Study and Analysis of Methodologies for Leaf Disease Detection Using Image Processing

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Abstract **-** In agriculture field there are various diseases, especially leaf diseases are the most popular diseases where spots occurs on the leaves. If this spots are not detected on time cause several losses. To detect leaf disease image processing techniques are used. In this paper leaf disease detection based on image processing viz. algorithms has been comparatively analysed. There are various ways of detecting leaf diseases with image processing. In this insight methodology of leaf disease detection based on image processing have been discussed which are contributed by various Researchers. The results of researcher are compared which can be useful for implementation of leaf disease detection along with image processing.

Keywords- *Image segmentation, Agriculture image processing, Digital image, Crop leaf.*

I. INTRODUCTION

In agriculture field there are various diseases, especially leaf disease are the most popularly diseases which occurs spots on the leaves. Fungi caused diseases in plant are the most primary diseases which occurs spots on the leaves. These spots stop the vital process of photosynthesis to take place, hence to a large affected area on leaf stop the growth of plant. Many fungi cause leaf spots on different plants. Leaf spots may vary from small dots to large dots with to unequal yellow or brownish spots that cover much of the leaf surface. For detecting leaf disease farmer are used naked eye observation method. But this method is not give good result.

To recognize and classify sugarcane fungi disease an automated system has been implemented using algorithm such as chain code technique, bounding box method and moment analysis[1]. The accuracy of the algorithm is tested by estimating the percentage standard known area covered by standard known area shapes like Triangle, Circle, Square, and Rectangle drawn by using a tool such as paint which comes as accessories of Microsoft Windows Operating System. Estimated values are compared with actual area covered to calculate Percentage Deviation (D) and Percentage Accuracy of the algorithm [1]. For detecting cotton leaf disease detection HPCCDD algorithm are used.

In agriculture field the image analysis can be applied for the following mission:

1. To detect diseased leaf.
2. To identify affected area by disease.
3. To find the margin of the affected area.
4. To determine the color of the affected area.

II. REVIEW OF LITERATURE

Here different papers are studied and analysed based on the approaches used by the different researchers and modifications are made to provide more reliability in the proposed system.

"Leaf Disease Severity Measurement Using Image Processing" [1] in this work for detection of leaf diseases has been used some methods likes threshold method and triangle thresholding method. Thresholding method are used to segment the leaf area and triangle thresholding method are used for lesion region area. There are some methods are used for image processing (1) Image Acquisition: In this paper Sugarcane brown spot diseased leaves are taken for this study. Controlled environment are used to take leaves image and are stored in the JPEG format. Affected leaf is placed flat on a white background; the light sources are mounted at 45 degree on each side of the leaf so as to remove any reflection and to get even light everywhere, thus a better view and brightness is present. The affected leaf is zoomed at a point picture take only leaf and white background. (2) Image Segmentation: Image segmentation is the primary step to separate the different regions with special significance in the image, these regions do not overlap each other and each region should meet proper stability conditions in specific regions. In this research two different segmentation techniques are implemented to obtain total leaf pixels and lesion area leaf pixels. Finally diseases are catcogrise by calculating the quotient of lesion area and leaf area.

Applications of Perceptual Hash Algorithm in Agriculture Images [2] this work mainly focusses on the image retrieval and its application in agriculture, which is based on perceptual hash algorithm. Perceptual hashing techniques are used to convert the image into binary sequence; the used technique reduces the digital image storage space which bring great suitable to image management and image maintenance.

This paper first describes the related technologies of perceptual hashing algorithm; then presents the design of sensing hash structure, image recognition and image authentication; finally, the application programs and procedures of the algorithm is given, which based on agriculture crop pests' data sets[2].

Content-based Image Retrieval

Content-based Image Retrieval direct use of the low-level image features to retrieve images, such as color, texture, shape and spatial relationship between objects [4].

By analyzing the low-level feature information of the images, the algorithm produces an image feature vector as its index [5]. And retrieve images by similar queries of Multi-dimensional image feature.

Perceptual Hash Algorithm

Perceptual hash algorithm is a common method of content-based image retrieval and mainly used for similar picture search [6]. It is a kind of oneway mapping from multimedia data sets to perceive abstracts. It maps the multimedia data with the same content-aware to the only digital abstract, which also meet the robustness and safety awareness. The data amount of original image will reduce significantly after sensing feature extraction, and the data abstract set contains the key features of the original image [7-8].

Perceptual Hash Algorithm Steps:

In this algorithm, the Image included features are used to generate a set of fingerprints, and these fingerprints are compared. Following is a brief description of the algorithm operation process [9]:

1) Reduction in size: Ignore high-frequency and detail, leaving only the structure of light and shade. The picture shrinks to the size of 8x8.
2) Simplified colors: Turn the picture after shrink to 64 shades of gray.
3) Calculate the average: Calculated for all 64 pixel gray average.
4）Comparing pixel gray: Compare the gray level of each pixel with the average value. Less than the average denoted by 0; otherwise, denoted by 1.
5) Compute the hash: Constitute a 64-bit integer by together the results of the previous step, which is the fingerprint of this picture. Get fingerprints later, you can compare different picture. If not the same data bit is not more than 5, it shows two pictures are very similar; if greater than 10, it stated that this is two different pictures. This algorithm is very reliable.

Classification of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Techniques [3] this work focused on cotton leaf disease, the Foliar fungal disease which is found on cotton plants. To detect this disease HPCCDD algorithm is developed. In this paper for identify the disease image RGB feature ranging techniques are used, in which, first enhancement is done on captured images. Then color image segmentation is used to get disease spots. After that Homogenize techniques like Sobel and Canny filter are used to identify the edges, these extracted edge features are used in classification to identify the disease spots [10]. Cotton Diseases Control has been developed in a BP neural network as a decision-making system. [11] Cotton foliar diseases shows a method for automatic classification of cotton diseases used Wavelet transform energy has been used for feature extraction while Support Vector Machine has been used for classification. [12] Existing research work described in the features could be extracted using a self-organizing feature map with a back-propagation neural network is used to recognize the color of the image. [13] Earlier paper were based on fuzzy feature selection approach fuzzy curves (FC) and surfaces (FS) this proposed work is used to select features of cotton disease leaf the image. [14] Present work carried out on RPM and Dis Bin and compared with the classical PCA based technique. [15] The cotton leaf disease segmentation is performed using updated self-organizing feature map with genetic algorithms for optimization and support vector machines for further classification.[16].

III. ALGORITHM TECHNIQUES

This section will discuss some of the popular algorithm techniques that are used for plant leaf disease detection.

A. Triangle Thresholding Method

For selecting the thresholding value of gray imageTriangle thresholding method is used. To select the thresholding value of gray image the triangle is developed by drawing a line between the maximum of the histogram at brightness bmax and the lowest value bmin in the image. The distance 'd' between the line and the histogram, h[b] is computed for all values of 'b' from b=bmin to bmax. The brightness value 'bo' where the distance between h [bo]. The accuracy of the algorithm is tested by estimating the percentage standard known area covered by standard known area shapes like Triangle, Circle, Square, and Rectangle drawn by using a tool such as paint. Estimated values are compared with actual area covered to calculate Percentage Deviation (D) and Percentage Accuracy (A) [1].

$$D = (SM - EM) \times 100 / SM \quad (1)$$
$$A = 100 - D \quad (2)$$

SM- Standard Measurement, EM- Experimental Measurement [1]

Table 1. Determining the accuracy of the algorithm

Shape	Stand Measure (SM)	Expt Measure (EM)	Deviation (D)	Accuracy (A)
Triangle	2.49	2.45	1.61	98
Rectangle	0.90	0.90	0.00	100
Square	1.98	1.99	1.00	99
Circle	6.81	6.60	3.10	97
Group of All	12.19	12.42	1.87	99

B. Perceptual Hash Algorithm Structure

Image is the main means of transmission of multimedia information, so the focus of this study is perceptual hashing applications. The following is the general steps of perceptual hashing generated:

A. Image Preprocessing

The use of pre-processing is to reject some of the unwanted effects of the original image such as noise, etc. Maximize the conserve of image information and to minimize the real amount of data, thereby increase the accuracy and effectiveness of the feature extraction.

B. Perceived Image Feature Extraction

Feature extraction is the basic perception hash structure. Image features include color, texture, edge, corner, and image transform domain coefficients and so on. Discrete cosine transform is used for perception of feature. In this process, two-dimensional image data is mapped into a one-dimensional feature vector, and the one dimensional feature vector has the following characteristics: image with the same or similar content should have the same or similar one-dimensional image feature vectors; whereas one dimensional feature vector of the different content images should be different, that is, their perceived distance greater than the threshold value [2].

C. Perceptual Hashing Algorithm Implementation Process

The basic structure of perceptual hashing generate is shown in Figure.1.

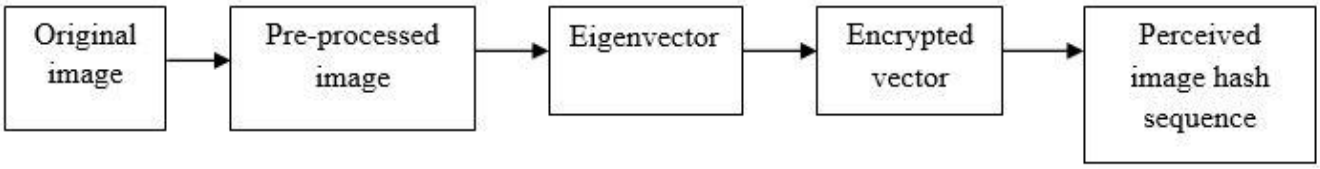

Fig.1: Basic framework of perceptual hashing generate

Homogeneous Pixel Counting Technique for Cotton Diseases Detection (HPCCDD)

Following steps are used to develop HPCCDD algorithm [3]

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 Color Filtering
5. Masking green-pixels
6. Remove the masked cells inside the boundaries of the infected clusters
7. Find Edge detection
8. Calling the pixel Ranging function to calculate the RGB features
9. Texture Statistics Computation
10. Configuring Disease Reorganization and Pest Recommendation.

In this algorithm take the input image of leaf and convert input image into a grayscale image, after converting input image in to greyscale color filter is used. After that affected leaf spot color used RGB pixel counting values as a feature segment. Segmentation are used for edge detect, for identify the clarity of image the Canny and Sobel Edge detection homogenous techniques are used and we get center pixel of opposite neighboring one, two, three pixels of clarity of edges getting white lightning[3]. The Homogeneity-based edge detector takes the result of any edge detector and divides it by the average range of the part.

This division discards the effect of not level lighting in the image. The average range of an area is available by convolving the part with a mask containing all ones and separating by the size of the area. Following table shows the comparison of various detection technique/ algorithm of leaf disease detection:

Table 2. Comparison of Detection Technique

Authors	Detection technique/Algorithm	Parameters/ Accuracy
Sanjay B. Patil	Simple threshold and Triangle thresholding methods	Accuracy of 98.60 % detection on Fungi-caused diseases in sugarcane
P.Revathi	HPCCDD Algorithm	Accuracy of 98.1 % detection on cotton leaf spot diseases
Xin Liu, Qian Zhang	Perceptual Hash Algorithm	perception hash value of Similar leaf disease images is closer to each other.

IV. CONCLUSION

The image processing techniques are used for recognizing plant diseases. The some techniques for detection of plant diseases are: triangle thresholding method, perceptual hash algorithm, HPCCDD. These

techniques are used to detect or indicate the health and diseased of plants leaves. By using HPCCDD detect the edge of affected leaf for that develop an Advance Computing system that can identify the disease affected part of a cotton leaf spot by using the image analysis technique. Hash algorithm techniques are used color and texture feature for leaf disease detection. Thresholding method are used to segment the leaf area and triangle thresholding method are used for lesion region area. Image processing technology for detecting leaf disease is more convenient and accurate. It will help to farmer for selection of pesticides and controlling the leaf disease.

V. REFERENCES

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