Detection and classification of plant leaf diseases using Image Processing

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Abstract- It proposes and evaluates a framework for detection of plant leaf disease. Studies shows that relying on naked eye observation of experts to detect such diseases can be prohibitively expensive, especially in developing countries. Providing fast ,automatic,cheap and accurate image processing solutions for that task can be of great realistic significance. The proposed framework uses image segmentation using K-means technique and pre-trained through nueral network. Experimental results indicate that the proposed approach can significantly support accurate and automatic detection of leaf diseases.

Keywords– SVM,CCM, K-means, Nueral networks

I. INTRODUCTION

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be an image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too. The main objectives of this project is to detect and classify the diseases in the stem and in the leaves of the plants.Learning how to detect the diseases of the plants.It helps the farmers to identify the diseases.It can detect the diseases with around 93% accuracy.

The rest of the paper is organized as follows. Proposed image processing algorithms are explained in section II. Experimental results are presented in section III. Concluding remarks are given in section IV.

II. PROPOSED ALGORITHM

2.1 Image processing steps-

We propose an image-processing-based solution for the automatic leaf diseases detection and classification. The proposed approach starts first by creating device-independent color space transformation structure. There are two methods: Clustering Method and Feature Extraction.The first phase is the image acquisition phase. In this step, the images of the various leaves that are to be classified are taken using a digital camera. In the second phase image pre-processing is complicated. In the third phase , segmentation using K-means clustering is performed to discover the actual segments of the leaf in the image. Later on, feature extraction for the infected part of the leaf is complicated based on specific properties among pixels in the image or their texture. After this step, certain statistical analysis takes are complicated to choose the best features that represent the given image, thus minimizing feature redundancy. Finally, classification is complicated using neural network detection algorithm.

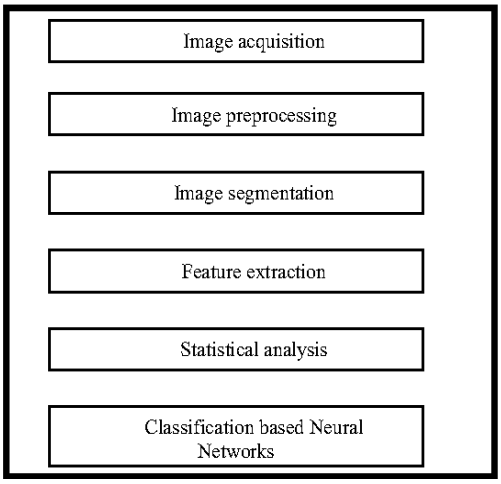

Figure 1. The basic procedure of the proposed vision-based disease detection algorithm

III. METHODOLOGY-

3.1 Clustering:

Image segmentation and feature extraction is the important steps in image processing. Image segmentation is done using Clustering method. (Svm) is used to partition the leaf image in to four clusters in which one or more clusters contain the disease in case when the leaf is infected by more than one disease.

This algorithms tries to classify objects based on set of features into K number of classes. The classification is done by minimizing the sum of squares of distance between the objects and corresponding cluster or class centroid. In our experiments,the K-means clustering is set to use squared eqclidean distances. A Support Vector Machine (SVM) is a discriminative classifier formally defined by a separating hyperplane. In other words, given labeled training data, the algorithm outputs an optimal hyperplane which categorizes new examples. In two dimensional space this hyperplane is a line dividing a plane in two parts where in each class lay in either side.

3.2 Feature Extraction Method:

The method followed for extracting the feature set is called the Color Co-occurrence Method or CCM method in short. It is a method, in which both the color and texture of an image are taken into account, to arrive at unique features, which represent that image.The CCM methodology consists of three major mathematical processes. First, the RGB images of leaves are converted into 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. Hue Saturation Intensity (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 nano meters is called visible light because the human visual system is sensitive to this range.

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The default color error parameter is the mean of (Delta-E 2000)2 calculated for all patches where $5 \leq L^* \leq 98$ and each of the R, G, and B channels are less than 99% of the maximum value Nonlinear optimization is used to calculate the matrix.

3.3 Neural Network:

A neural network is a series of algorithms that endeavours to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates. Neural networks can adapt to changing input so the network generates the best possible result without needing to redesign the output criteria.

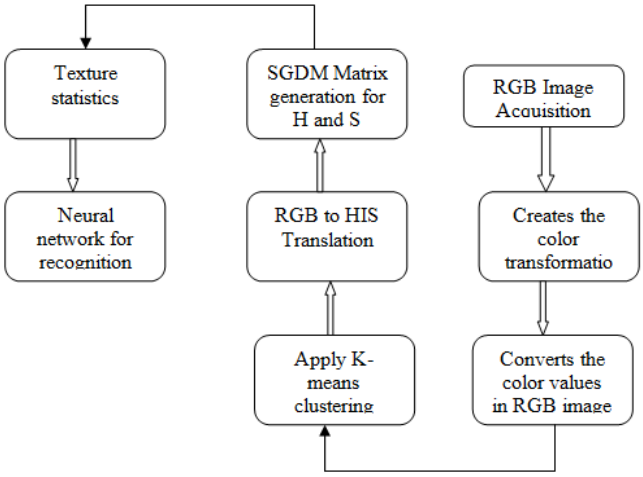

Figure 2. Image Acquisition and classification

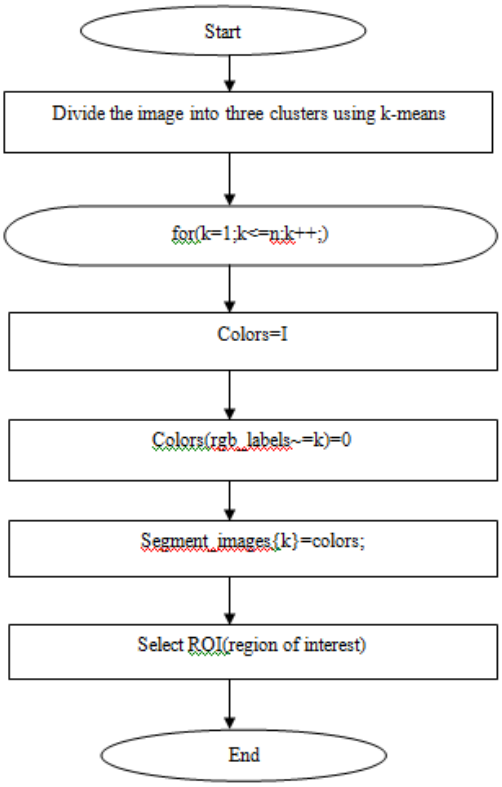

Figure 3: Flowchart for conversion from RGB to HIS

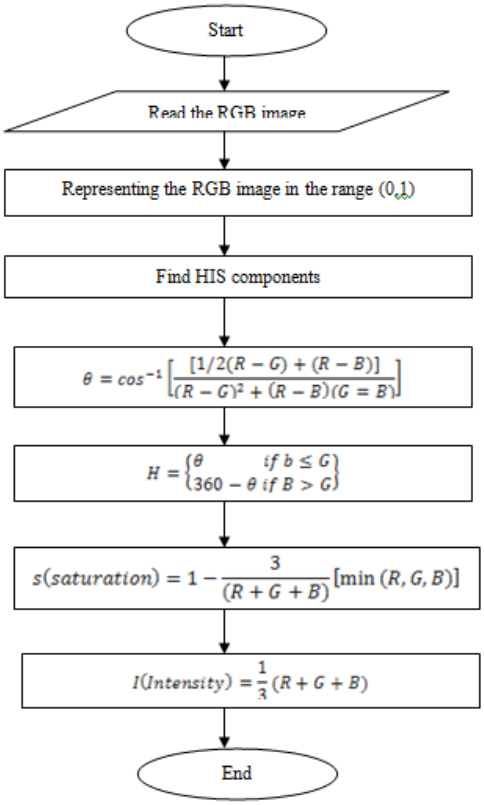

Figure 4: Flowchart for k-means clustering

IV. EXPERIMENT AND RESULT

Figure 5(a). The image of the leaf is selected

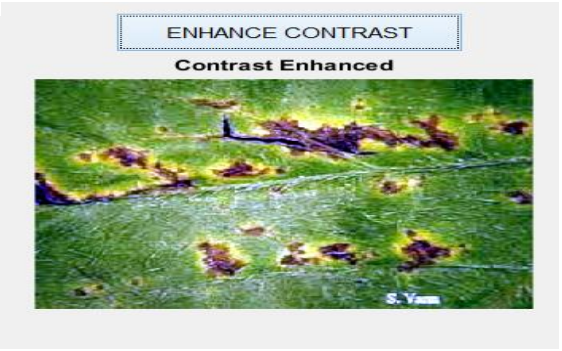

Figure 5(b): Image with enhanced Contrast

The original image is divided into three different clusters. Then a single cluster is selected for the further process.

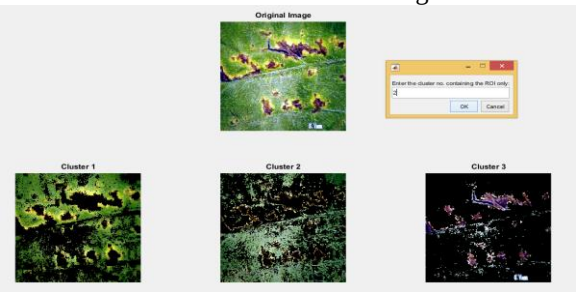

Figure 5(c): The images of different Clusters

The disease that is affected to the leaf is displayed. The leaf is not infected by any disease.

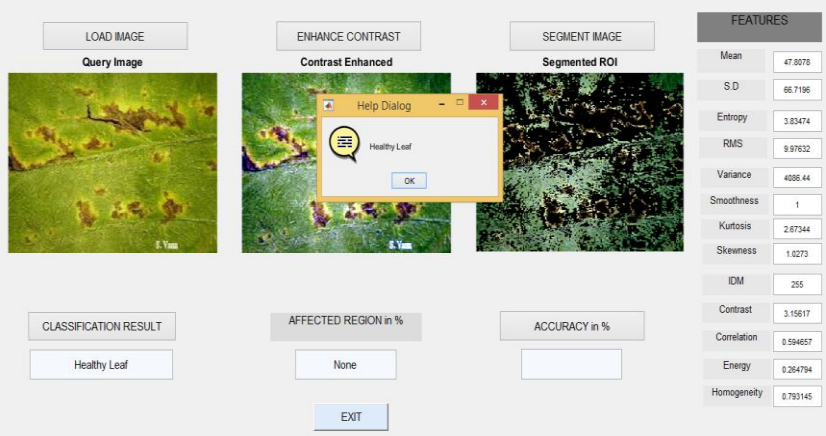

Figure 5(d): The image of the disease that is affected to the leaf.

K means method is used in order to detect the disease but SVM method is used for the purpose of classification. Initially the leaf image of the pomegranate is selected from the dataset and then the contrast enhancement is performed, then the image segment is calculated and the 3 different clusters can be found, among 3 one cluster is selected as the segmented ROI(Region of interest) and then the disease that is affected to that particular leaf is displayed.

V. CONCLUSION

The proposed approach is image-processing-based. In the first step of the proposed approach, the images at hand are segmented using the K-Means technique.In the second step, the segmented images are passed through a pre-trained neural network. As a tested, we use a set of leaf images taken from Al-Ghor area in Jordan. Our experimental results indicate that the proposed approach can significantly support accurate and automatic detection of leaf diseases. Based on our experiments, the developed Neural Network classifier that is based on statistical classification perform well and can successfully detect and classify the tested diseases with a precision of around 94%.

VI. REFERENCE

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