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GRADING OF APPLE FRUIT DISEASE

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ABSTRACT

In agricultural industry the need to effectively grow a plant and increases its yield is very important task. Diseases in fruit cause a difficult problem in agricultural industry. In this paper an adaptive approach for classification and grading of apple fruit diseases is proposed and experimentally validated. The image processing based approach is composed of the following main steps:The frist step is to read the input image from database.Edge detection technique is used for defect segmentation. In second step some state of art features are extracted from segmented image,and finally images are classified into one of the classes. Depending on the affected area grading has been done namely Healthy, Partially affected, moderately affected, and fully affected. We have considered three types of diseases namely apple scab,apple blotch and apple rot. Practical implementation of classification and grading of apple fruit has been done using MATLAB.

KEYWORDS: Segmentation, Feature extraction, Classification,Grading.

INTRODUCTION

India is the second largest producer of fruits with a production of million tons. This accounts 10% of the world fruit production. In agricultural science images are the important source of data and information. A large variety of fruits are grown in India of which apple, citrus, banana, grape, mango, guava, are the major ones. Also, identifying the fruit disease is not easy task. It requires experience and knowledge of fruit and their diseases. The various types of diseases on fruits determine the quality, quantity, and stability of yield. The diseases in fruits not only reduce the yield but also go down the variety. There are no sensors are available for real time assessment of trees health conditions.

The approach introduced here can be used for designing automatics systems for agricultural process using images. Several applications of image processing technology have been developed for the agricultural operations such as [1]

1. To sense diseased leaf, stem, fruit.
2. To enumerate affected area by disease.
3. To find shape of affected area.
4. To decide color of affected area
5. To find out size & shape of fruits Etc.

DATABASE:

The following different apple diseases are considered for creating database.

1. Apple Scab

Gray or brown corky spots are present on the surface of apple. On the surface some pin point scab with rough, black, circular spots may be develop.[1]

Figure 1.Apple scab

2. Apple rot

Apple rot contains mainly two types of diseases.

I) Bitter Rot

Usually, bitter rot infections produce slightly sunken, circular brown spots on the surface that may be surrounded by a red halo. When the spot becomes near about an one inch in diameter, spore-bearing structures appear in concentric circles on the diseased apple surface

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Figure 2.Bitter Rot

II) White Rot

Disease appears as sunken, circular, brown spots, often with a reddish or dark halo. Scattered clumps of fungal appear on the surface. As the rot expands, the rotted area extends towards the central part as a cylinder of affected tissue. This can be seen by splitting the fruit. The rot is spongy and watery, having a clear to light tan color under hot weather conditions.

Data Set Preparation
Image Preprocessing
Image Segmentation
Feature Extraction
Classification and Grading

Figure 3.Bitter Rot

3. Apple Blotch

On the surface Dark, shiny raised blotches with irregular or lobed edges are appearing. The surface of fruit having fungal disease.

Figure 4.Apple Blotch

Good Apple

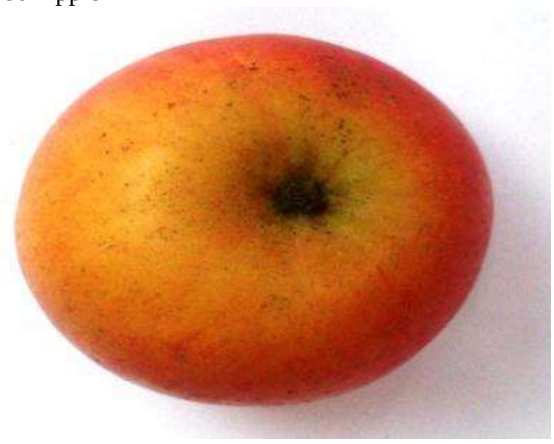

Figure 5. The basic procedure of the proposed approach

PROPOSED APPROACH

The framework of the proposed solution is shown in the Fig. 6. Each stage of the proposed method is described in the rest of this section.

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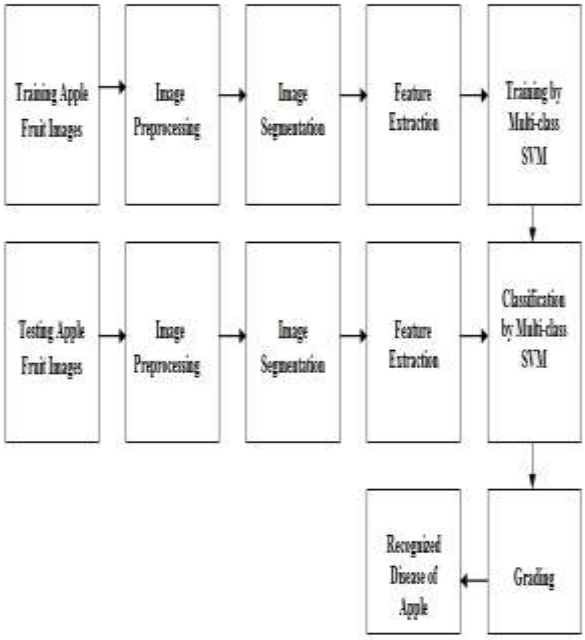

Figure 6. Frame work of proposed approach

The steps of proposed approach are shown in figure 6. The first step is read the input image that is we take the diseased or normal fruit images from the database. Next step is image preprocessing where the image is resized into the specific dimension. Then most important steps are image segmentation and feature extraction. At the last image is classified in one of the two classes either normal or infected. Depending on the percentage of affected area the grading is decided.

IMAGE PREPEOCESSING

Image preprocessing improves the image in ways that increases the chances for success of other processes. The original input image is resized to a specific dimension. The colored image is converted into gray scale image.

Figure 7. Resized Image

IMAGE SEGMENTATION

More precisely, image segmentation is the process of assigning a label to every pixel in an image so that pixels with the same label share certain visual characteristics. The ultimate goal of segmentation technique is to simplify and/or change the representation of an image into a form more meaningful and easier to analyze.

FEATURE EXTRACTION

Three features are used for feature extraction of database images are color, morphology and texture. Feature extraction consists of two types of features high level features and low level features. The above three are the low level features.[4]

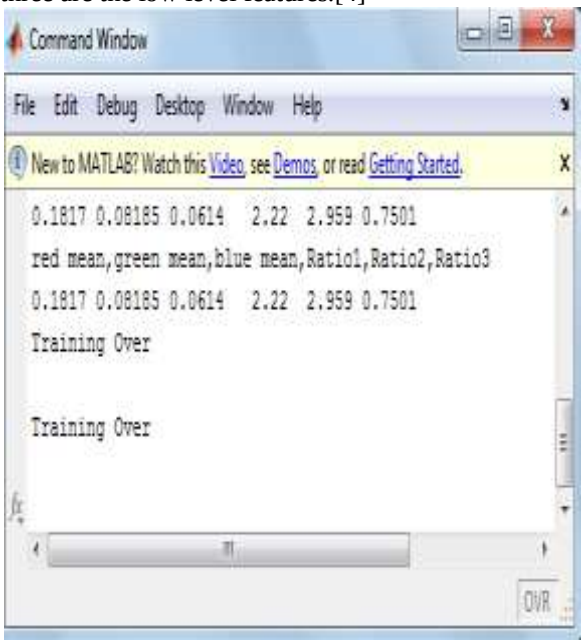

Figure 11.Feature extracted

GRADING

Estimation of percentage and grading: To estimate the percentage of affected area on the fruits' image samples, we have to find the affected area.

The percentage of affected area is calculated using equation (1).

Percentage = (Affected area/Total area)*100 (1)

Where, Affected area= Number of brown spots count

Total area = Total size fruit

The grading is performed based on percentage of affected area, whether image sample is normal, partially affected, moderately affected or unhealthy as shown below.

Less than 1% affected area = Normal

Less than or equal to 10% affected area = Partially affected

Less than or equal to 30% affected area = Moderately affected

More than 30% affected area = Unhealthy

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Algorithm 1: Estimation of percentage of affected area.
Input: Image samples
Output: Percentage of affected area
Start
Step1: Accept image samples
Step 2:Find the affected area
Step 3: Estimate the percentage of affected area using Equation (1).
Step 4: If (percentage < 1)
Display 'normal'
Else if (percentage<=10)
Display 'partially affected
Else if (percentage<=30)
Display 'Moderately affected'
Else
Display 'Unhealthy'
STOP

RESULT

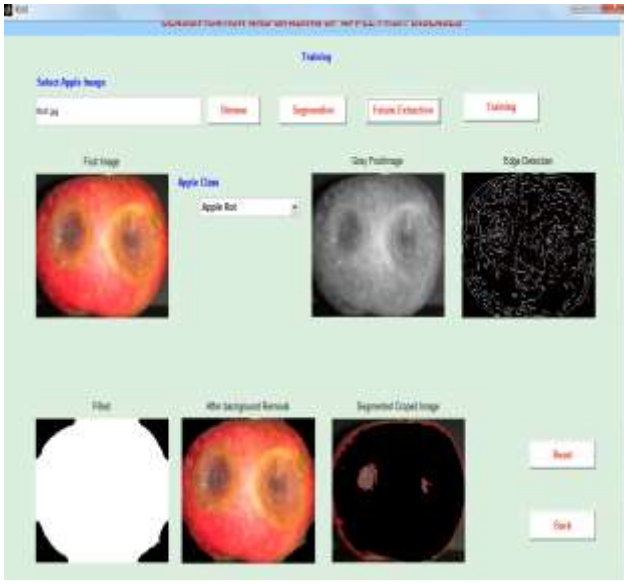

Figure 12 Segmentation

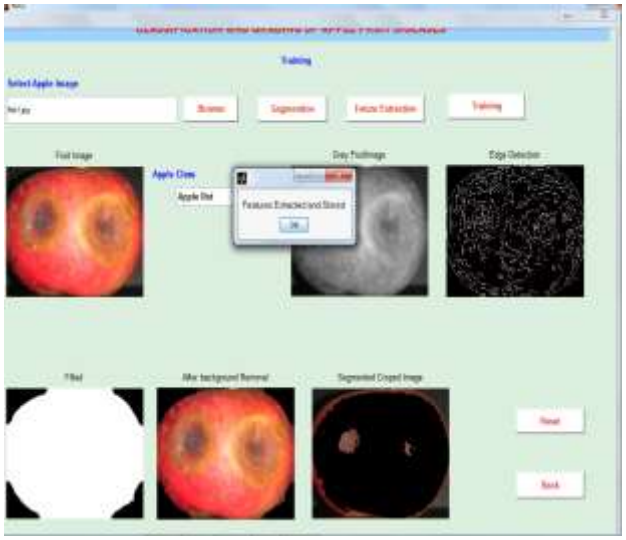

Figure 13 Feature extraction

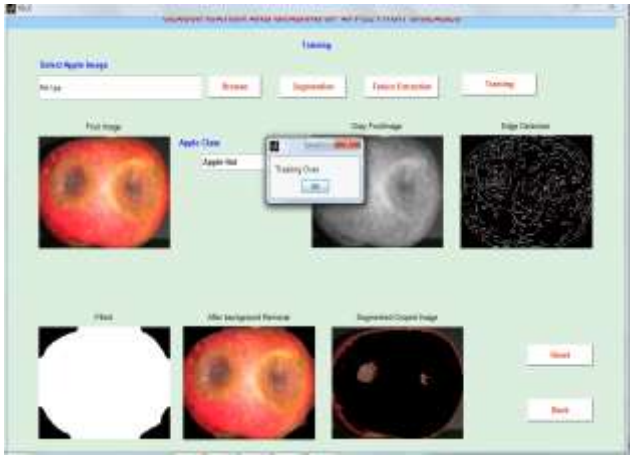

Figure 14. Training

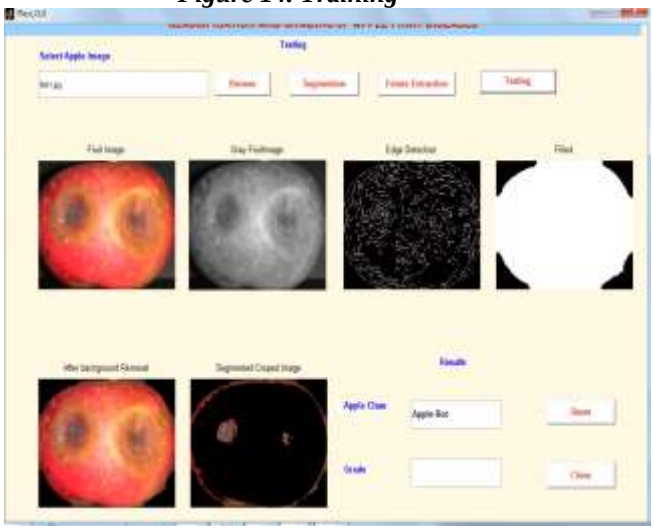

Figure 15.Classification

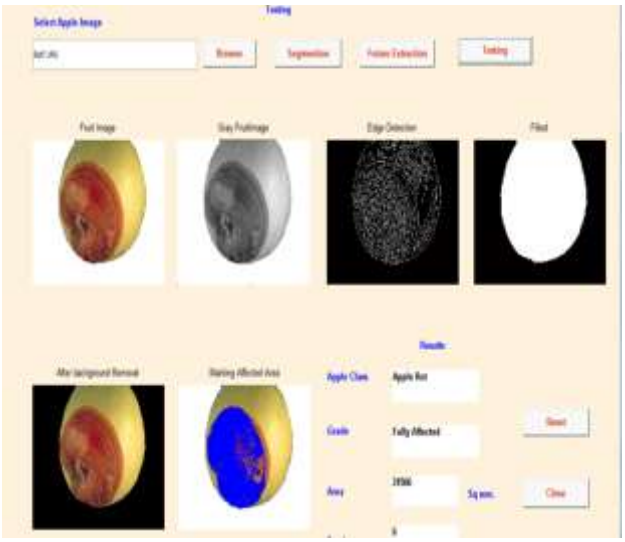

Figure 15.Grading

CONCLUSION

An image processing based approach is proposed and evaluated in this paper for classification and grading of apple fruit images. We make the database of different diseased and normal apple fruit image. The image processing technique, which employ the different technique for proposed approach. Our experimental result indicate that the proposed solution and can be significantly support automatic classification and grading of apple fruit diseases.[6] To improve and enhance the functionality and flexibility of recognition system more future work should be implemented. Future work includes fusion of more than one feature

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