural Expert System) diagnostic model is used for detection of diseases in cucumber crop and in order to diagnose the diseases on the leaf the four stages are implemented: image enhancement, segmentation, feature extraction and classification .The different disorders that were tested are Leaf miner, Downey and Powdery. For the detection and classification of certain diseases in plant leaves different morphological features of the leaves are used. The system which is been proposed consists of an artificial vision system (camera), a combination of classifier and image processing algorithms [4]. A Back propagation neural network is used for recognition of leaves in[5].It was proved that just a back propagation network and shape of leaf image is enough to specify the species of a leaf. Prewitt edge detection and thinning algorithm is used to find leaf tokens as input to back propagation algorithm. It was reported that there is a scope for enhancement of this work which involves more experimentation's with large training sets to recognize various leaves with pest or damaged leaves due to insects or diseases and develop an expert system. A software prototype system is described for disease detection based on the infected images of various rice plants. They used image growing, image segmentation techniques to detect infected parts of the plants. Zooming algorithm is used to extract features of the images [6]. Self Organize Map neural network is used for classifying diseased rise images. Method for fast & accurate detection & classification of plant diseases is proposed in [7]. Otsu segmentation, K-means clustering & back propagation feed forward neural network for clustering & classification of diseases that affect on plant leaves.

II. Proposed Methodology

In this paper an effective image segmentation algorithm has been implemented for color and texture analysis. The following steps are implemented in the algorithm for plant disease detection:

1. Images for detection

The samples of Malus Domestica both healthy and affected are collected using a digital camera.

2. Separation of RGB Components

The format for color images is the RGB. Each matrix corresponds to one segment of the red color, green color or blue and gives an indication of how much of each of these colors a certain pixel should use. A histogram is a chart that expresses the intensity variations in an indexed or a grayscale image. The information in a histogram can be used to choose appropriate enhancement operation**.** The process of manipulating intensity values can be done automatically by the histeq function. Histogram equalization can be performed by histeq function which involves transforming the intensity values so that the histogram of the output image approximately matches a specified histogram**.**

The process that subdivides an image into its constituent parts or objects is called as image segmentation. The segmentation which has been implemented in this paper is the color and texture based segmentation. On the basis of color and texture of the image, the presence of adequate symptoms required for detection of disease can be done.

Texture segmentation is the identification of desired markings or spots based on the texture configurations of an image. Texture analysis refers to the characterization of regions in an image by their texture content. Texture analysis attempts to quantify intuitive qualities described by terms such as rough, silky, or bumpy in the context of an image. The algorithm being used for texture analysis is co-occurrence matrix method. The image analysis technique selected for this study was the CCM method. The use of color image features in the visible light spectrum provides additional image characteristic features over the traditional gray-scale representation. The CCM methodology established consists of three major mathematical processes. First, the RGB images of leaves are converted into Hue Saturation Intensity (HSI) color space representation. Once this process is completed, each pixel map is used to generate a color co-occurrence matrix, resulting in three CCM matrices, one for each of the H, S and I pixel maps. (HSI) space is also a popular color space because it is based on human color perception. Electromagnetic radiation in the range of wavelengths of about 400 to 700 nanometers is called visible light because the human visual system is sensitive to this range. Hue is generally related to the wavelength of a light and intensity shows the amplitude of a light. Lastly, saturation is a component that measures the “colorfulness” in HSI space. Color spaces can be transformed from one space to another easily [5].

Color segmentation of image is an important operation in image analysis and in many computer vision, image interpretation, and pattern recognition systems, with applications in scientific and industrial field(s) such as medicine, Remote Sensing, Microscopy, content based image and video retrieval, document analysis, industrial automation and quality control. The performance of color segmentation may significantly affect the quality of a system which understands image [5].

In texture analysis K-means Clustering Technique has been used. The K-means clustering algorithm tries to classify pixels based on a set of features into K number of classes. The classification has been done by minimizing the sum of squares of distances between the objects and the corresponding cluster or class centroid. However, in this work K-means clustering has been used to partition the leaf image into four clusters in which one or more clusters contain the disease in case when the leaf shows the symptoms that is has been infected by more than one disease.

3. Image Analysis Image analysis is concerned with making quantitative measurements from an image to produce a description of it.

4. Matching Threshold

During the thresholding process, individual pixels in an image are marked as "object" pixels if their value is greater than some threshold value (assuming an object to be brighter than the background) and as "background" pixels otherwise. This convention is known as threshold above. Variants include threshold below, which is opposite of threshold above; threshold inside, where a pixel is labeled "object" if its value is in between two thresholds; threshold outside, which is the opposite of threshold inside.

III. RESULTS AND DISCUSSIONS

In this paper fig-1(a) shows the original image which is followed by its rgb2gray equivalent in fig-1(b).The histogram of the original image is shown in fig-1(c) and fig-1(d) shows the histogram equalized image which is been done for contrast improvement. The texture, color analysis is given in fig-1(e) and fig-1(f) are obtained on Malus Domestica leaves after implementing the above algorithms.

Fig-1(a) Original Image **Fig-1(b) Gray equivalent**

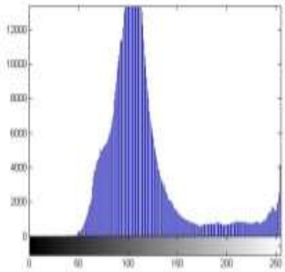

Fig-1(c) Histogram

Fig-1(d) Histogram Equalized Image

Fig-1(e) Texture Analysis

Fig- 1(f) Color Analysis

The above results show the effect after applying the algorithms in a normal leaf without any effect of disease. When a leaf is affected by any disease or it shows any symptoms then after the implementation of the CCM and K- means clustering algorithms the following results are obtained shown by figure 2(a)-(f). Fig-2(a) shows an affected leaf or a diseased leaf followed by the rgb2gray equivalent as shown in fig-2(b). The histogram of the affected leaf is shown in fig-2(c) and further the histogram equalization is done in fig-2(d). Color and texture analysis of the diseased leaf is shown in fig-2(e) and 2(f).

Fig-2(a) Affected Leaf

Fig-2(b) Gray Equivalent

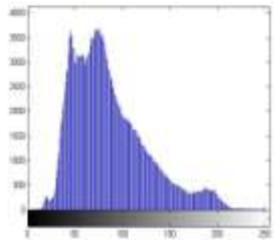

Fig-2(c) Histogram

Fig- 2(d) Histogram Eq.

Fig-2(e) Texture Analysis

Fig -2(f) Color Analysis

By comparing the texture and color analysis images with the previous ones, few spots on the images can be seen which can be used for the further detection of plant diseases.

IV. Conclusion

The methodology adopted in this paper is used for classification of various kinds of plant diseases using texture and color analysis. A Bayes classifier can be used to classify various plant diseases working upon the resultant images. We have considered 10 images samples, both normal and affected of malus domestica. First the samples are acquired then color and textures features are applied to extract useful features that are necessary for discriminating normal and affected image samples using a classifier In future we can utilize Bayes, K-means clustering and principal component classifier can be analyzed for classification purpose.

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