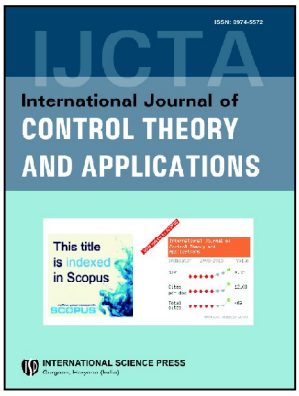

International Journal of Control Theory and Applications

ISSN : 0974-5572

Volume 10 • Number 10 • 2017

Infected Fruit Part Detection Using Different Segmentation Techniques

Anuradha[1] and Bhupinder Kaur[2]

[1] *(ME(CSE)), Chandigarh University, Gharuan, Mohali, E-mail: anuradhak423@gmail.com*
[2]*(Associate Professor, CSE), Chandigarh University, Gharuan, Mohali, E-mail: erbhupinderkaur@gmail.com*

Abstract: The diseases in fruits cause problems in economic losses and production in agricultural industry worldwide. Modern food industries work on the quality and safety of all of the eatable items. Fruits such as oranges and apples are imported and exported on the large scale. Identifying the defects manually has become very much time consuming process because some labor should be required to fulfill this task. The combined study of image processing and segmentation techniques gave a turning point to the defected parts segmentation in fruits to calculate percentage of infection in fruit. The increasing awareness towards the quality of food has opened new opportunities of researchers in this area. In this research the implementation of marker controlled watershed segmentation algorithm has been done using MATLAB.

Index Terms: Fruit Segmentation, Watershed, Segmentation, MATLAB.

INTRODUCTION

The division of an image into meaningful structures are 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 one in which, pixels in the same category have similar grey scale values and form a connected region, neighboring pixels those are in different categories have dissimilar values. Segmentation is also useful for image analysis and image compression. Segmentation is often the critical step in image analysis: the point at which we can move from considering each pixel as a unit of observation to working with objects(or parts of the 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 be usually overcome these problems, and by this stage the computer should already have done most of the work.

TYPES OF SEGMENTATION

1. Threshold based segmentation.
2. Edge based segmentation.
3. Region based segmentation.

4. Clustering techniques.
5. Matching.

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 the 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.

Proposed Objectives of Research

Our main objective of the 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

- To find the size of infected part in fruit.
- To find the %age of infection in fruit.
- To calculate the Execution time for implementation of the algorithm.

PROPOSED METHODOLOGY

Watershed Segmentation

As per 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 the image processing operations. This approach deals with catchment basins and watershed ridge lines are in an image by assuming it as a surface where light pixels are low. In geography, a watershed is the ridge that divides the areas drained by different river system. The watershed transform is a morphological gradient-based segmentation techniques. The gradient map of the image is considered as a relief map in which different gradient values are correspond to different heights. If we punch a hole in each local minimum and immerse the whole map in the water, the water level will rise over the basins.

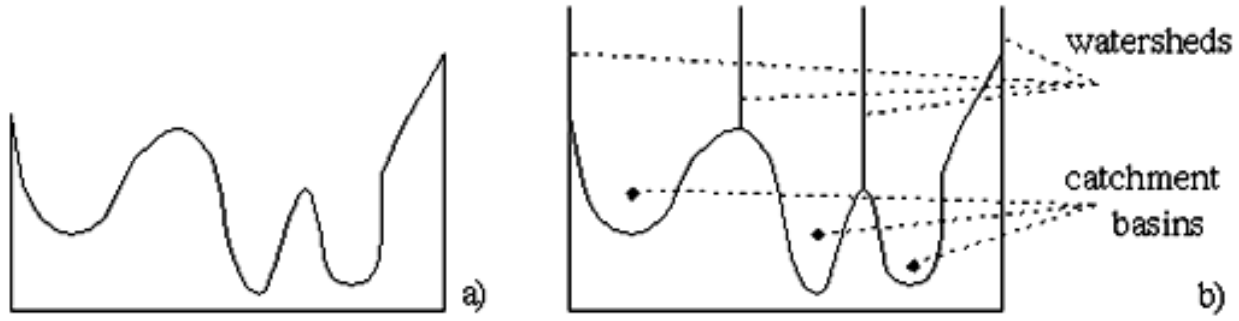

Figure 1: a) gray level profile of data. b) Watershed segmentation

When two different bodies of water meet, a dam is built between them. The progress continues until all the points in the maps are immersed. Finally the whole image is segmented by the dams which are then called watersheds and the segmented regions are referred to as the catchment basins. A catchment basin is the geographical area draining into a river or reservoir. The watershed algorithm applies for these ideas to gray-scale image processing in a way that can be used to solve the variety of image segmentation problem. Watershed algorithm, a segmentation method in mathematics morphology, was firstly introduced to the image division areas by Beucher and Meyer.

As per initial step the image is converted from color image to gray scale and computed the gradient magnitude as the segmentation functions 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 are 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 a input.

STEP 2: Convert the image into gray scale.

STEP 3: Find out the gradient magnitude.

STEP 4: Marked the foreground objects.

STEP 5: Mark the background objects.

STEP 6: Estimate the watershed transform.

EXPERIMENTAL RESULTS

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

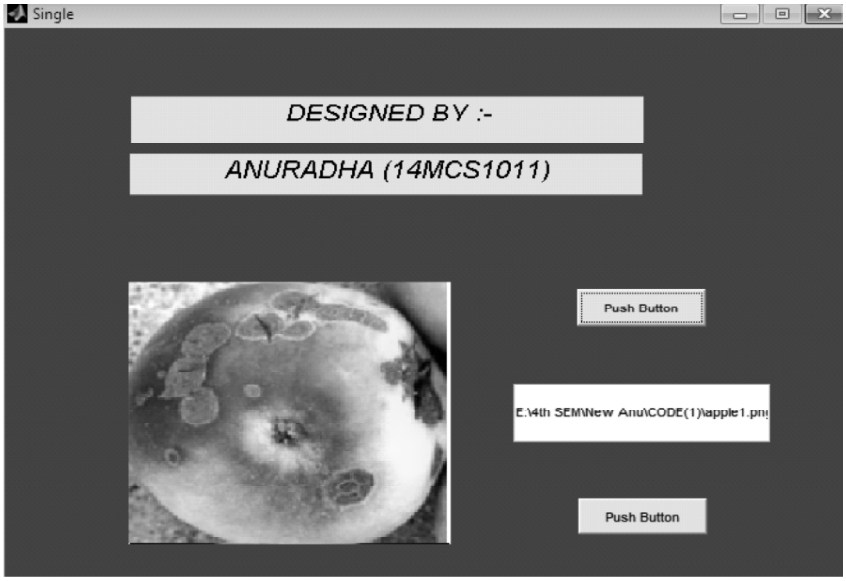

Figure 2: GUI Design

In this section the GUI will be appeared when we execute the program.

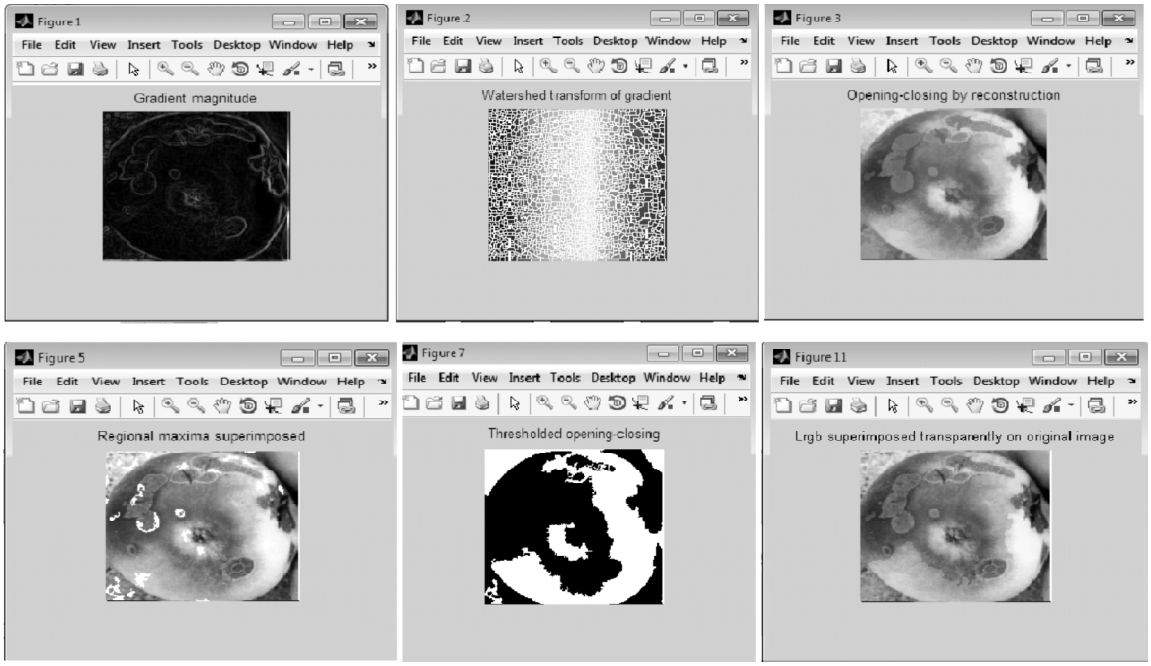

Figure 3: Outputs obtained by Watershed Algorithm

The images above shows all the outputs of the Apple fruit segmentation using marker controlled watershed algorithm. In the fourth figure above the infected parts of the apple fruit will be highlighted and in fifth figure the infected parts are extracted. Last figure shows different segments of fruit.

The infected parts of fruit are detected using watershed algorithm. The parameters percentage of infected area and execution time for code are calculated and their graphical representation is shown above in the form of bar graph.

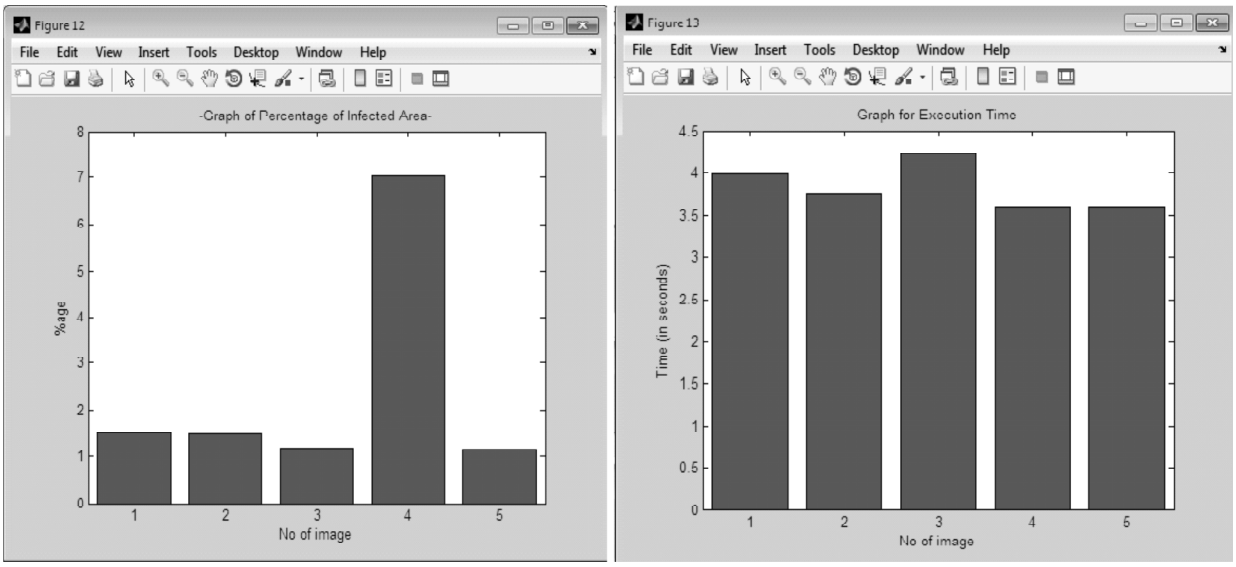

Figure 4: Graph of %age of infection and Time of Execution

Watershed Algorithm (Performance Table)

Name of image	*Fruit size of input image*	*Size of infected part*	*% of infected area(%)*	*Execution Time*
Apple	151590	2302	1.518570	3.984705
apple1	81299	1203	1.47923	3.759031
apple2	76107	903	1.186487	4.224255
apple3	69741	491	7.040335	3.607448
apple4	77107	899	1.165912	3.608703

This table 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.

CONCLUSION

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 the 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.

REFERENCES

[1] Shiv Ram Dubey, Pushkar Dixit *et al.*, "Infected Fruit Part Detection using K-Means Clustering Segmentation Technique, "International Journal of Artificial Intelligence and Interactive Multimedia, Volume 3, Issue 7, pp. 2278 – 1323, 2013.

[2] Shiv Ram Dubey, Anand Singh "Adapted Approach for Fruit Disease Identification using Images".

[3] P. Pandiyammal, Dr. M. P. Indra Gandhi, "Infected Fruit Part Detection Using Clustering ", International Journal of Advanced Research in Computer Science and Software Engineering , Volume 5, Issue 3, pp. 176-182, 2015.

[4] Ridhuna Rajan Nair, Swapnal Subhash Adsul, "Analysis And Detection of Infectedz Fruit Part Using Improved k-means Clustering and Segmentation Techniques", International Journal of Scientific & Engineering Research, Volume 3, Issue 5, pp. 37-41, 2015.

[5] J. Ramprabhu, S. Nandhini, "Embedded Based System for the Fruit Quality Management Using PIC Micro Controller", International Journal of Engineering and Computer Science , Volume 4, Issue 1, pp - 10051-10056, 2015.

[6] Vani Ashok1, Dr. D. S. Vinod2, "Using K-means Cluster and Fuzzy C Means for Defect Segmentation In Fruits", International Journal of Computer Engineering & Technology, Volume 5, Issue 9, pp- 0976 – 6367, 2014.

[7] Y. Li and Y. Shen, "Robust image segmentation algorithm using fuzzy clustering based on kernel-induced distance measure," in *Proceedingsof the International Conference on Computer Science and SoftwareEngineering*, 2008, vol. 1, pp. 1065-1068.

[8] D. E. Ilea and P. F. Whelan, "Color image segmentation using a spatial k-means clustering algorithm," in . *Proceedings of the Irish Machine Vision & Image Processing Conference 2006 (IMVIP 2006),* Dublin City University, 2006, pp. 146–53.

[9] R. D. Silva, R. Minetto, W. R. Schwartz, and H. Pedrini, "Satellite image segmentation using wavelet transforms based on color and texture features," in *Proceedings of the 4th International Symposiumon Advances in Visual Computing*, Part II, 2008, pp. 113-122.

[10] H. C. Chen and S. J. Wang, "Visible color difference-based quantitative evaluation of color segmentation," in *Proceedings of the IEEE -72- Conference on Vision Image and Signal processing*, 2006, vol. 153, no. 5, pp. 598-609.