Wheat Disease Detection Using Image Processing

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Abstract: **The most important factor in reduction of quality and quantity of crop is due to plant disease. Identifying plant disease is a key to prevent agricultural losses. The aim of this paper is to develop a software solution which automatically detect and classify plant disease. It includes four steps, first step image acquisition, second step is image preprocessing, third step is image segmentation and fourth step is feature extraction which consider color, shape and size. For classification we used here Neural Network based classifier.**

Keywords: plant disease, acquisition, preprocessing, segmentation, feature extraction, neural network classifier.

I INTRODUCTION

Globally in food production plant disease make significant reduction [1]. It can be improved by technical support. Mostly farmers used their naked eyes for plant observation, which need continuous monitoring and expertise. This method is highly time consuming and expansive, which is not possible for large farming. So it is important to have automatic solution for identifying these diseases. Many researchers used image processing techniques for detection and classification. [7] Sushil al. designed a classifier for fungal disease detection in wheat plant by pattern recognition technique. He used a radial basis function (RBF) of neural network for classify wheat disease. Ismail et al. designed a multiple classifier for automatic reorganization of the damage and symptoms on plant leaves from images.[11] Arti developed a method to detect disease by calculating leaf area through pixel number statistics. [5] Sachin developed on integrated image processing system to help automatically inspection of leaf patches and helps identify the disease types. This paper talks about various method available in image processing for automatic wheat crop disease detection.

Section II Image acquisition and image preprocessing techniques. Section III includes proposed work which includes segmentation, feature extraction, features selection and classification method. Section IV includes Experimental Results. Finally conclusion and advantages of proposed systems.

II IMAGE ACQUISITION AND IMAGE PROCESSING

For this research we captured images with digital camera (canon A3500, 16 mega pixels) background of all images were suppressed using subtraction technique and all images stored in Jpeg format. We took some images from internet to increase database [3].

Preprocessing: While taking images noise may get captured. Before segmentation we removed this noise by using 3×3 median filter.

III PROPOSED WORK

Segmentation: It is an important step in image processing. It helps us to divide images in order to extract the infected area from wheat leaf, which helped us to analyze the disease [9]. We need K-means clustering partitioning method [7] [8]. The function K- means helps to cluster the data and returns index according to the help to clusters. K-means clustering is suitable for large amount of data. It prepared cluster in such a way pixels in object is closer to each other and pixels from different objects are far from each other.

Feature Extraction: After segmentation feature extraction plays a vital role to represents segmented images on a vector of fixed features that should be distinct and relevant for the classifier performance. We used three features for our

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study 1) Texture 2) Shape 3) Color. Which are useful to prepare classifications of damage and symptoms.

Texture features: Texture features are extended using Gray Level co-occurrence matrix (GLCM). GLCM method is statistical analysis tool of gray level image. It measures the distribution of gray levels based on the spatial relation of pixels using given distance and directions in the image.

Shape Features: Shape Features represent different geometric characteristics of an object. This includes area, perimeter, circularity and complexity.

Color Feature: Acquire by various methods such as color histogram, color structure descriptor and color moments. We used two methods one is color histogram and second is color moments [3]. Both methods are easy to use and effective in color description. Color moment method represent by three ways: Mean, Standard deviation and skewness.

a) Moment 1(Mean): Presenting the mean color of a form

$$\text{Mean}=\sum_{J=1}^{N} P_{ij}$$

Where N is the total number of pixels of the affected area, P_{ij} is the pixel color of co-ordinates (i,j).

b) Moment 2(Standard deviation): Showing the square root of the difference of the distribution.

$$\text{Std. Deviation}=\sqrt{\sum_{J=1}^{N} (1/N \sum P_{ij}(P_{ij}-E_i)^2)}$$

c) Moment 3(Skewness): it measures the degree of asymmetry in the distribution.

$$\text{Skewness} = \sqrt[3]{\sum_{J=1}^{N} (1/N \sum P_{ij}(P_{ij}-E_i)^3)}$$

Classification: In this paper we used two classification techniques to obtain higher rate of reorganization of damages and symptoms. One is Neural network works on texture, color and shape. Second one is support vector machine works on texture and shape features. Each classifier gives best results for the selected features [3][4].

Color Histogram analysis
Algorithm:
1. Read the image.
2. Convert RGB image into Gray image.
3. Plot the histogram.

The algorithm is repeated for the healthy as well as visually deficient leaf. Input RGB image of healthy leaf is first transformed in to gray scale image to plot the histogram. For defected images same steps are carried out for plotting the histogram.

IV EXPERIMENTAL RESULTS

Using Histogram[1]

Fig.1 Healthy Wheat

Fig2. Healthy Wheat Histogram

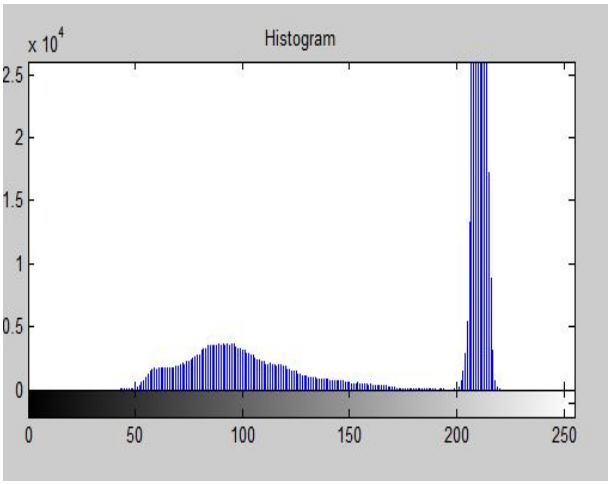
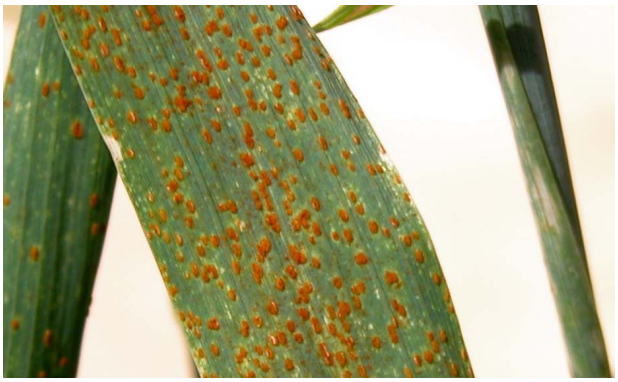


Fig.3 Unhealthy Wheat Image: Image affected by fungal disease



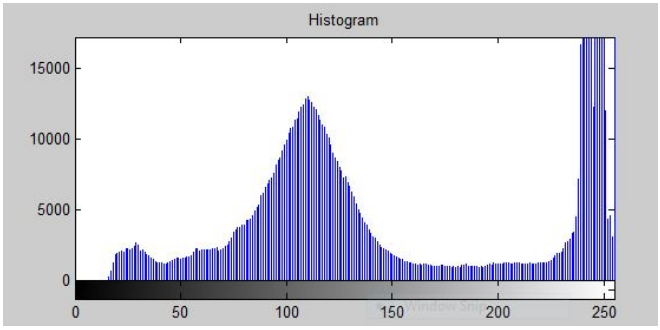


Fig.4 Unhealthy Wheat Histogram

From above Healthy and unhealthy Histogram observation we can say that

1. Histogram of Healthy wheat is concentrated symmetrically at certain value on the gray scale.
2. Histogram of healthy wheat leaf has maximum peak occurs generally about 30% and 90% of dynamic range. This indicates frequency of occurrence of single color in leaf.
3. Histogram of deficient wheat leaf has non symmetric shape at certain values on gray scale. Narrow downs the dynamic range than the healthy leaf.
4. Histogram of deficient leaf has smaller peak amplitude than that of normal.

Using Neural network and Support vector machine [7] [8]
This research carried out 120 images among which 65% images used for training purpose and 35% images used for testing purpose.
We calculate the accuracy using formula as below

$$\text{Accuracy (\%)} = \frac{\text{No. of images correctly classified}}{\text{Total No. of Images used for testing}} \times 100$$

TABLE 1. ACCURACY OF THE RESULT

Sr. No.	Classification Method	Accuracy
1	Neural Network	80.21
2	Support Vector Machine	89.23

V CONCLUSION

This paper deals with various methods for wheat disease detection. In first Histogram method we come to know Healthy wheat histogram has maximum peak occurrence compared to unhealthy wheat which means frequency of occurrence of normal color is more than different colors. In Second method we use two methods one is neural network another is support vector machine. If we observe the result we come know support vector machine gives more accurate results than Neural Network. Proposed method efficiently detects and classifies fungal disease of wheat plant. This method could apply for detecting and classifying other plants. Future work of this study will focus to improve the proposed algorithm in order to reduce the error of classification

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