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Identification Of Wheat Rust Disease In Digital Images

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Abstract- **Rust disease in wheat cause calamitous problems in economic losses and wheat production worldwide .In this paper, a solution for the determination, classification and prevention of wheat rust disease is proposed and experimentally verified. We have composed a scheme that uses image processing techniques. In this scheme some state of the art features are extracted from the segmented image and finally the disease is recognized using template matching technique. This work has been implemented on MATLAB platform. The proposed technique is accurate and economical with small relative error.**

Key words- **RGB to Grayscale, Template matching, Feature extraction, RGB to HSV**

I. INTRODUCTION

Wheat production and related activities face significant losses in India, which are close associated to the lack of appropriate technology. The wheat rust diseases are seen where the wheat crop is grown at very higher evaluation. It can cause significant reduction in both quality and quantity of wheat production and results in yield losses. Since it is necessary to detect and identify the wheat rust diseases using some image processing or sequential techniques to prevent wheat crop from heavy losses in production of crop and yield losses at early stages of disease occurrence. We have considered three types of diseases in wheat crop; black rust, brown rust and yellow rust as shown in fig.1

a **b** **c**

Figure 1: Three common wheat rust disease a) Black rust b) brown rust c) yellow rust Black rust is distributed over a steam part of the wheat crop which caused greater and more spectacular damage to wheat crop. It appears relatively high summer precipitation in spring wheat areas. Brown rust generally distributed through the humid and semi humid wheat producing areas and it is restricted to the leaves and produces brown color on the infected parts. Yellow rust is easily distinguishable by it color, it is limited in its distribution to the area of relatively cool summer temperature and humid winter [11]. We have proposed a classical approach for segmentation of wheat crop using a globally adaptive threshold method to segment contamination defects on wheat leaf. Feature extraction technique is suggested to classify and recognize the wheat rust diseases based on obtained feature values. Feature extraction represents the size, shape, color values help for identification of wheat rust and its structure [8]. Feature extracted by using a RGB to HSV [7] conversion algorithm that would be implemented on the basis of hue, intensity and saturation parameter of image sample.

Template based approach is used for finding a small part of an image which match a template image. It determines the best location by testing all or a sample of a viable test location within the searched image that the template image may match up to [9].

We have proposed and experimentally validated the significance of using globally adaptive thresholding technique for the disease segmentation and RGB to HSV algorithm for automatic detection and classification of wheat rust disease.

II. THE PROPOSED APPROACH

The steps of proposed approach are shown in fig.2 for the wheat rust disease identification and detection problem.

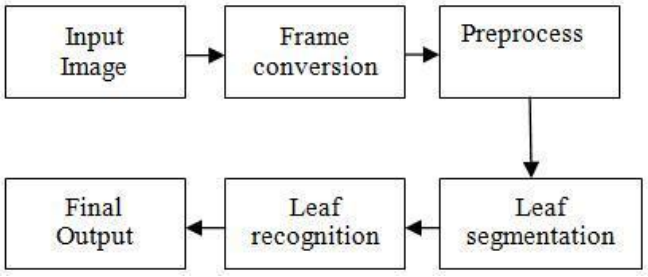

Figure 2:The procedure of the proposed approach

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2.1 Image acquisition

Image acquisition: to acquire a digital image.

2.2 Image pre-processing

Image pre-processing: to improve the image in ways that increases the chances for success of the other processes. It contains processes such as blurring, median filtering that enhance the image quality for the proper identification of infected part of leaf. The framework of the proposed solution is shown in the Fig. 3. Each phase of the proposed method is described in the rest of this section
Figure 3: Framework of the proposed approach.

2.3 Image segmentation

Thresholding [4] is the simplest method of image segmentation. From a grayscale image, Thresholding can be used to create binary images. During the thresholding process, individual pixels in an image are marked as "object" pixels if their value is greater than some threshold value (assuming an object to be brighter than the background) and as "background" pixels otherwise.

This convention is known as threshold above. Variants include threshold below, which is opposite of threshold above; threshold inside, where a pixel is labeled "object" if its value is between two thresholds; and threshold outside, which is the opposite of threshold inside (Shapiro, et al. 2001:83). Typically, an object pixel is given a value of "1" while a background pixel is given a value of "0." Finally, a binary image is created by coloring each pixel white or black, depending on a pixel's labels.

Algorithm for Thresholding method:

Step 1. An initial threshold (T) is chosen; this can be done randomly or according to any other method desired.

Step 2. The image is segmented into object and background pixels as described above, creating two sets:

1. = {f(m,n):f(m,n)>T} (object pixels)
2. = {f(m,n):f(m,n) T} (background pixels)

Step 3. The average of each set is computed.

1. = average value of G1
2. = average value of

Step 4. A new threshold is created that is the average of m1

And m2

1. T' = (m1 +m2)/2

Step 5. Go back to step two, now using the new threshold computed in step four, keep repeating until the new threshold matches the one before it.

2.4 Feature extraction

In this proposed approach, we are extracting feature that result in some quantitative information of interest or features that are basic for differentiating one class of objects from another. Transforming the input data into the set of features is called feature extraction. Proposed method classifies and recognizes wheat rust diseases images based on obtained features values such that size, shape, color [8]. Feature extracted by using a RGB to HSV conversion algorithm [7] that would implemented on the basis of hue and saturation parameter of image sample. Hue defines the color itself. Saturation indicates the degree to which the hue differs from a neutral gray.

The values run from 0, which means no color saturation, to 1, which is the fullest saturation of a given hue at a given illumination. Intensity component - lightness or value, indicates the illumination level. Both vary from 0 (black, no light) to 1 (white, full illumination). All these parameter specifies distinguishable characteristics of wheat rust diseases to identify the one disease from another. [9] Template matching approach is useful to implement the use of templates that detail the matching object under a number of different conditions, such as varying perspectives, illuminations, color contrasts, or acceptable matching object.

III. METHODOLOGY

The proposed methodology in this paper, to perform the analysis for image features extract using steps:

- Select disease infected wheat leaf image. Calculate the grey scale components (8 bit) for given R, G, and B pixel using a conversion formula.
- Calculate the binary output pixel values based on current threshold
- Crop the image to improve its framing
- Compute RGB to HSV algorithm to measure fine details of image.
- Extraction of features using template matching approach.
- Compare the result with the database to get final output.

In this paper, Images of the infected wheat plants are captured by closed camera to acquire good quality images then this color image is converted into grayscale image using RGB to grayscale conversion. We propose to use thresholding approach [4] for leaf image segmentation. In our work, we assume that the leaf image is available with simple and uniform background. Cropping of image is another function which removes the unwanted part of image

and leaving behind that part which would be needful for the further identification of infected part. For significant detection of wheat rust, RGB to HSV conversion is useful which help to highlight the disease part. By using the feature based and template based approaches we will extract feature such as size, shape, color that would be compare with the standard database to classify and identify the desired wheat rust disease.

IV. EQUATIONS

4.1 RGB to Grayscale conversion

33% of all colors is used to compose final 100% grayscale component.

$$gs = (r * 0.33 + g * 0.33 + b * 0.33)$$

4.2 RGB to HSV conversion

Value= (RGB)max
Saturation=255* [(RGBmax- RGBmin)/ RGBmax]
Hue=R=0+43[(G-B)/(RGBmax- RGBmin)]
=G=41+43[(B-R)/ (RGBmax- RGBmin)]
=B=171+43[(G-R)/(RGBmax- RGBmin)]

V. EXPECTED RESULT AND ANALYSIS

An image processing based solution is proposed and evaluated in this project for the detection and classification of wheat rust diseases. We will be using three wheat diseases namely: Black rust, Brown rust, Yellow rust in evaluation of our program as shown in fig 3. We will display the precautionary measures and available fertilizers for the respective disease as shown in Table 1.

Table 1: Details of the disease and preventive measure

Disease name	*Pathogen name*	*Fungicides*
Yellow rust	**Puccinia striiformis**	**Strobilurin fungicides**
Brown rust	**Puccinia triticina**	**Demethylation inhibiting (DMI)**
Black rust	**Puccinia graminis,**	**Premixes of Strobilurin fungicides +**

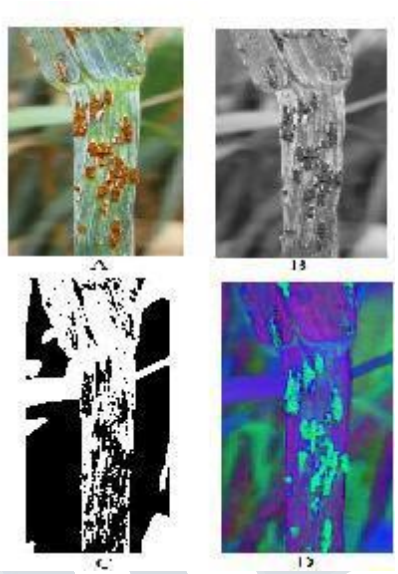

Figure3:Disease detection A)Black rust B)Grayscale conversion C) Thresholding D)RGB to HSV

VI. CONCLUSION

Various diseased leaf images will be used for the experiment for effective and fast identification of the rust disease. Appropriate remedial measures will be applied to repair and revitalize the plant by displaying the precautionary measures on the PC itself. The future work can be concentrated on developing image processing algorithms using wireless technologies and robots enabling higher efficiency in real time applications.

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