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Early Detection of Diseases in Triticum Aestivum (Wheat) Using Image Processing Techniques in LabVIEW

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Abstract: Recently, one of the active research areas in agriculture productivity and quality of a crop. During the past decades, dramatic improvement of agriculture which plays a vital role in improving economic status have been achieved in all over the world considerably. The innovative technology approach is being advocated, particularly farmers in less favorable. The main concept of the work helps to improve productivity and sustainable agriculture using low external inputs, and also less harmful to nature recourses. The goal of this research is to develop an image recognition system that can recognize the wheat disease. To automate these activities, like texture. Color and shape, disease recognition system is feasible. The work concentrated on Triticum Aestivum (Wheat) disease detection by digital image processing. This is the novel approach of disease detection in wheat instead of many different disease detection techniques have been proposed for the wheat crops. The obtained image can be processed by using LabVIEW. The results are analyzed also evaluated through classification techniques. The results, which we have achieved, are more useful and they prove to be helpful for formers during the cultivation of wheat, a major food crop in the world.

Keywords: Color, texture, shape, Threshold image, LabVIEW, Digital image processing and precision agriculture

1. INTRODUCTION

Agriculture is regarded as an essential thing for every one day-to-day life. In the present scenario of the agriculture requirement further enhances the motivation to innovation and new technology extent to the creation of new species.

Many agriculture automotive technologies are being developed by researchers that pose questions about the efficiency and effectiveness of practices. The need-based idea has been motivated us to develop the early stage intimation in the technique to detect the disease in wheat leaf by image processing techniques such as preprocessing segmentation and particle analysis technologically has been successfully exploited to complete the detection task [1]. To develop an effective solution to maintain the optimum growth level in the cultivation of a crop. In this respect, we have successfully utilized the virtual instrumentation and image processing technique to process wheat leaf image to control various defects in that due to such disease and other nutritional and climatic defects, by taking all these parameters into consideration one can easily monitor the various level of defects can be rectified. To this, the new system has been developed and its working module has to demonstrate. The system has been programmed based on the detailed survey made on the issue and suitable rectification made on the problem and new system has been developed [2]

2. RELATED WORK

S. Phadikar et al [3] propose a method to detect the wheat disease based on the feature extraction and Fermi energy based segmentation from the wheat, color shape and position of the features are extracted and also designed feature extraction algorithm. Finally using selected features, a rule base classifier has been built that cover all the diseased wheat plant image and provides superior result compare to traditional classifiers. Piyush Chaudhary et al [4] proposed a method based on the effect of YCbCr, HIS and CIELAB color space in the process of disease spot detection are compared. The experiments were carried upon different Monocot and Dicot family plant leaves with both noisy and noise free background. By this the method which is independent of background noise and plant type. The threshold can be calculated by applying Otsu method on color component to detect the disease spot. Y. Taguchi et al [5] a novel method for controlling wheat blast disease using fan-forced wind on wheat wheat fields was carried out to determine the appropriate strength and the duration of artificially generated wind that can effectively reduce the severity of wheat blast disease compared with the use of fungicide. For this purpose, large electric fans capable of directing wind to large areas in the field were constructed. The leaves and panicles of wheat evaluated to determine the appropriate win-force and its period application that could be effectively used to control wheat blast disease.

Qi Li suggest [6] the Beside the RGB color space; there are other color spaces, such as HSV lab, that may be engaged to this framework. However, it is worth noting that a popular edge detector, such as acanny detector, may not be effective in such color spaces, in fact, we tested

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canny detector on HSV channels of images and observed the edge images output from HSV channels are much noisy than edge images from RGB channels. Sheeba O., Nikki Vinayan [7] deals with age Related Macular Degeneration (AMD) requires the quantification of deposits in thehuman retina. Vision assistant of LabVIEW is used for the automatic detection and mapping of deposits in the retinal images. The result is the display window which helps the doctor to make the accurate diagnosis or get information regarding the efficacy of the treatment very faster during the course of the disease. Birdevindersingh et al [8] deals with vision assistant to develop an accurate and automatic number plate recognition system. They have used vision assistant along with LabVIEW 2010 to obtain the desired results. We get an overall efficiency of 98.5% for this system.

3. METHODOLOGY

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is animage, like video frame of photograph and output may be image or characteristics associated with that image [9 and 10]. Solving an image processing problem typically involves a number of different steps. For the purposes, these steps can be organized into an image processing chain, consisting of the following steps: (i) Preprocessing and Filtering. (ii) Segmentation. (iii) Object recognition. (iv) Image understanding. (v) Enhancement and feature extraction.

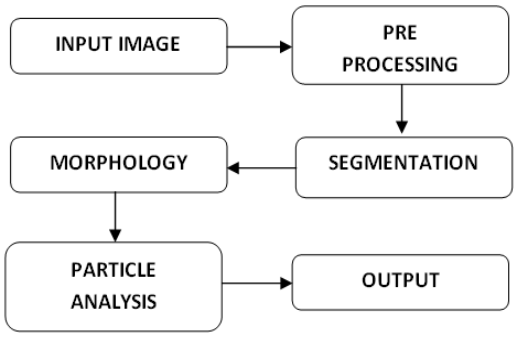

Fig.1. Block diagram of the proposed approach

3.1. Image acquisition

Image acquisition: the process of actually capturing the image and sending it to the computer. Image preprocessing: to perform some operation on the mage to change its appearance [11]. Image analysis: to use parts or the entire image to gain some other information. All the computers we use today have national instruments IMAQ image boards, these boards and the drivers that run them were designed by the same company who makes LabVIEW, so they are fully compatible with LabVIEW. This source of the image can be anything CCD camera, camcorders, TV, VCR, etc… There are two important VI libraries you will be using both are accessible from the function palette [12 and 13].

3.2. Preprocessing and segmentation

Impulse Noise

The impulse noise is also called as salt and pepper noise. It is caused by sharp, sudden disturbances in the image signal. Its appearance is randomly scattered white or black (or both) pixels over the image [14 and 15]. For an 8-bit image, the typical value for pepper noise is 0 and for salt noise 255.

Gaussian Noise

Gaussian noise is an idealized form of white noise, which is caused by random fluctuations in the signal. Gaussian noise is evenly distributed over the image. This means that each pixel in the noisy image is the sum of the true pixel value and a random Gaussian distributed noise value [16].

Speckle noise is also called multiplicative noise. It can be modeled by random values multiplied by pixel values. This type of noise occurs in almost all coherent imaging systems such as laser, acoustics, and SAR (Synthetic Aperture Radar) imagery [17].

Periodic Noise

If the image signal is subject to a periodic, rather than a random disturbance, we might obtain an image corrupted by periodic noise. Usually, periodic noise requires the use of frequency domain filtering. This is because whereas the other forms of noise can be modeled as local degradations, periodic noise is a global effect [18 and 19].

In image and video processing, images are often corrupted by impulse noise. The preprocessing steps include the operations of noise removal and transforming the image from RGB color space into L*a*b* color space.

In this thesis, one of the most popular methods to remove impulse noise is the median filter, which has high efficiency to suppress the noise. The median filter is a non-linear filter used to remove noise from an image by replacing pixels with the middle pixel value selected from a certain window size. Median filter works best with noise whilst retaining sharp edges in the image [20 and 21].

3.3. Morphology

Morphological image processing is a collection of non-linear operations related to the shape or morphology of features in an image. According to Wikipedia, morphological operations rely only on the relative ordering of pixel values, not on their numerical values, and therefore are especially suited to the processing of binary images. Morphological operations can also be applied to grayscale images such that their light transfer functions are unknown and therefore their absolute pixel values are of no or minor interest.

Morphological techniques probe an image with a small shape or template called a structuring element. The structuring element is positioned at all possible locations in the image and it is compared with the corresponding neighborhood of pixels. Some operations test whether the element "fits" within the neighborhood, while others test whether it "hits" or intersects the neighborhood

A morphological operation on a binary image creates a new binary image in which the pixel has a non-zero value only if the test is successful at that location in the input image.

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4. RESULTS AND DISCUSSION

This research work proposes early detection of disease. The wheat cultivating field monitoring camera output is taken as input and the input video was converted into image frames one of the images one sample image is taken for processing the image in IMAQ vision and motion tool in LabVIEW software. The various processes are gray-scale extraction, histogram equalization, gamma correction, morphological processes, edge detection, area calculation and segmentation . To convert any color to a grayscale representation of its luminance, and thefirst one must obtain the values of its red, green, and blue (RGB) primaries in linear intensity encoding, by gamma expansion. Then, add together 30% of the red value, 59% of the green value, and 11% of the blue value (these weights, depend on the exact choice of the RGB primaries, but are typical). In image processing, histogram equalization is a method of contrast adjustment using the image's histogram. Also, histogram equalization can produce undesirable effects (like visible image gradient) when applied to images with low color depth. Morphological operations are used to understand the structure or form of an image. This usually means identifying objects or boundaries within an image. Morphological operations are dilation and erosion. Dilation causes objects to dilate or grow in size; erosion causes objects to shrink. The amount and the way that they grow or shrink depend on upon the choice of the structuring element. The erosion of a set by a structuring element is the set of pixel position for which, a structuring element placed with its reference point there will be contained completely within the set. The combination of erosion followed by dilation is called an opening, referring to the ability of this combination to open up gaps between just touching features. Performing the same operations in the opposite order produces a different result. This sequence is called a closing because it can close breaks in features. Openings can be used to separate touching features. It is possible to continue erosion until all features have separated but none have been completely erased. After the separation is complete, dilation grows the features back toward their original size. Edge detection is a terminology in image processing and computer vision, particularly in the areas of feature detection and feature extraction, to refer to algorithms which aim at identifying points in a digital image at which the image brightness changes sharply or more formally has discontinuities. Figure2 displays the Input sample image.

The input image sample is changed it into HSL image by color enhancing method and the first step of the preprocessing process can be done by the image. Processed image is given as input to measure the threshold value of an image. HSL intensity image has measured the value of binary and the pixel and intensity of the image can be changed by the extraction of the given input image. This image has to be further enhanced to such that only the defect spots are visible and the rest of the image details are discarded. This is done by applying a lookup table (LUT) to an image.

Fig. 2. Input Image of wheat leaf

The lookup table transformations are basic image processing functions that highlight details in areas containing significant information, at the expense of other areas. LUT transformations are used to improve the contrast and brightness of an image by modifying the dynamic intensity of regions with poor contrast. For each grayscale value of an image, the corresponding grayscale value is obtained from LUT and assigned to every pixel in the gray scale plane. Here an exponential transform is used which decreases the brightness and contrast in dark regions. It increases contrast in bright regions. Here only the defect spots are illuminated and rest of secondary details such as veins is darkened. Only the disadvantage is that the diseased spot is also illuminated. Figure3 displays the Colour enhanced image.

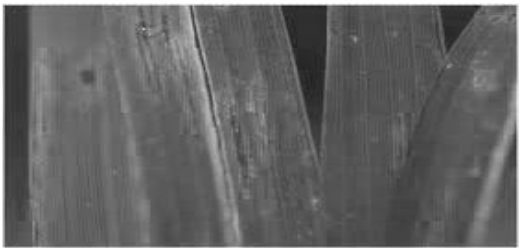

Fig3. Colour enhanced the image.

The next step is thresholding. The thresholding value is obtained from histogram analysis of a segment. It is done with the help of line profile which gives the gray scale distribution along a line of pixels in the image. A value for the maximum value is selected as the thresholding level. Thresholding can be considered as the special case of clipping. The resultant image becomes binary. In thecase of 8-bit images the gray level below and including the threshold are mapped onto zero, while gray levels greater than thethreshold value are mapped onto 255. Because of simplicity of implementation thresholding holds an important central position in image segmentation. Segmenting disease spot in an enhanced image is an important prerequisite for measuring and understanding region affected with thedisease. The goal here is to separate disease spot from rest of unwanted details. After the mentioned process agood amount of background details is removed. The remaining isolated pixels and the diseased spot can be removed with the help of morphological operations. The defect spots are detected without affecting intensity variations caused by vessels. Since the images that are dealt with have a variable

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contrast and a background, even choosing the best threshold cannot give good results. Figure 4 displays the threshold image.

Fig.4. Threshold output Image

Here the concept of mathematical morphology is used as a tool for the extraction of image components. Mathematical morphology is an approach to image analysis based on set theory. Morphological processing refers to certain operations where an object is hit with a structuring element and thereby reduced to a more relevant shape.
The origin of structuring element coincides with '1' in the image and any one of the '1'pixels in the structuring element extend beyond the object (1 pixel) in the image then change the '1' pixel in the image to '0'. Then the option of thegradient is used where the interior contours of the defect spots are removed preserving only the boundary of the defect spots. The process is a combination of opening and closing which is the derivation of the dilation and erosion operation. The well-defined disease spot structures have been obtained.

Fig.5. Binary morphological output Image

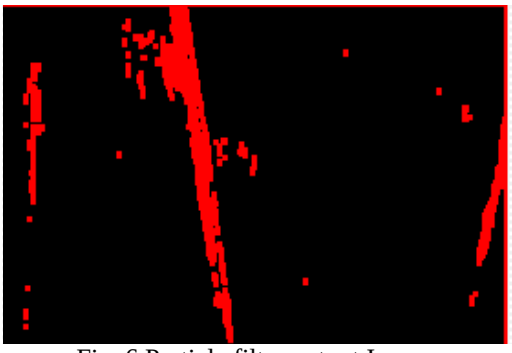

Fig. 6.Particle filter output Image

The binary morphological image processed in particle filter function to separate the particles of defected area of wheat crop. Figure5 displays the Particle filter image. The particle filter output image is analyzed by particle analysis function. The values can be measured and dimensional changes can also be analyzed. Figure6 displays Particle analysis measurement. The particle measurement is done on the image. Numerical variables are assigned to defect spots in the image. The area of defect spots in pixels is displayed as a table in Figure 7. The first row of the results table lists the numerical label associated with each particle. When a particle is clicked in the display window, the measurement results for that particle are highlighted in blue. When the results for a particle are clicked, the particle is highlighted in green in the processing view. Figure 6 shows the image with numerical variables assigned to defect spots. Tests were conducted on many wheat images, affected with Wheat Disease Defect.

Particle Measurements

1	9.00	580.00	13.00	580.00	9.00	576.00	13.00	576.00
5	10.00	607.00	20.00	607.00	11.00	598.00	20.00	597.00
	11.00	562.00	14.00	559.00	11.00	562.00	14.00	559.00
	24.00	385.00	36.00	376.00	24.00	380.00	36.00	380.00
	35.00	423.00	41.00	423.00	35.00	419.00	41.00	420.00
	36.00	567.00	43.00	561.00	36.00	567.00	42.00	561.00
	42.00	541.00	50.00	541.00	42.00	529.00	50.00	537.00

Fig.7. Particle filter output Image

The designed detection method involved image processing techniques to prove it is possible with the easier detection of the crop in a particular area with a special assessment of affected part data. The acquired image is undergone processing of defected area separation results in the defects status of the crop. The following figure 8 shows the pixel profile of input image and image.

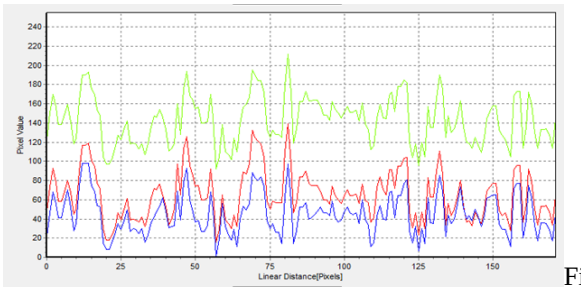

Fig. 8. Pixel profile for wheat input

For PDD detection, the algorithm developed is successful in detecting and extracting the defect spots from the leaf images. Here, an automated and reliable method using LabVIEW is developed for analyzing the progress and extent of PDD (Wheat Disease Defect) from the wheat image. The final image provides information about defect spots, which enables to identify if the crop is infected from PDD or not. It also can be used to study the natural course of the treating the crop. The advantage of the system is thesimplicity of operation and also borders of affected areas are much more clearly defined. In LabVIEW no

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knowledge of programming language is needed. LabVIEW development systems offer the possibility of developing standalone systems.

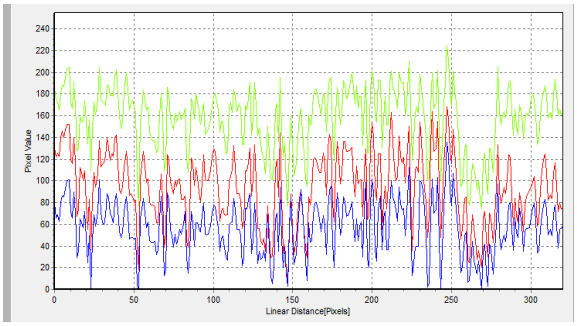

Fig. 9. Pixel profile for wheat output image

4. CONCLUSION

An efficient work of detection of diseases in TriticumAestivum (Wheat) crop using image processing has been implemented here. The advanced image processing methods can be used to detect wheat disease in early stage. Detection of diseases objects then its counting, distance and area of affected part to compare with thereference image for percentage in the crop and its status of thecondition also be detected. The image processing tools also allow features to be measured automatically which would be too time-consuming to do manually. The image processing for detecting deformation based on themorphology of disease in wheat crop based could be identified. This is possible for calculating dimensions of the diseased spot can be measured. The results are analyzed and also evaluated through classification techniques in the further studies. The results, which we have achieved, are more useful and they prove to be helpful for farmers during the cultivation of wheat, a major foods crop. Thus, this will enable the technology to be applied in monocot and dicot plant crops. It is also can be done for other food and cash crops.

REFERENCES

[1] Georges Giraud, "The World Market of Fragrant Rice, Main Issues and Perspectives", International Food and Agribusiness Management Review, Vol. 16(2), 20133
[2] R. Maheswaran, S. Muruganand, C. Hemalatha, "A Hybrid Embedded System Design for Real-Time Monitoring the Detection of Diseases and Nutrients Deficiency in Oryza Sativa L Using LabVIEW", International Journal of Applied Engineering Research, 16 (2015)
[3] SantanuPhadikar, Jaya sil, Asitkumar Das, "Rice disease classification using feature selection and rule generation techniques", Computers and Electronics in Agriculture 90 (2013) 76-85.
[4] Piyush Chaudhary, Anand K. Chaudhari, A.N. Cheeran and ShardaGodara, " color transform Based Approach for Diseases Spot Detection in Plant leaf", International Journal of Computer science and Telecommunication 3 (2012).
[5] Yoshihiro Taguchi, Mohsen Mohamed Elsharkawy, Naglaa Hassan, MitsuroHyakumachi, " A-novel-method-for controlling rice blast disease using fan forced wind on paddy fields", Crop protection 63 (2014).
[6] Qi li, " A primal sketch based framework for bean –shape contour extraction", Neurocomputing 142 (2015)
[7] Sheeba ., Nikki Vinayan, " Image segmentation and Analysis in the case study of macular degeneration using LabVIEW", International Journal of Engineering and Advanced Technology 3 2013.
[8] Birdevinder Singh, Karmjeet Singh, "A new Approach for the Detection of Registration Number of Vehicles using LabVIEW", International Journal of Research in Advent Technology, 4 2013.
[9] Remote sensing system (SIRSS) for in-season crop monitoring", Computers and Electronics in Agriculture, Vol.78, pp.1-8, 2011.
[10] M. Perez-Ruiz, P. Gonzalez-de-Santos, A. Ribeiro, C. Fernandez-Quintanilla, A. Peruzzi, M. Vieri, S. Tomic, J. Aguera, "Highlights and preliminary results for autonomous crop protection", Computers and Electronics in Agriculture, Vol.110, pp.150-161, 2015.
[11] Daudi S. Simbeye, Jimin Zhao, Shifeng Yang, "Design and deployment of wireless sensor networks for aquaculture monitoring and control based on virtual instruments", Computers and Electronics in Agriculture, Vol.102, pp.31-42, 2014.
[12] David Joseph Sampson, Young Ki Chang, H.P. VasanthaRupasinghe, Qamar UZ Zaman, "A dual-view computer-vision system for volume and image texture analysis in multiple apple slices drying", Food Engineering, Vol.127, pp.49-57, 2014.
[13] S. Viazzi, G. Ismayilova, M. Oczak, L.T. Sonoda, M. Fels, M. Guarino,E. Vranken, J. Hartung, C. Bahr, D. Berckmans, "Image feature extraction for classification of aggressive interactions among pigs", Computers and Electronics in Agriculture, Vol.104, pp.57-62, 2014.
[14] Weilin Wang, Changying Li, Ernest W. Tollner, Glen C. Rains, "Development of software for spectral imaging data acquisition using LabVIEW", Computers and Electronics in Agriculture, Vol.84, pp.68-75, 2012.
[15] E. Bauriegel, A. Giebel, M. Geyer, U. Schmidt, W.B. Herppich, "Early detection of Fusarium infection in wheat using hyper-spectral imaging", Computers and Electronics in Agriculture, Vol.75, pp.304-312, 2011.
[16] Georges Giraud, "The World Market of Fragrant Rice, Main Issues and Perspectives", International Food and Agribusiness Management Review, Vol.16, 2013.
[17] The Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India, "Annual Report", 2012-2013.
[18] Mare srbinovska, Cvetangavroski, vldimirDimecv, Aleksandra Krkolevs, VesnaBorozan, "Environmental parameters monitoring in precision agriculture using Wireless Sensor Network", Journal of cleaner Production, Vol.88, pp.297-307, 2015.
[19] Bayo, D. Antolin, N. Medrano, B. Calvo and S. Celmaa, " Early detection and monitoring of Forest Fire with a Wireless Sensor Network System", Procedia Engineering, Vol. 5, pp.248-251, 2010.
[20] Haitao Xiang, Lei Tian, "An automated stand-alone in-field remote sensing system (SIRSS) for in-season crop monitoring", Computers and Electronics in Agriculture, Vol.78, pp.1-8, 2011.
[21] M. Perez-Ruiz, P. Gonzalez-de-Santos, A. Ribeiro, C. Fernandez-Quintanilla, A. Peruzzi, M. Vieri, S. Tomic, J. Aguera, "Highlights and preliminary results for autonomous crop protection", Computers and Electronics in Agriculture, Vol.110, pp.150-161, 2015.