RESEARCH ARTICLE OPEN ACCESS

Infected Part Detection and Segmentation of Fruits Using Marker Controlled Watershed Algorithm

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ABSTRACT

Diseases in fruit cause problems in economic losses and production in agricultural industry worldwide. Modern food industries work on the quality and safety of the products. Fruits such as oranges and apple are imported and exported on large scale. Identifying the defect manually has become very much time consuming process. The combined study of image processing and clustering technique gave a turning point to the defected part segmentation in fruits to calculate percentage of infection in fruit. The increasing awareness towards quality of food has opened new opportunities of research in this area. In this research work, Marker Controlled Watershed algorithm for segmentation of fruit's infected parts as been implemented. Implementation time for the code has also been calculated. The affected area of fruit will also be computed in terms of percentage.

Keywords:- Fruit Segmentation, Marker Controlled Watershed, Segmentation, MATLAB.

I. INTRODUCTION

The division of an image into meaningful structures is often an essential step for image analysis, object representation, visualization and many other image processing tasks. Each pixel in an image is allocated to one of a number of these categories. A good segmentation is typically one in which, pixels in the same category have similar grey scale values and form a connected region, neighboring pixels which are in different categories have dissimilar values. Segmentation is also useful in Image Analysis and Image Compression. Segmentation is often the critical step in image analysis: the point at which we move from considering each pixel as a unit of observation to working with objects (or parts of objects) in the image, composed of many pixels. If segmentation is done well then all other stages in image analysis are made simpler. But, as everyone can see, success is often only partial when automatic segmentation algorithms are used. However, manual intervention can usually overcome these problems, and by this stage the computer should already have done most of the work.

II. TYPES OF SEGMENTATION

1. Threshold based segmentation.
2. Edge based segmentation.
3. Region based segmentation.
4. Clustering techniques.
5. Matching.

III. BACKGROUND

PROBLEM FORMULATION

Analysis of quality of fruit is accomplished on the bases of appearance, shape and size of fruit. The manual analysis process is based on traditional visual quality inspection performed by human operation which is very much time consuming, slow and expensive .It has become increasingly difficult to hire persons who are adequately trained and willing to undertake the responsible task of inspection of eatable products. A cost effective consistent and accurate detection of infected area is possible using machine vision. In image processing various segmentation algorithms were tested before but not with the satisfactory results. In this research work the main target is to find out the percentage of infection in fruit items. For this research work marker controlled watershed algorithm has been implemented.

IV. PROPOSED OBJECTIVES OF RESEARCH

Our main objective of research work is to extract and detect the infected part in fruit using marker controlled watershed algorithm, various parameters for quality check will be calculated

- Calculate %age of infection in different fruit sample images.
- Calculate the Execution time for calculating %age of infection.

PROPOSED METHODOLOGY

MARKER CONTROLLED WATERSHED SEGMENTATION

As per marker controlled watershed segmentation approach, this technique is mainly used for the problems where adjacent objects are there in an image and we have to separate them using image processing operations. This approach deals with catchment basins and watershed ridge lines in an image by assuming it as a surface where light pixels are low. In geography, a watershed is the ridge that divides areas drained by different river system. The watershed transform is a morphological gradient-based segmentation technique. The gradient map of the image is considered as a relief map in which different gradient values correspond to different heights. If we punch a hole in each local minimum and immerse the whole map in water, the water level will rise over the basins. When two different body of water meet, a dam is built between them. The progress continues until all the points in the map are immersed. Finally the whole image is segmented by the dams which are then called watersheds and the segmented regions are referred to as catchment basins. A catchment basin is the geographical area draining into a river or reservoir. The watershed algorithm applies these ideas to gray-scale image processing in a way that can be used to solve a variety of image segmentation problem. Watershed algorithm, a segmentation method in mathematics morphology, was firstly introduced to the image division area by Beucher and Meyer.

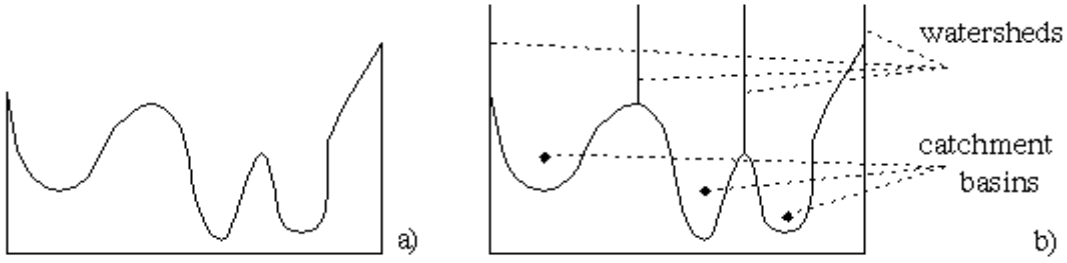


Figure 1 a) gray level profile of data.

b) Watershed segmentation

As per initial step the image is converted from color image to gray scale and computed the gradient magnitude as the segmentation function where gradient is highest at the borders of the object and generally low inside the object. Then the internal marker to distinguish the foreground of adjacent objects is used. The background of the image will then be segregated from the foreground objects using the external markers. Finally results of the watershed transform and examination of the final image has been done. The detailed algorithm is the following:

STEP 1: Insert the original image as input.
STEP 2: Convert the image into gray scale.
STEP 3: Find out the gradient magnitude.
STEP 4: Mark the foreground objects.
STEP 5: Mark the background objects.
STEP 6: Estimate the watershed transform.

V. EXPERIMENTAL RESULTS

The segmentation of image takes an important branch in the surgery navigation and tumor radiotherapy. However, due to medical imaging characteristics, the low contrast and fuzzy boundary is usually occurred in the images. In the experiment, the image data from clinical laboratory are included to test the proposed code. The output of watershed transformation algorithm is as shown below. Firstly the original MRI brain image is as shown in figure below is transformed to a proposed watershed algorithm is that a superimposed image of ridge lines and original binary image, note the over segmentation. The results for the k-means clustering algorithm are also shown below as labeled figures with details.

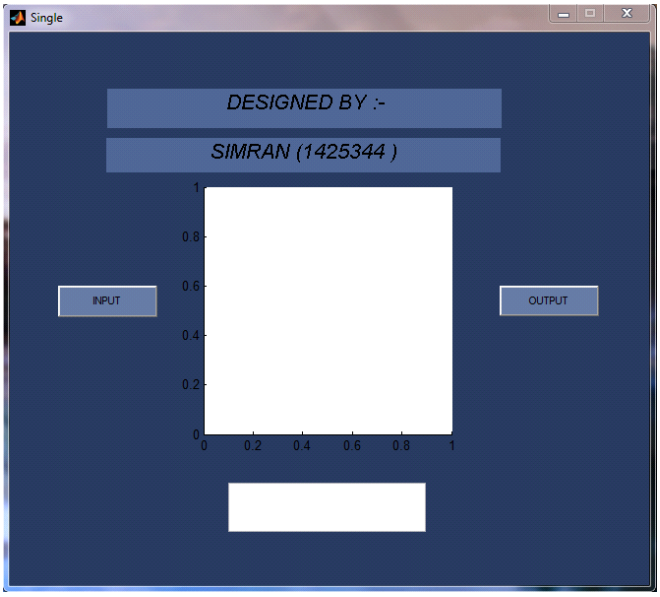
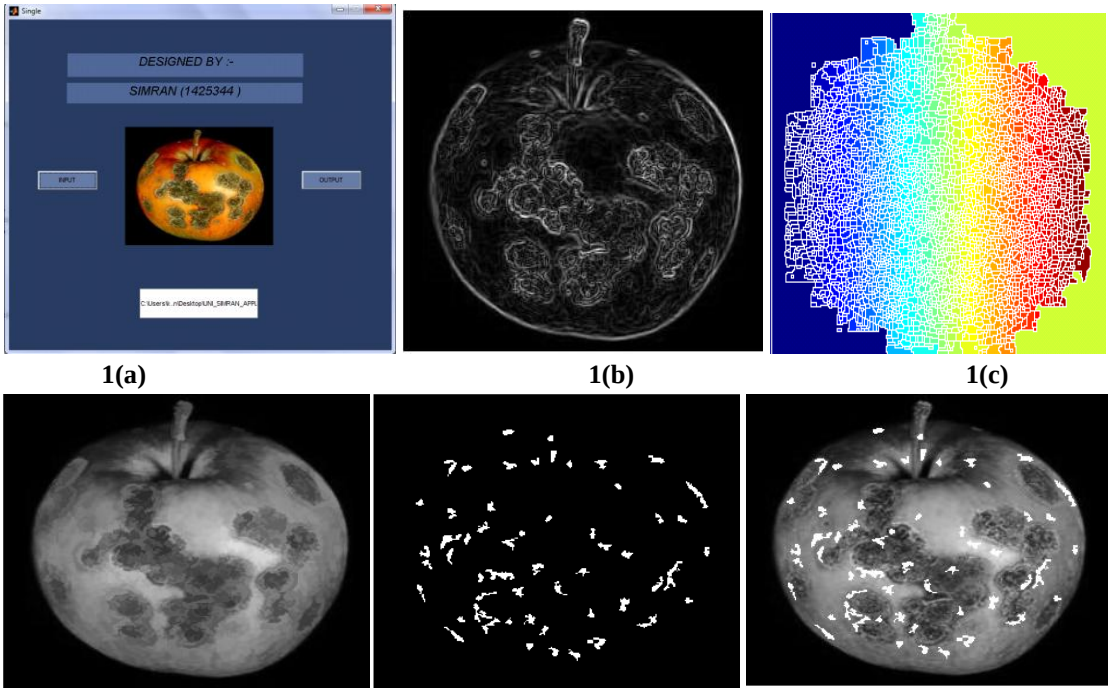


Figure 1: GUI Design



1(a) **1(b)** **1(c)**

1(d) **1(e)** **1(f)**

Figure 1: (a) Input image (b) Gradient magnitude image (c) Watershed gradients of image (d) Reconstruction (e) Regional maxima calculation (f) Infection detection

Watershed Algorithm (Performance Table)

Sr. No.	Image	Size of input image	Size of infected Part	% age of infection	Elapse time
1	apple.png	151590	2302	1.51	7.11
2	apple1.png	81299	1203	1.47	1.35
3	apple2.png	76107	903	1.86	1.466
4	apple3.png	69741	491	7.040	1.432
5	apple4.png	77107	899	1.16	1.34

These tables show the results obtained by the proposed watershed segmentation algorithm. This algorithm is implemented on different images taken from the different research papers for the implementation of this research work. Calculation of infection part size, percentage of infected part in fruit and time taken is shown.

VI. CONCLUSIONS

In this research a new technique to replace the existing algorithm in the original space is used. The result of this research confirms that the proposed method could be used for the segmentation of fruit images. This method has the advantages of calculating various parameters and reducing the time consumption. The graphical user interface has also designed to reduce the complexity of the software code.

FUTURE WORK

In this research marker controlled watershed algorithm has been applied, in the future research some better GUI design could be implemented for the users to get more effective user interface design. More parameters for the quality check can also be implemented. The time consumption parameter can also be improved using some other algorithm.

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