RESEARCH ARTICLE OPEN ACCESS

DESIGN AND IMPLEMENTATION OF PLANT DISEASE DETECTION ALGORITHM

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Abstract:

Various methods have been implemented for detecting and curing the diseases in the plants. This disease can be identified by spots on various parts of plants. The number of spots tells us how badly the plant is affected. But, it is very difficult to monitor the plant diseases manually. It requires a lot of work from the background as they have to spend most of their time in checking the plants, whether they are affected or not, what prevention method has to be applied and care must be taken too see that disease should not spread to whole plant. A smart phone image processing application is described here which is capable of detecting the diseases through the pictures of leaves. This application can be easily extended to any plant diseases and many smart phone platforms.

Keywords— ***Plant Disease, Lesions, Image Processing***

I. INTRODUCTION

Plant diseases can increase the cost of agricultural production and may result in economic disaster for a producer if it is not cured in early stages. The producers need to monitor their crops and detect the first symptoms in order to prevent the spread of a plant disease with low cost and has to save the major part of the production. Hiring professional agriculturalists may not be affordable especially in remote isolated geographical areas. Machine vision gives an alternative solution in plant monitoring and such an approach may anyway be controlled by a professional to offer his services with lower cost. Although, there are several techniques and tests that have to be performed in order to confirm a specific disease, but image processing technique can tell us what really happened at the field.

The plant diseases diagnosistechniques were clearly explained in[1]. There are two categories of plant diseases, those are primary and secondary. The plant diseases are classified based on pathogens [1]. The growth rate of a plant can be varies in accordance with the number of pathogens affected [1].

The computer based plant disease detection algorithms have been clearly explained in [2]. The molecular sensitivity can be determined by the minimum number of microorganisms.

Another familiar method to detect disease is with the help of DNA analysis is PCR which was clearly explained in [3] and [4].

In [5] they have given the clear idea about infrared spectroscopy which helps to determine non –destructive techniques.

The image processing plant disease detection methods in visible band was in [6] and [7].

The Stereomicroscope and Image Analysis for Quantifying Fruit Traits can be found in [8].

The experts system for plant diagnosis segmentation methods can be explained in [9].

In [10] and [11] the disease diagnosis techniques for rice and corn plants were explained.

The mobile application with predetermination can be found n [12].

The field of digital image processing refers to processing digital images by means of a digital computer. In recent years, various researchers are turning their attention towards the development of effective, efficient and robust computational techniques/methods for image processing analysis. Vision is the most advanced of our senses, so it is not surprising that images play the most important role in human perception.

An image processing technique that can be implemented as a smart phone application is present in [12] for recognition of plant diseases.

II. PROPOSED METHOD

The user captures the photos of plant parts and runs the plant disease recognition application. The application asks the user about plant type to test the disease. Additional information given by the user can help further recognition

process with higher accuracy. GPS location is also used to determine the specific rural region where the plant exists. Then weather report can be achieved for that region in order to verify that recognized disease is compliant with temperature and humidity conditions.

This is the strategy to segmentation of the photographs into leaf and background within the following variety of size and color options are extracted from each the RGB and HSI representations of the image. Those parameters are finallyfed toneuralnetworksandappliedmathematicsclassifiersthatareaccustomed confirmtheplantcondition.

Let assume if the brightness of background is higher

$$H_R(i) = \sum_{j=0}^{Sz} x_R(i,j)\ ,\ H_G(i) = \sum_{j=0}^{Sz} x_G(i,j)\ ,\ H_B(i) = \sum_{j=0}^{Sz} x_B(i,j) \quad (1)$$

Where $x(i,j)$ are binary values defined as:

$$x_R(i,j) = \begin{cases} 1, R[j] = i, \\ 0, R[j] \neq i \end{cases} \quad x_G(i,j) = \begin{cases} 1, G[j] = i, \\ 0, G[j] \neq i \end{cases} \quad x_B(i,j) = \begin{cases} 1, B[j] = i, \\ 0, B[j] \neq i \end{cases} \quad (2)$$

than the leaf then it is complicate to convert. Hence consider the back ground will be white. Then by using image thresholding technique converts RGB image into gray scale image.

SVM:-

The method uses many color representations throughout its execution. The separation between leaves and background is performed by an MLP neural network, that is including a color library designed a priori by suggests that of an unsupervised self-organizing map (SOM). thecolors gift on the leaves are then clustered by suggests that of an unsupervised and undisciplined self-organizing map. A genetic algorithmic program determines the quantity of clusters to be adopted in every case. A Support Vector Machine (SVM) then separates morbid and healthy regions

Fuzzyclassifier:-

The method tries to spot four totally different organic process deficiencies in feather palm plants. The image is segmental consistent with color similarities, however the authors didn't offer any detail on however this can be done. Once the segmentation, variety of color and texture options are extracted and submitted to a fuzzy classifier, which, rather than outputting the deficiencies themselves, reveals the amounts of fertilizers that ought to be accustomed correct those deficiencies.

Color analysis:-

The method aims to sight and discriminate among four sorts of mineral deficiencies (nitrogen, phosphorous, potassium and magnesium). The tests were performed victimization fava bean, pea and yellow lupine leaves. Before the color analysis, the photographs are born-again to the HSI and L*a*b color areas. The color variations between healthy leaves and also the leaves underneath take a look at then confirm the presence or absence of the deficiencies. Geometer distances calculated in each color areas quantify those variations.

Feature-based rules:-

As in several different strategies, the segmentation of healthy and morbid regions is performed by suggests that of threshold. The authors tested two types of threshold. Otsu's and native entropy, with the most effective results being achieved by the latter one. Afterwards, variety of form and color options are extracted. Those options are the premise for a collection of rules that confirm the sickness that most closely fits the characteristics of the chosen region.

KNN:-

k-Nearest Neighbour could be a easy classifier within the machine learning techniques wherever the category identification is achieved by distinctive the closest neighbours to examples and so build use of these neighbours for determination of the class of the query. In KNN the classification i.e. to that category the given purpose is belongs relies on the calculation of the minimum distance between the given purpose and different points.

Block Diagram

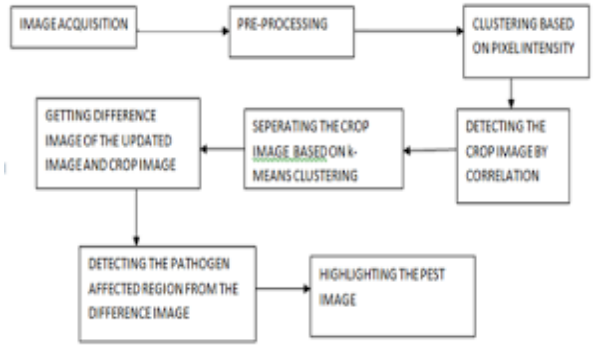


Fig. 1 Framework of the proposed system

The user captures photos of plant parts with lesions like leaves and fruits and then runs the plant disease recognition application. The application asks the user about the plant type / part displayed in the selected photograph in order to test the appropriate disease recognition rules. Additional information given by the user can help further the recognition process with higher accuracy.

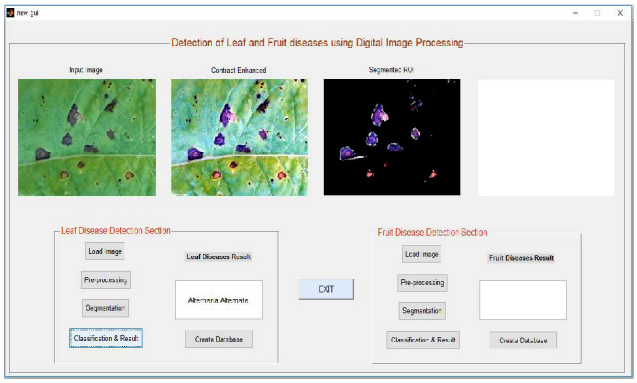
Fig2:Original image of diseased leaf

The image processing method extracts the following lesion features: number of spots, their grey level and area and then extracts a histogram indicating the number of pixels that have a specific red, green or blue color level. The limits of the regions in this histogram with higher pixel concentration as well as their peaks are used to determine the disease that matches with the leaf of photo used.

Fig. 3 Contrast enhanced and RGB to gray converted image

Segmentation means partitioning of image into various parts of same features or having some similarity. The segmentation can be done using various methods like otsu' method, k-means clustering, converting RGB image into HIS model etc.

Based on the shape of the leaf also, we can find the disease. We can also notice which part is mostly affected.



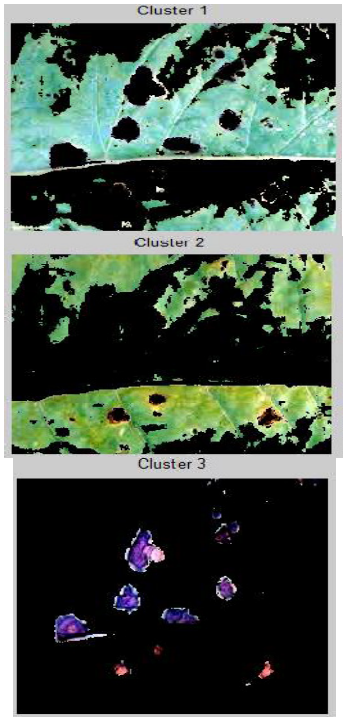


Fig. 4 Diseased leaf image clusters

Feature extraction and Classification of diseases will be done such as bacterial leaf spot, fungal disease, sun born disease etc.

$$\underset{j=1\ldots M}{\operatorname{argmax}}\, g^j(x), \text{ where } g^j(x) = \sum_{i=1}^{m} y_i \alpha_i^j k(x, x_i) + b^j$$

Finally we will get to know which type of disease is affected to that particular plant.

III.EXPERIMENTAL RESULTS

The developed application was evaluated using sick grape leaves. No healthy leaves were tested since they would have no spots to focus on. Either the upper or the lower surface of the leaf was used. The *l_c_s_m/l_c_m*limits were definedosing a small training set of 20 leaf photographs. The number of leaves affected by Downy Mildew, Powdery Mildew, Phomopsis, Esca in the training set, was 6, 3, 5 and respectively. In two of the leaves with Downy Mildew, the upper surface, while in the rest of them the lower one was used. Two of the lower surface leaves were displaying Downy Mildew spots at the early stages (white spots). The rest of them, displayed dark spots at the later stages of the disease. After using such a small number of training samples to define the disease recognition rules, the application was tested using a benchmark of 100 photographs.

Fig. 6 System shows leaf disease detection result

CONCLUSION

The successful detection of plant disease is very important for cultivation of the crop and this can be done by using image processing. A smart phone application based on image processing technique analyzes color features of spots in plant parts. The preliminary measurement results in the recognition of the number of spots and their area on plant leaves showed accuracy higher than 90%.

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