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LESION CHARACTERISATION FOR PLANT DISEASE DIAGNOSIS

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Abstract:

Major production and economical loses in agriculture are mainly due to the diseases in the plant. To control the spread of the disease, the farmers need a contiguous monitoring of the plant's health which requires more cost. Also the farmers must be educated and even be updated on the disease along with their impact of the plants. The most important symptoms of a disease such as lesions in the leaves, fruits, stems, etc, are visible. Our projects presents the methods that use digital image processing techniques to detect, quantify and classify plant diseases from digital images. A reliable diagnosis can be performed by the measurement of the lesion features along with descriptive information provided by the user. Appropriate actions can be suggested to the user based on these measurements and the conclusions that the system can reach. An image processing technique capable of recognizing the plant lesion features is described in our project.

Keywords – Plant Disease, Lesions, Image Processing.

1. INTRODUCTION

The agricultural production cost can be significantly increased if plant diseases are not detected and cured in their early stages. The plants have to be monitored all the time in order to detect the first symptoms of a disease before it is spread to the whole crop. Professional agriculture engineers may not be available to continuously monitor a crop if for example the crop resides in a distant region. Remote monitoring through machine vision can offer an alternative option. Molecular analysis may have to be performed in order to confirm if a plant is affected by a specific disease.The plant disease diagnosis can be done based on several symptoms. The progression of the symptoms in time can vary significantly depending on the biotic agents and they can be classified as primary or secondary. More than one pathogens can infect concurrently a plant. The symptoms that appear in this case may differ from the symptoms caused by the individual pathogens. The symptoms of a pathogen can be often expressed as fungal or bacterial leaf spots. The leaves can be distorted or a powdery mildew can appear. Spore structures may also be present.An image processing technique that can be implemented as a smart phone application is presented in this paper for the recognition of plant diseases. The system isolates the lesions (or spots) that can appear at various parts of a plant like the leaves, or the fruit. The diagnosis is based on the number of spots, their area and their color features. These features are compared with predetermined limits in order to select the matching disease.

2. EXISTING SYSTEM

To extract statistics and define new or customize the existing disease recognition rules. The end user can simply ignore or disable the display of such information. The plant disease diagnosis can be based on several symptoms that are described. The progression of the symptoms in time can vary significantly depending on the biotic agents and they can be classified as primary or secondary. More than one pathogens can infect concurrently a plant. The symptoms that appear in this case may differ from the symptoms caused by the individual pathogens. The symptoms of a pathogen can be often expressed as fungal or bacterial leaf spots. Vein banding, mosaic and ring spot can also appear.

Disadvantages of Existing System

1. Expensive technologies.
2. Lack of education on technologies.

3. LITERATURE SURVEY

[1]In a review of advanced techniques for detecting plant diseases [9] by S. Sankaran, A. Mishra, R. Eshani and C. Davis it presents a review of recognizing the need for developing a rapid, cost-effective, and reliable health-monitoring sensor that would facilitate advancements in agriculture. It describes the currently used technologies that can be used for developing a ground-based sensor system to assist in monitoring health and diseases in plants under field conditions. These technologies include spectroscopic and imaging-based, and volatile profiling-based plant disease detection methods. The paper compares the benefits and limitations of these potential methods.

[2]In real time PCR and its application for rapid plant disease diagnostics [10] by N.W. Schaad and R.D. Frederick explains about the portable real-time PCR instruments that described about allowing diagnostic assays to be run directly in the field or at remote locations other than the standard diagnostic laboratory. Rapid real-time PCR diagnosis can result in appropriate control measures and (or) eradication procedures more quickly and accurately than traditional methods of pathogen isolation. Disease losses are minimized and control costs reduced. Advantages and disadvantages of rapid real-time PCR for the detection of bacterial, fungal, and viral plant pathogens are described.

[3]In a Capacitive to digital Converter with Automatic Range Adaptation[3] by K. Georgakopoulou, C. Spathis, N. Petrellis and A. Birbas describes about capacitive sensors.Capacitive sensors have profoundly found their way in everyday life. Devices and instrumentation ranging from specialty equipment to smartphones all employ in one way or the other a capacitive sensor and its associated readout circuit, making the latter ubiquitious. We present a capacitive readout system that automatically adapts its range to the unknown measured capacitance, thereby extending its functional input range, as well as its application and instrumentation compatibility. The proposed system achieves a constant resolution for a range of input capacitance up to 690 pF.

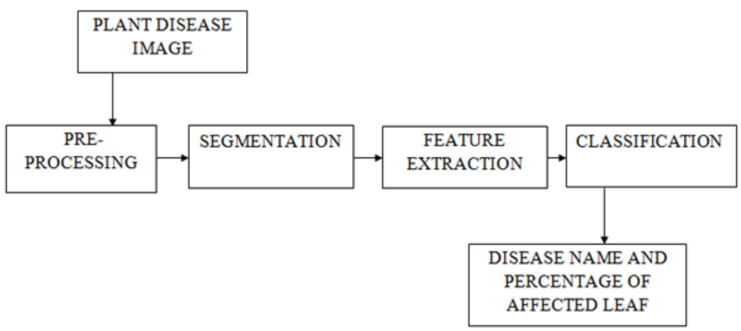
4. PROPOSED SYSTEM

The user has to upload the image of the plant with lesions from which the disease has to be detected. Then the image is segmented into clusters of healthy leaf region, infected region of pathogens and affected region of leaf due to the pathogens. Based on the cluster selected, the feature of the selected clusters is obtained. By the feature derived, it is compared with the standard character of the disease and the name of the disease that affected the plant will be given. The percentage of the affected leaf is also obtained.

Advantages

- This technology improves edges recognition
- It overcomes the drawback of size reduction and slow device connectivity

5. ARCHITECTURE



Pre-processing : The aim of Pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing.

Segmentation : Image segmentation is the process of partitioning a digital image into multiple segments .The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze.

K-Means Clustering

In the first step of fitness computation the dataset of pixel is clustered according to nearest respective cluster centers such that each pixel x_i of color image is put into the respective cluster with cluster center z_j for $j = 1, 2, \ldots, K$ by the following equations

If $||x_i - z_j|| < ||x_i - z_l||$

$i=1,2,\ldots\ldots,m \times n$, $l=1,2,\ldots..k$ and $p \neq j$.

calculating mean of each pixel of the clusters

$z_i(r,g,b)=1/n\sum(x_j(r,g,b))$ $i=1,2,3\ldots k$ (1)

calculating Eucledian distance between pixels

$M=\sum M_i$ (2)

$M_i=\sum|(x_j(r,g,b)-z_i(r,g,b))|$ (3)

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Feature extraction / selection: Feature extraction involves reducing the amount of resources required to describe a large set of data.

GLCM(Gray Level Co-occurrence Matrix)

For feature extraction the method used is GLCM method. It is the methodology in which both the texture and color of an image are considered, to come to the unique features, which shows that image.

$$\text{CONTRAST}=\sum_{i,j=0}(i,j)^2C(i,j) \quad (4)$$

$$\text{ENERGY}=\sum_{i,j=0}C(i,j)^2 \quad (5)$$

$$\text{LOCAL HOMOGENEITY}=\sum_{i,j=0}C(i,j)/(1+(i-j)^2) \quad (6)$$

$$\text{ENTROPY}= -\sum_{i,j=0}C(i,j)\log C(i,j) \quad (7)$$

Classification : Image classification refers to the task of extracting information classes from a multiband raster image. The resulting raster from image classification can be used to create thematic maps.

SVM(Support Vector Machine)

In this phase of classification, extraction and comparison of the co-occurrence features for the leaves with the corresponding feature values are stored in the feature dataset. First, the Minimum Distance Criterion and then SVM classifier are used to done the classification. The measurement of success of classification is done by using the classification gain and following Eq. (8) is used for calculation:

Gain(%)=number of correct classification/total no. of test images *100 (8)

6. ALGORITHM

1) The survey on different the Image acquisition is the very first step that requires capturing an image with the help of a digital camera.
2) Preprocessing remove the undesired distortion from the image. Clipping of the leaf image is performed to get the interested image region and then image smoothing is done using the smoothing filter. To increase the contrast Image enhancement is also done.
3) Mostly green colored pixels, in this step, are masked. In this, we computed a threshold value that is used for these pixels. Then in the following way mostly green pixels are masked: if pixel intensity of the green component is less than the pre-computed threshold value, then zero value is assigned to the red, green and blue components of the this pixel.
4) In the infected clusters, inside the boundaries, remove the masked cells.
5) Obtain the useful segments to classify the leaf diseases. Segment the components using genetic algorithm.

CONCLUSION

Diseases classification techniques that can be used for plant leaf disease detection and an algorithm for image segmentation technique used for automatic detection as well as classification of plant leaf diseases has been described . Therefore, related diseases for these plants were taken for identification. With very less computational efforts the optimum results were obtained, which also shows the efficiency of proposed algorithm in recognition and classification of the leaf diseases. Another advantage of using this method is that the plant diseases can be identified at early stage or at the initial stage. Disease can be detected towards the accuracy of 90% approximately.

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