Scab Diseases Detection of Potato using Image Processing

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***Abstract*-Scab disease of potato tubers resulting in lowered tuber quality due to scab-like surface lesions. Potato is the most demanding vegetable of India to increase the productivity. In this paper proposes image processing methodology to detect scab disease of potato. In this paper first, the captured images are collected from different potato field and are processed for enhancement. Then image segmentation is carried out to get target regions (disease spots). Finally, analysis of the target regions (disease spots) based on histogram approach to finding the phase of the disease and then the treatment consultative module can be prepared by on the lookout for agricultural experts, so plateful the farmers.**

***Keywords:* Image processing, disease detection, image learning technique.**

I. INTRODUCTION

The one and only area that serves the food desires of the intact human race is the Agriculture zone. It has played a key responsibility in the development of human civilization. Plants exist all over the place; we live, as well as places without us. Research in agriculture is designed to increase the efficiency and quality of agricultural product. Potato plant pathology is the scientific research of plant caused by contagious diseases. Diseases detection application is implemented to upgrade the agricultural sector .Disease management make available accurate treatment advices. The machine vision system now a day is normally consists of computer, digital camera and application software. Various kinds of algorithms are integrated in the application software. Scab symptoms are quite variable. Usually roughly circular, raised, tan to brown, corky lesions of varying size develop randomly across tuber surfaces. Russet scab occurs as a rather superficial layer of corky tissues covering large areas of the tuber surface. Pitted scab occurs where lesions develop up to 1/2 inch deep; these deep lesions are dark brown to black, and the tissues underneath are often straw-colored and somewhat translucent. More than one of these lesion types may be present on a single tuber. Although scab symptoms are usually noticed late in the growing season or at harvest, tubers are susceptible to infection as soon as they are formed. Small brown, water-soaked, circular lesions are visible on tubers within a few weeks after infection.

WANG Chenglong, LI Xiaoyu, WANG Wei, Liu Jie, TAO Hailong and WEN Dongdong [1] proposed a new technology of machine vision was employed to detect the major and minor axes of potatoes. Hear this method to detect the size of potatoes is presented based on the censorial principal axis of potatoes. Firstly, the color space of the image was converted from RGB to HSI, by applying the Otsu, a method of single threshold segmentation, to the H component values of the HSI image, binary image was gained through extracting potatoes from the gray images of H component values, which were preprocessed with the de-noising method of a mean filter. Ebrahim Ebrahimi, Kaveh Mollazade, Arman Arefi [2] used a machine vision based on the algorithm which was proposed in RGB and HIS spaces to overcome this challenge; the use of machine vision to analyze the greening area of potatoes is suggested.

II. SYMPTOMS

Scab symptoms are fairly variable. Frequently roughly circular, raised, tan to brown, corky lesions of varying size build up erratically across tuber surfaces. Russet scab crop ups as a slightly superficial layer of corky tissues covering large areas of the tuber surface. Pitted scab crop ups where lesions develop up to 0.5 inch deep; these deep lesions are dark brown to black, and the tissues underneath are often straw-colored and somewhat lucent. Again, these abrasion types may be present on a single tuber. Although scab symptoms are usually noticed late in the growing season or at harvest, tubers are susceptible to infection as soon as they are formed. Small brown, water-soaked, circular lesions are perceptible on tubers within a few weeks after infection. Mature tubers with a well-developed skin are no longer vulnerable, but existing lesions will continue to increase as tubers enlarge, increasing disease severity throughout the growing season. Scab is a large amount severe when tubers develop under warm, dry soil conditions. Coarse-textured soils that dry out swiftly are therefore more conducive to scab than are fine-textured soils.

More than a few other conditions can be confused with scab. White, enlarged lenticles, which frequently occur on potato tubers harvested from wet soil, can be mistaken for scab. Usually this condition will disappear when tubers are dried. Patchy russeting, checking or cracking of tuber surfaces caused by the fungus Rhizoctonia spp. also may be confused with russet scab. A very dissimilar and uncommon disease called powdery scab, caused by the fungus Spongospora subterranea, causes very similar scab-like symptoms. Laboratory examination may be necessary to identify these diseases.

III. PROPOSD METHODOLOGY

The proposed methodology aims to model a promising disease grading system for potato. For the experimentation purpose, pomegranate potato is considered. The flow chart of the methodology is presented in the annexure 1 in the appendix. The system is divided into the following steps: (1) Image enhancement (2) Image Pre-processing (3) Color image segmentation (4) Histogram draw (5) Disease detection by picks value.

The proposed system is an efficient module that identifies various diseases of that plant and also determines the stage in which the disease is. The system employs various image processing and machine learning techniques.

A. IMAGE ENHANCEMENT

The aim of image enhancement is to improve the interpretability or perception of information in images for human viewers, or to provide `better' input for other automated image processing techniques. Image enhancement techniques can be divided into two broad categories:

1. Spatial domain methods, which operate directly on pixels, and
2. Frequency domain methods, which operate on the Fourier transform of an image.

For the purpose of image enhancement, authors have visited and captured images from several pomegranate farms in the places of Nadia District e.g. Krishnanagar Block-1, Chapra Block, Dhantola Block and Ranaghat Block, India and improve the interpretability or perception of information in images for human viewers.

B. IMAGE PRE-PROCESSING

Image processing is a structure of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Preprocessing uses the techniques such as image resize segmentation, filtering, cropping, contrast enhancement, angle correction, morphological operations etc.

C. IMAGE SEGMENTATION

There are two main segmentation methods based on machine vision. One is segmentation based on the gray image, and the other is segmentation based on color image.

D. SEGMENTATION BASED ON GRAY VALUE

Digital image filtering

In order to horizontal the image and diminish image noise, RGB image usually was processed by the image filters, such as average filter, median filter and Winer filter. In this study, the R, G and B components of the RGB image were respectively processed by median filter. Figure 3 shows the image of HM001 and the image after median filtering.

E. GRAY IMAGE BASED SEGMENTATION

The RGB image was renovated to a gray image, and the following conversion formula was used:

Gray = R × 0.299 + G × 0.587 + B × 0.114 --(1)

Where, R, G and B indicate the corresponding color value of the red, green and blue components of the RGB image. The median filtering Not only reserved the trough between the two peaks in the original histogram and characteristics of potato but also made the image smoother. Because of the uneven surface of the potato and uneven distribution of light, the method is not significant. Figure 6 shows the histogram of HM010 after filtering, in which there is only one peak.

F. COLOR SPACES CONVERSION

The gray image based segmentation will lead to incomplete segmentation, which also result the loosing of the edge. Thence, in this study, a segmentation method based on color image was presented. However, the RGB image is constituted by the three monochrome images(R, G and B), in which the color and grayscale can not be separated out.

G. BACKGROUND SEGMENTATION

After processing by average filtering (Figure 8), the binary image was extracted from the H component through Using Otsu. Finally, integrated potato binary image was acquired by filling and erosion, in which the pixel value of potato was 1 and the pixel value of the background was 0.

H. FEATURE EXTRACTION

Because of the direction of potato the image is neither vertical nor horizontal; we need to rotate the binary image with the intersection angle, which is between the principal axis and the horizontal axis.

I. CENTROIDAL PRINCIPAL AXIS

The algorithm which can calculate the intersection angle between the principal axis and the horizontal axis is the following:

$$P_x = {M_i}/{P_A} ----(2)$$

$$P_y = {M_j}/{P_A} -----(3)$$

Where P_x and P_y are the coordinates of centroid pixel, M_i and M_j are mean value and P_A is total area.

J. COLOR IMAGE SEGMENTATION

Image segmentation refers to the progression of partitioning the digital image into its ingredient regions or objects so as to change the representation of the image into something that is more consequential and easier to analyze. K-means clustering technique has been used in the present work to carry out segmentation. K-Means Clustering is a method of cluster analysis which aims to partition n observations into k mutually exclusive clusters in which each observation belongs to the cluster with the nearest mean. The objective function is:

$$W = \sum_{m=1}^{r}\sum_{n=1}^{c} | G_m{}^n - P_j |^2 ------(4)$$

Where $| G_m{}^n - P_j |^2$ is a chosen distance measure between a data point $G_m{}^n$ and the cluster centre P_j, is an indicator of the distance of the *n* data points from their respective cluster centers. The K-Means follows by:

1. Place K points into the space represented by the objects that are being clustered. These points represent initial group centroids.
2. Assign each object to the group that has the closest centroid.
3. When all objects have been assigned, recalculate the positions of the K centroids.
4. Repeat Steps 2 and 3 until the centroids no longer move. This produces a separation of the objects into groups from which the metric to be minimized can be calculated.

K. HISTOGRAM DRAW

Generally, in image processing expressions area of a binary image is the total number of on pixels in the image. The original resized image is converted to binary image such that the pixels corresponding to the potato image are on. Then we plot the histogram for calculate the change the pick value.

L. DISEASE GRADING BY PICKS VALUE

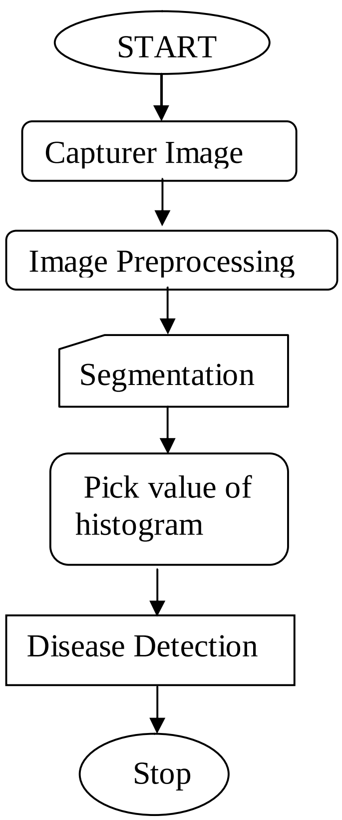
A histogram based System is developed for disease grading by referring to the disease scoring scale in Table I. The main grading system depend on

$$G = \sum_{x=0}^{r-1}\sum_{y=0}^{c-1} P(x,y)\log P(x,y) -----(5)$$

Where G = grade value, P(x,y) = Image matrix function , r=row value and c=Colum value

$$P(x,y) = \frac{p(x,y,1,0)}{\sum_{x=0}^{r-1}\sum_{y=0}^{c-1} P(x,y,1,0)} -----(6)$$

III.PROPOSED WORK FLOW DIAGRM:



IV. RESULT AND DISCUSSION

Now, potato images are used to test proposed algorithm. First we get the Original potato (Fig1) and another disease potato (Fig2).Then we calculate the gray value of each potato (Fig3 & Fig4).Finally we segmented the each image using K-Mean clustering ,i.e., background removed image and we get picks values from each histogram (Fig5 & Fig6) and define the disease detection .

Fig1: Original disease free Potato

Fig2: Original affected Potato

Fig3: Gray Image

Fig4: Gray Image

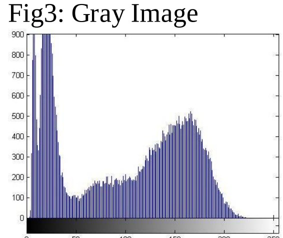


Fig5: Histogram

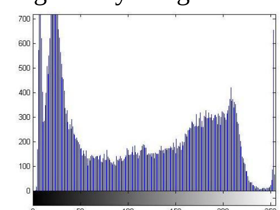


Fig6: Histogram

Data Sample	**Training Sample**	**Testing Sample**	**Classifier Accuracy**
Field 1	235	67	87.6%
Field 1	230	65	94.2%
Field 1	240	55	95.78%
Field 1	235	54	97.5%
Field 1	230	50	89.8%
Field 1	235	55	95.3%

Table I: Testing table

V. CONCLUSION

In this paper, we proposed a novel histogram based Scab Diseases Detection of Potato. Using , the histogram approach and colour image segmentation technique to exact intensity pattern. to Scab disease accordingly it is then possible to analyze the different potato diseases. Here there is more scope to reduce the various errors which will be occurred during the simulation, that can be minimize as the more no of input is provided accordingly. The consequence from the preliminary study indicated that the proposed strategy is effective to assess disease intensity by the plant pathologist more accurately.

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