International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Detecting the Plant Diseases and Issues by Image Processing Technique and Broadcasting

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Abstract: ***Image processing is the technique of exploring and detecting the various images available and providing the required output in the form of images or other detailed report. Initially, it processes the image, then an analysis is carried out and finally, the image is well understood and evaluated. This renders the required target of observing plants and their diseases. This forms the key factors of this paper. The idea is to observe and identify the diseases that attacked the plants, with the help of sensors that use image processing techniques to broadcast the captured image to the cloud. In turn, the image can then be viewed by us wherever we reside, in any part of the globe.***

Keywords: Aerial Videography, image processing, sensors, sensing communication, broadcasting

1. Introduction

The research and review is based on finding the diseases and various issues of the plants through broadcasting and image processing techniques. Generally, the plants are exposed to various threats, bacterial diseases and pests. The core idea of this paper is to identify these menaces to the plants through the way of implementing a sensor in the plant environment and then broadcasting even the minute changes in the plants by a cloud communication. So that, even the deepest alteration in the plants is discovered and the resulting changes are obtained to us, no matter whichever part of the earth we are in. This technique is referred to as 'image processing'. It is used to perform studies on the alterations of the plant cell environment. This technique also proves to be inexpensive and these data processing techniques are very useful in detecting the changes in the plant, be it minute or drastic. This technique would be helpful for the owners of the fields in monitoring their land and their plants, which are the most important factors for further development and improving the present development tasks. This technique is also called as 'Aerial Videography'. This technique was previously known to the people, but was not implemented as there was a lack of tools. It is now implemented using easy-to-use remote sensing technique. Nowadays, video-capturing sensors, monitoring equipment and recorders have become an important tool for further development for the field researchers.

There are various methods to detect plant pathologies. Some diseases will not have any visible symptoms associated with each of them, or in some cases, the symptoms are discovered when it is too late to react and to stop the disease from spreading. In those cases, some kind of sophisticated psychoanalysis [1] with a powerful microscope is necessary. There are few other cases where the signs can only be detected in parts of the electromagnetic spectrum that are not visible to humans. A common approach in this case is the use of cloud computing and broadcasting techniques that explore multiple and hyper spectral image captures. These methods use the image processing techniques to employ the processing tools and achieve the goals.

2. Techniques implemented for analysing the plants

There are basically two solutions:

- Partial classification: When a disease has to be identified amidst several pathologies, it may be the best option to perform the partial classification, in which the regions to be detected are being classified as per the explored symptoms and diseases, instead of applying a complete classification into any of the possible diseases. This type of method is explained in 'Neural Networks' [2].
- Real time monitoring: In this case, the system continuously monitors the crops and the fields, and brings into view an alarm as soon as the disease of interest is detected in few of the plants. [3]

2.1 Neural Networks

This method tries to discriminate a given disease from other pathologies that affect the rubber tree leaves. The algorithm does not require any kind of segmentation techniques. Rather, principal component analysis is applied directly to the RGB values of the pixels of the low resolution (15X15 pixels) images of the leaves. [2] Then, the first two principal components are fed to the multilayer perceptron (MLP) neural network with one hidden layer, whose output reveals if the sample is infected by some disease of the interest that is known, or not.

2.2 Thresholding

This method tries to discriminate between the affected maize plants, which are already affected by the armyworms from the healthy crops using digital images. This model categorises the algorithm into two methods: image processing and image analysis. In the image processing stage, the image is transformed to a grey scale,threshold and filtered to remove artefacts. In the image analysis stage, the whole image is divided into 12 blocks. Blocks whose leaf area is less than 5% of the total area are discarded. For each remaining blocks, the number of connected objects, representing the diseased and affected regions, is counted.

Then the threshold is set to ten, when the plants or the crops are discovered to be diseased or not.

3. Dual-Segmented Regression Analysis

This method is proposed a method for monitoring and early detection of calcium deficiency in nature. The first step is the plant segmentation and then thresholding process is taken place so that the canopy region is isolated. The outlines of the region of interest are applied back to the original image, in such a way that only the area of interest is considered. Apart from that, the number of colour features (RGB and HSL) and texture features (from the grey level co-occurrence matrix) are extracted. After the separation point identification, the onset of stress due to the calcium deficiency is calculated by identifying the mean difference between the treatment and control containers at each measured time for all features. Dual-segmented regression analysis is performed to identify where in time a change point was present between the nutrient-deficit group of plants and the healthy group of plants. The authors concluded arguing that their system can be used to monitor plants in greenhouses during the night, but more research is needed for its use during the day, when lighting conditions vary more intensely.

4. Quantification

The methods presented in this section aim to quantify the severity of a given disease. Such a severity may be inferred either by the area of the leaves that are affected by the disease, or by how deeply rooted is the affection, which can be estimated by means of colour and texture features. Most quantification algorithms include a segmentation step to isolate the symptoms, from which features can be extracted and properly processed in order to provide an estimate for the severity of the disease.

Figure 1: Symptoms of a diseased plant as per the image processing techniques

It is worth noting that the problem of determining the severity of a disease by analysing and measuring its symptoms is difficult even if performed manually by one or more specialists, which have to pair the diagnosis guidelines with the symptoms as accurately as possible. As a result, the manual measurements will always contain some degree of subjectivity, which in turn means that references used to validate the automatic methods are not exactly "ground truth". It is important to take this into consideration when assessing the performance of those methods. The methods presented in the following are grouped according to the main strategies they employ to estimate the severity of the diseases.

5. Thresholding

The first methods were proposed by Lindow and Webb to use the digital image processing in 1983. The images were captured using analog video camera which used up a red light illumination to highlight the narcotic areas in the image processed output. These images were then stored in a computer after digitisation. Leaves from tomatoes, bracken fem, sycamore and California buckeyes were used to perform these tests. The identification of these narcotic regions were made by a method called thresholding. [4] To compensate the pixel variations of the leaves, this algorithm was used to identify the narcotic regions of the healthy plant and they were misclassified as a part of the diseased parts of the plant leaves. This was done to obtain the correct set of the narcotic plants.

Another person, named Prince et al, in 1993, used his techniques to compare the visual and digital image processing methods in quantifying the severity of the leaf rust. Two different imaging systems were tested. The first one, aimed at capturing the images using the black and white coupled device (CCD) camera. The second idea aimed at capturing the images with a colour CCD camera. [5] Both the cases were based on segmentation process techniques and thresholding process. According to him, there was better performance than the visual evaluation in the image processing technique, where this method opted to check out even the more severe areas. The colour imaging processing technique had a large potential in deciding between the rusted and non-rusted foliage.

In 1997, Tucker and Chakraborthy, proposed their ideas of image processing. It aimed at quantifying and qualifying and identification of the diseases in oat and sunflower leaves. The algorithm had many steps, in which the first step was segmentation. Here, the threshold varies according to the disease of the plant leaves. The resultant pixels were connected into many clustures which represented the diseased regions in the plant. They are categorised into different types based on the characteristics of the lesions. There were good results, but some observed errors due to manipulations of the process techniques during the capture of the images.

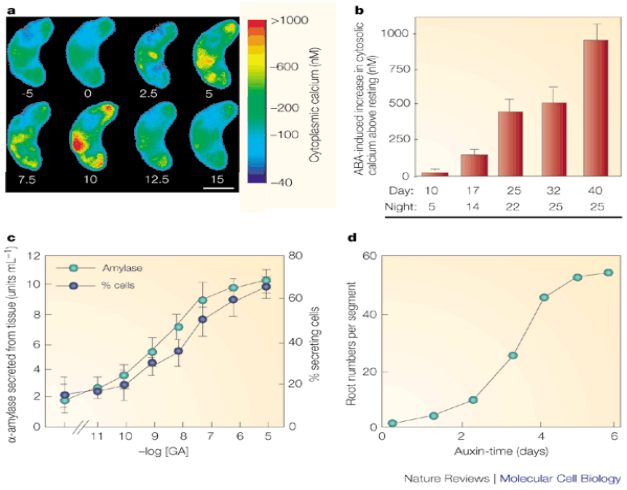

Figure 2: Picture of each cell of a plant being examined with the environmental threshold

There were two others, who proposed a method to quantify the maize streak virus. They were named Martin and Rybicki in 1998. Their model technique was based on the ideas of Lindow and Webb (1983), but this model explored the leaved more and denoted an output which marked more accurate results than the old methods. They compared the image processed with the visual assessment, by using commercial software packages which aimed at providing more accurate and apt outputs. They were made computer based to make it simple and easy for the image processing to be done. They were made precise and accurate.

Skaloudova et al. in 2006 proposed another method idea of his own which measures the damage caused in leaves by the spider mites and bites. Two stage thresholding was the method used for this technique. The first half of the leaf in background was concentrated in the first part of the technique. The second part focussed on the separation of the healthy parts of the plants. The final estimation is provided the ratio of the number of pixels in damage areas and the number of pixels of the healthy surface. [7] This method was then compared with the results of two other methods and it was concluded that the leaf damge index provided more better results than the other methods when compared based on chlorophyll and fluorescence. Weizheng et al. in 2008 presented a strategy to compare and identify the lesions in soybean leaves. Two step thresholdingprocess was the main aim of this algorithm. The first threshold process aimed at separating the leaf from the ground. The image containing the leaf is then converted to the HIS colour space, and the sobel operator is made to identify the edges of the lesions. The second part of the threshold is applied to the gradient image. At last, the small images of binary nature are put together and the white pixels are filled. The resultant object after the technique is used to reveal the diseased object in the leaves.

6. Colour Analysis

In 2008, Boesse et al, proposed a technique to esmitate the harshness of the eelgrass leaf injury, which can be caused by wasting disease, desiccation, and micro herbivory feeding. The first step of the segmentation process involves the unsupervised segmentation of the leaves into a number of classes based on different headings. After the process, the quantification is just a process of measuring the areas occupied by the injuries of the plants. According to the survey and the opinion of the author, the approach still has a number of problems that limit its utility, but this method proves to be an improvement = when compared to other methods.

The method which was proposed and presented by Pagola et al in 2009 involves dealing with the problem of nitrifying and deficience identification of the barley leaves. There are different colour channels in the RGB space and the Principal Component Analysis (PCA) is applied to the technique to obtain the measure of the ‘greenness’ of the pixels. [8] The deep variations of the plants can be found out, by this method, which involves even the veins and leaf spots identification and evaluation. The authors and the public concluded that this method had high correlation with the largely used chlorophyll meters.

7. Conclusion

The wide ranging variety of applications on the subject of totalling objects in digital images makes it difficult for everyone to outlook all possible useful ideas present in the literature, which can cause potential solutions for challenging issues to be missed. This paper would provide a widespread and detailed study of the subject, which aims at detecting the structure and diseases of plants through a cloud computing way and broadcasting the views to the user far away. Because this paper would be a survey journal on the topic and issues, the descriptions are short, providing a quick, and an easy overview which is detailed underlying the ideas of each of the subjects. Certain bibliographies of the respective articles can also be taken as reference in order to understand the topic more.

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