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Image Classification of Crop Using Neural Network

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ABSTRACT: We proposed software solution for automatic classification and detection of plant leaf diseases which is an improvement to the solution proposed in [1] as it will be able to provide quick and more accurate solution. The process consists of four main phases as mentioned in [1]. The following extra two steps are required to add successively after the segmentation phase. In the first step we find the mostly green colored pixels. And in second step, these green pixels are masked based on their specific threshold values which will compute using Otsu's method, then those mostly green pixels are masked. The other additional step is that the pixels with zeroes R.G.B. values and the pixels on the boundaries of the infected cluster are completely removed. The experimental results indicate that the proposed technique is a fast and accurate technique for the detection of plant leaves diseases. The proposed approach can successfully detect and classify the examined diseases with a precision between 83% and 94%, and able to achieve 20% speedup over the approach proposed.

KEYWORDS: digital image processing, leaf diseases, banana, pattern classification

I. INTRODUCTION

Plant diseases have turned into a crucial as it can cause significant reduction in both quality as well as quantity of agricultural products [20]. It is estimated that 2046 plant disease affected in Georgia (USA) is approximately $1039.74 million. Of this amount, around 185 million USD was spent on controlling the leaf diseases, and the rest is the value of damage caused by the diseases. The naked eye observation of experts was the main approach adopted in practice for detection and identification of plant leaf diseases [20]. However, this method requires continuous monitoring by experts which might be large expensive in large area off arms. Further, in some developing countries, farmers may have to go long distances to contact experts for identification, this makes consulting experts too expensive and time consuming [14; 5; 8].

Automatic detection of plant diseases is a very important research topic as it may prove benefits in monitoring large fields of crops at early stage, and thus automatically detect the symptoms of diseases as they appear on plant leaves [1; 18; 8]. Therefore looking for accurate and automatic, less expensive and accurate method to detect plant disease cases is of great realistic significance[14; 5].Machine based on detection and recognition of plant diseases can provide clues to identify and treat the diseases in its early stages [8; 18].Three are two main characteristics of plant-disease detection software based methods that must be achieved, they are: speed of detection and accuracy in finding the disease. In this paper an automatic detection and classification of leaf diseases is proposed, this method is based on ANNs as a classifier tool using and K-means as a clustering procedure.

II. LITERATURE SURVEY

Earlier papers are describing to detection of the plant leaves diseases using various approaches are discussed below In [1], they discussed about automatic detection and classification of diseases. Plant disease spots are different in color but not in intensity. Thus color transform of RGB image is used for better segmentation of disease spots. Median filter is used for image smoothing and Otsu method is used to calculate threshold values to detect the disease spot. It doesn't give accurate result for Dicot family plant. P. Revathi and M. Hemalatha [4] investigated advance computing technology to assists the farmer in plant development process. This approach used mobile to capture infected cotton

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leaf images. RGB color feature segmentation is carried out to get disease spots. Edge detection technique is used for extraction of image features of spots to detect diseases. Neural network is used to categorize the diseases. The segmentation process is not suitable for Monocot familyplant. S. Dubey and R. Jalal [5] explored the concept of detection and classification of apple fruit diseases. The proposed approach is composed of three steps such as segmentation ,feature extraction and classification. K-means clustering technique is used for the image segmentation.

The features are extracted from the segmented image and images are classified based on a Multiclass Support Vector Machine(SVM). The proposed approach is specific to apple fruit diseases and cannot be extended to other fruit diseases. In [6], the approach focused on Cercospora leaf spot detection in sugar beet using hybrid algorithms of templatematching and support vector machine. The approach adoptsthree stages; first, a plant segmentation index of G-R is introduced to distinguish leaf parts from soil contained background for automatic selection of initial sub-templates. Second is robust template matching method adopted forcontinuous observation of disease development, foliartranslation and dynamic object searching. Then, Support Vector Machine (SVM) is used to disease classification by a color features named two dimensional, xycolor histogram. The segmentation process is not suitable for other Dicot family plant. Yan, Han and Ming [7] proposed to select features of cotton disease leaf image by introducing fuzzy selection approach , fuzzy curves and fuzzy surfaces. The features which are extracted from fuzzy selection approach are used for diagnosing and identifying diseases. This approach removes the dependent features of image so as to reduce the number of features for classification. Sannakki, Rajpurohit, Nargund and Kulkarni [8] proposed an approach to diagnose the disease using image processing and artificial intelligence techniques on images of grape plant leaf. The input image of grape leaf is complex at background. The thresholding is used to mask green pixels and image is processed to remove noise using anisotropic diffusion. Then segmentation is done using K-means clustering technique. The diseased portion from segmented images is identified. The results were classified using back propagation neural network. In [9], they investigated approach for automatic detection of chilies plant diseases. For that, CIE Lab color transformation model is used to extract color feature from infected image. Compare the color feature for detection of disease. There is no effective work done in feature extraction. But it could yield more result accuracy if appropriate work would have been done. Next paper [10] discussed about the monitoring of grapes and apples plant diseases. It suggests a solution to farmers for healthy yield and productivity. K-means clustering is used for segmentation and artificial neural network is used for classification of features. Also back propagation concept is used for counting the weight of mango. Morphology, color and texture features are extracted for classification.

III. PROPOSED METHODOLOGY

The overall concept used for image classification is almost the same. First, the digital images are acquired from the environment using a data storage device or by digital camera. The n image-processing techniques which will be applied to the acquired images to extract useful features that are necessary for further observations. After that, several techniques are apply to classify the images according to the specific disease. Figure 1 shows the basic procedure of the proposed approach

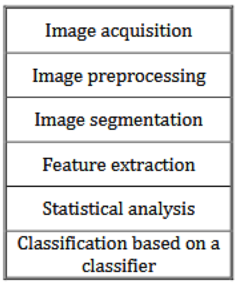

Fig: Basic procedure for proposed image based disease detection

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The proposed steps are illustrated in Algorithm 1. In the initial step, the RGB images of all the samples of leaf images were picked up. Some real samples are shown in Figure 1. We can identify by Figure 1that leaves belonging to early scorch, cottony mold, ashen mold and late scorch have significant differences form greasy spot leaves in terms of color and texture. Also, Figure 2shows two images; the right side image is a normal image and the left side image is infected with tiny whiteness disease. However, the impacted pattern related to these six classes (early scorch, cottony mold, ashen mold, late scorch, tiny whiteness and normal) had very small differences a sit cannot identify to the necked human eye, which may justify them is classifications.

Fig: Bacteria Blight

Fig: Fire Blight

In step two a color transformation structure is created for the RGB leaf image and then, a device-independent color space transformation for the color transformation structure is applied in step three. Steps 2 and 3 are needed for carrying out step 4. In this step the images in database are segmented using the K-Means clustering technique [10; 7; 3;9]. Same four steps combines in phase 1 whereas, the infected objects are determined. In step five, we are identifying the mostly green colored pixels. After that, based on specified and varying threshold value which is computed for current pixels using Otsu's method [12; 13], these mostly green pixels are masked as follows: if the green component intensities of pixel is less than the pre-computed threshold value, the RGB components of the this pixel is assigned to a value equal to zero. This is done because that these pixels have no valuable information to the disease identification and classification steps, and most probably those pixels represent healthy areas in the leave. Hence, the image processing time should become significantly reduced. In step 6 the pixels with zero RGB values and the pixels on the boundaries of the infected cluster (object)were completely removed out. Phase 2formed by steps 5 and 6, and this phase is very helpful to gives more accurate disease classification and identification results with satisfied performance and the overall computation time should become vary less.

The observations behind steps 5 and 6 were experimentally validated. Next, instep 7 the infected cluster is then converted to HIS format from RGB format. In the next step, the SGDM matrices are then computed for each pixel map of the image for only H and S images. The SGDM is a measure of the probability that the given pixel at one particular gray-level will occur at a distinct distance from other pixel and orientation angle from another pixel, given that pixel has a second particular gray-level other than previous one. By using the SGDM matrices, the texture statistics for each image we regenerated. Concisely, the features set are computed only for pixels inside the boundary of the infected areas of the leaf. In other words, healthy areas also inside the infected areas were removed. Steps 7 –10 form phase 3 in which the identification of texture features for the segmented infected objects in this phase are calculated. Final step is, the recognition process in the fourth phase was performed to the extracted features by using a pre-trained neural network. For each image in the data set the all required steps were repeated. The Proposed approach for segmentation and classification plant diseases can be divided into four phases:

Algorithm:

1 RGB image acquisition
2 Create the color transformation structure
3 Convert the color values in RGB to the space specified in the color transformation structure
4 Apply K-means clustering
5 Masking green-pixels
6 Remove the masked cells inside the boundaries of the infected clusters
7 Convert the infected (cluster / clusters) form RGB to HIS Translation

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8 SGDM Matrix Generation for H and S
9 Calling the GLCM function to calculate the features
10 Texture Statistics Computation
11 Configuring Neural Networks for Recognition

IV. CONCLUSION AND FUTURE WORK

In this paper, respectively, the applications of K-means clustering and Neural Networks (NNs) have been formulated for clustering and classification of diseases that affect on plant leaves. Recognizing the disease is mainly the purpose of the proposed approach. Thus, the proposed Algorithm was tested on five diseases which influence on the plants; they are: Early scorch, Cottony mold, ashen mold, late scorch, tiny whiteness. The experimental results indicate that the proposed approach is a valuable approach, which can significantly support an accurate detection of leaf diseases in a little computational effort.

An extension of this work will focus on developing hybrid algorithms such as genetic algorithms and NNs in order to increase the recognition rate of the final classification process underscoring the advantages of hybrid algorithms; also, we will dedicate our future works on automatically estimating the severity of the detected disease.

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