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Article

Fruit Disease Recognition and Identification using Image Processing

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A B S T R A C T

This paper presents fruits disease detection using image processing technique. When diseases affect fruits there is significant decrease in the production of fruits due to which farmers suffer in selling their yield. This problem motivated to develop the new techniques to detect and diagnose the diseases affecting fruits. To increase production and quality, it is necessary to control such harmful diseases at the earlier stage. In our country most farmers are illiterate. So they cannot get correct information about fruits diseases. It requires an agricultural officer. But it is difficult for an agricultural officer to reach at every farmer. In mentioned system digital image processing is fast and accurate technique for detection of diseases in fruits.

Keywords: Fruit Diseases, Digital Image Processing, SVM classifier, K-Means Clustering, Segmentation, Feature Extraction

Introduction

India is the agricultural land, India produces 44.04 million tons of fruit and it is a second largest producer of fruits. India contributes 10% in world fruit production. Indian farmers grow variety of fruits those are apple, banana, citrus, grape, mango, guava, papaya, watermelon and many more. Fruit industry contributes around 20% of the country's development. Production of quality fruits has been decreased because of disgraceful development of fruit, absence of upkeep and manual assessment. Quantity and nature of the agricultural items are decreased by the disease of fruits. The main causes for fruit diseases are viruses and bacteria. The diseases are also caused by bad environmental conditions. There are numerous characteristics and behaviors of such fruit diseases in which many of them are less distinguishable. The diagnosis of fruit disease is an important aspect.

In this field farmers need manual monitoring system. But this will not give the exact result always. So we need one smart operating system to detect the fruits.

For this need there will be new technology has been proposed to satisfy the process. Here we are using some of the image processing technologies and algorithms. We will implement the system like it will detect the fruit disease. We are using K-means clustering technique to cluster the images. We can train the dataset image to detect the disease and give the maximum possible results. For these we are using MATLAB 7.14 software. Here MATLAB used for:

- To read images in MATLAB environment
- To display images on MATLAB desktop
- Analyzing data
- Performing image processing
- Matrix calculation
- To perform image segmentation
- Image enhancement
- Image registration
- 3D image processing operations

Methodology

To find out whether fruit is diseased or healthy, certain steps must be followed. i.e., Pre-processing, Feature extraction,

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Training of classifier and Classification. Pre-processing of image, is bringing all images size to a reduced uniform size. Then comes extracting features of a pre-processed image which is done with the help of HoG. HoG is a feature descriptor used for object detection. In this feature descriptor the appearance of the object and the outline of the image is described by its intensity gradients. One of the advantage of HoG feature extraction is that it operates on the cells created. Hu moments: Image moments which have the important characteristics of the image pixels helps in describing the objects. Here Hu moments help in describing the outline of a particular fruit. Hu moments are calculated over single channel only. The first step involves converting RGB to Gray scale and then the Hu moments are calculated. This step gives an array of shape descriptors. Haralick Texture: Usually the healthy fruit and diseased fruit have different textures. Here we use Haralick texture feature to distinguish between the textures of healthy and diseased fruit. It is based on the adjacency matrix which stores the position of (I,J). Texture is calculated based on the frequency of the pixel I occupying the position next to pixel J. To calculate Haralick texture it is required that the image be converted to gray scale. Colour Histogram: Colour histogram gives the representation of the colours in the image. RGB is first converted to HSV colour space and the histogram is calculated for the same. It is needed to convert the RGB image to HSV since HSV model aligns closely with how human eye discerns the colours in an image. Histogram plot provides the description about the number of pixels available in the given color ranges.

Implementation

Pre-processing the entire framework for our model is based on the techniques of image processing and classification. We have acquired the digital image samples of different varieties of the fruit from the environment using a digital camera. Every sample image was then analyzed and processed using our proposed approach. Useful features were then extracted to further classify those samples for our required objective.

The samples can be classified into faultless and faulty. In the next step we have done the color transformation by creating a Mat lab code to convert digital image to binary image and then RGB image. Image transformation is most important step as it is first input of K-means Clustering. The K-Means Clustering algorithm has been used to classify the pixels of sample fruit into the number of clusters based on similar kind of feature weights. This helps to identify the cluster containing infected portion of the sample fruit afflicted with some specific disease. Histogram Equalization, To enhance the contrast in sample data, we have used histogram equalization technique to stretch out the available range of intensities. The given sample distribution is mapped into a wider and more uniform distribution implemented with a remapping function, the cumulative distribution function. K-means Clustering To find groups in unlabeled data with number of groups denoted by variable K, each data point is iteratively assigned to one of K groups based on the features that are extracted. The clustering of data points are done based on the similarity of features.

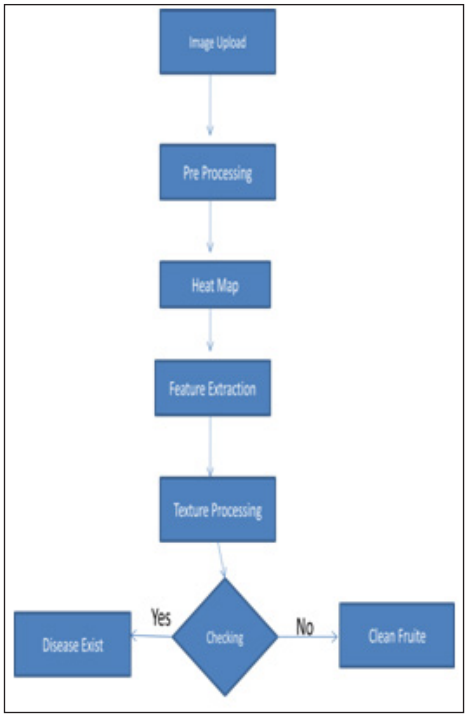

Figure 1.Data Flow Diagram

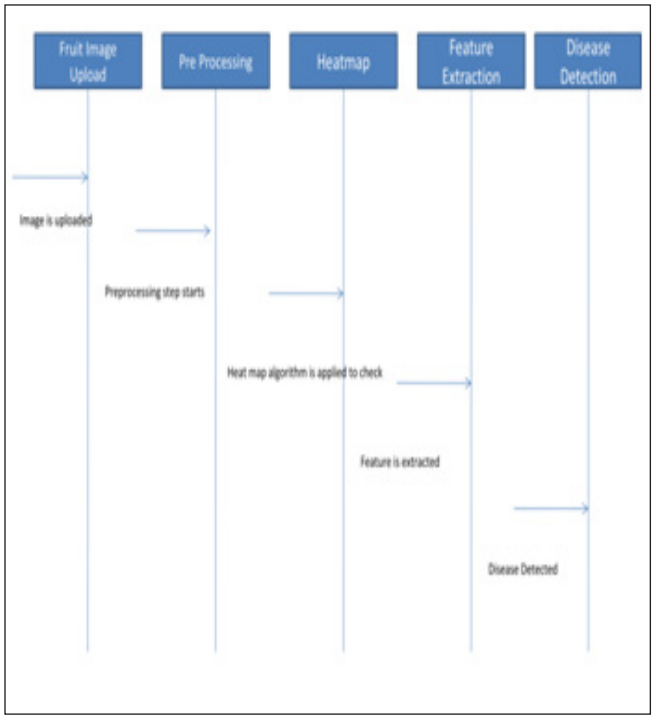

Figure 2.Sequence Diagram

Result and Discussion

Validation Result

Resultant fruit is abstracted (Figure 3).

Figure 3.Running the Program

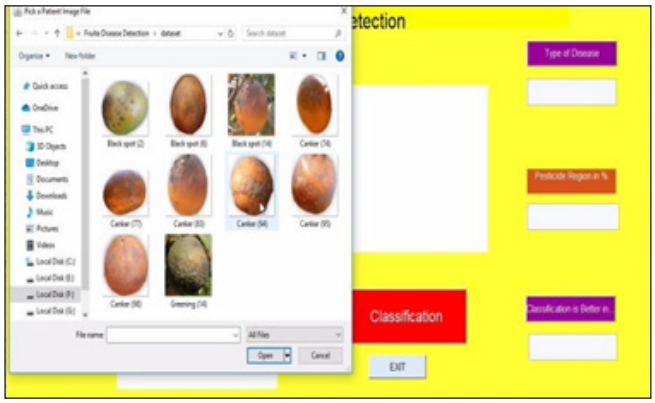

Figure 4.Loading the Original Image of a Fruit for Disease Detection

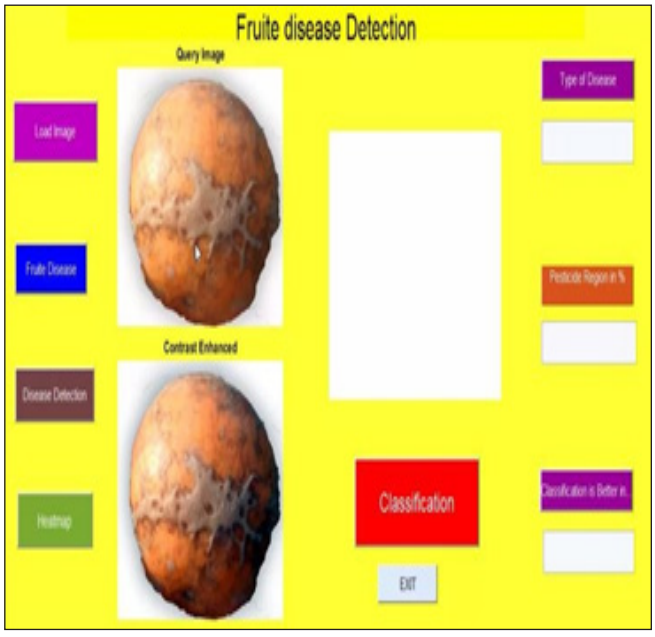

Figure 5.Query Image and Contrast Image are Loaded

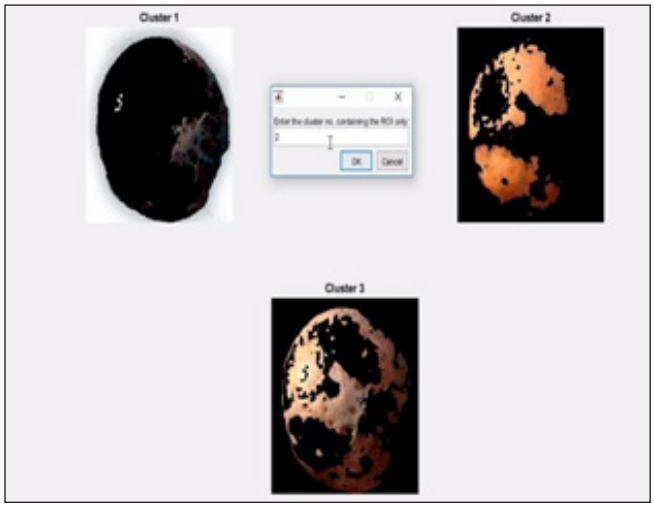

Figure 6.Among Three Cluster Images any one is Chosen for Percentage of Disease Detection

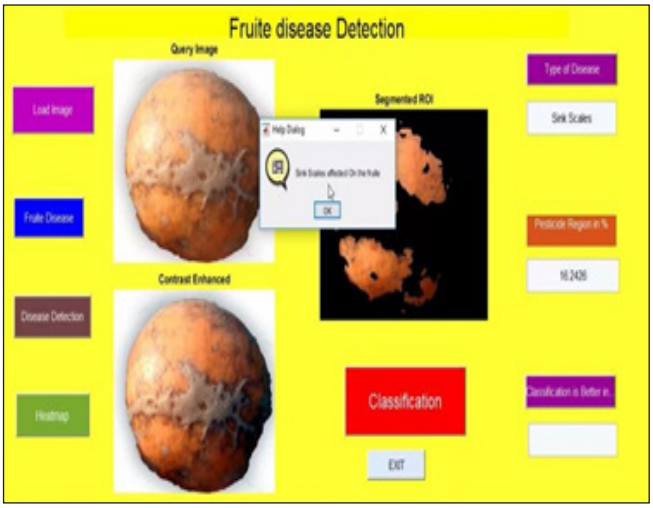

Figure 7.The type of Disease is Analysed

Figure 8.Classification is done again for better accuracy and good going

Figure 9.Classification is Done Again for better Accuracy and Good Going

The Fruit types and their Respective Disease are as Follows

Apple

Apple fruit are susceptible to a number of fungal and bacterial diseases and insect pests. Different diseases of apple are Bitter rot, black rot, scrub on fruit, Sooty blotch and flyspeck damage. Figure 10, shows some images on diseases of apple fruit.

Figure 10.Diseases of Apple Fruit (a) Bitter Rot (b) Black Rot (c) Scrub on Fruit (d) Sooty Blotch and Flyspeck

Figure 11.Diseases of Banana Fruit (a) Crown Rot (b) Anthracnose (c) Cigar end Tip Rot

Banana

The disease attacks banana plants at all the phases of development. Infection assaults the blooms, skin and distal closures of banana heads. Different diseases of Banana fruit are Crown Rot, Anthracnose, Cigar End Tip Rot. Above Figure 11, shows some of the images of Banana fruit disease.

Mango

Diseases of Mango fruits are Anthracnose, Diplodia Stem-end Rot and powdery mildew. These diseases are caused due to different environmental factors. Figure 12, shows some of the images of mango fruit disease.

Figure 12.Diseases of Mango fruit (a) Anthracnose (b) Diplodia Stem-end Rot

Future Scope

In future, the proposed methodology can be integrated with other yet to be industrialized, methods for disease identification and organization using color and texture study to develop an expert system for early soya plant foliar disease warning and administration, where disease type can be recognized by color and texture analysis and the severity level estimation by our future method since it is disease independent. Performance of the system can be improved in future by using advanced background separation methods to separate fruit object from a complex background. More infections like Downy Mildew (DM) and Sudden Death Syndrome (SDS) can also be classified along with BB, FE, BS and SR by using proposed ST-NDCT based cataloguing algorithm, but due to non-availability of suitable and sufficient training and test data at present it has not been incorporated into present work. The similar methodology can be applied to other plant foliar infections

and early warning systems for rice, cotton-crops, fruits, vegetables and beans, etc. The use of other cataloguing methods can be exploited to improve accuracy of system in future.

Conclusion

Disease recognition for organic product is anticipated. The information picture is beginning pre-handled, at that point its choices are removed on 3 boundaries in particular tone, morphology, CCV at that point, training and order of a comparable are finished. The projected framework gives two techniques to client to look at ailment contamination for the info pomegranate picture similarly as with plan search and keeping in mind that does not aim search. Test results show totally unique exactness levels of affliction recognition upheld the info picture quality and furthermore the phases of the disorder. General framework exactness is estimated to be 82. Accordingly, this technique makes one stride towards elevating ranchers to attempt the great cultivating and allowing them to require decisions for a more vigorous yield by making them competent to require the obligatory preventive, restorative activity on their harvest. In future, the framework will be improved with the new alternatives consolidated as instructing the framework to see illnesses for various organic products, increment dataset size to help framework execution to see sicknesses extra precisely.

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