Image Segmentation Tools: A Comparative Study

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Abstract—One of the most vital processing step in Image and computer vision applications is Image segmentation. Comprehensive research has been conducted to generate algorithms and applications for image segmentation, but it is still difficult to evaluate whether one application produces more accurate segmentations than another does. Currently, we demand reliable, fast, and user-friendly segmentation tool. The aim of this work was to study and compare two image segmentation tools on a set of gray type and color images, namely: **3D SLICER, and GIMIAS**. *The study tries to compare the tools depending on quality of the segmentation that results from each one. The experiment results show the superiority of 3D Slicer over GIMIAS in terms of the flexibility and usability*

Keywords—Image Segmentation, Image Processing, 3D Slicer, and GIMIAS.

I. INTRODUCTION

When we said Segmentation we mean the process of grouping of the neighboring pixels into areas (which we called segments) depending on the similarity criteria. Objects in Images are almost and often homogeneous and can delineated by segmentation. Thus, if we reduce the number of elements in the image we can get better segmentation especially if the elements are separated and don't have overlapping. Hence quality assessment of segmentation is in the focus of this evaluation of different presently available segmentation tool.

Segmentation is used to simplify image, represent something that is more meaningful, to make the image easier to understand and analyze and to create three-dimensional models for images.

It is useful to Locate tumors and diagnosis disease, Surgery planning, Face recognition, Fingerprint recognition, Iris recognition, Object detection.[1]

There are many methods used to segment image such as: [3]

-   Threshold method.
-   Cluster methods
-   Histogram methods
-   Dual clustering method
-   Region-growing methods
-   Partial differential equation-based methods
-   Variation method.
-   Multi-scale segmentation

II. BACKGROUND ABOUT USED TOOLS

In this section, we define the tool's that used in the paper in abstract way, and that's is 3D SLICER and GIMIAS.

A. 3D SLICER version 4.6

It is a free (open) source program used for image processing specially for medical image informatics and 3D visualization. It can be used for microscopy, CT, US, Bidirectional interface for devices, nuclear medicine, and MRI [3].

By using the 3D slicer tool, I saw that it is depending on Region-growing methods and Threshold method segmentation.

B. GIMIAS (Graphical Interface for Medical Image Analysis and Simulation)

It is also an open source program used to solve biomedical images, individualized simulations and computational modeling.

Through my use of the program I can be observed that it contains a set of basic operations like Clinical navigation, Multimodal (2D ,3D) image visualization, Multiplatform and Manual segmentation (which allow the user to draw and determine the region for each segment) [4].

III. THE RESEARCH PURPOSE AND TESTING RESULTS

The purpose of the paper is to use 2 segmentation tool's and compare between them by using some factor like segmentation result, the ease of use, type of picture that supported by each tool, and the accuracy to determine objects.
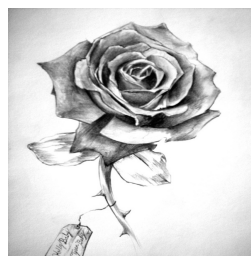
All the segmentation tools are used to apply segmentation on LENA, CAMEAMAN and pictures.

Lena.jpg
Grayscale
512×512

cameraman.jpg
Grayscale
512×512

Flower.jpg
Grayscale
512×512

Figure 1: picture that used to test tool's

I have fixed the type of images, because the GIMIAS program deal with the images with (JPG) extensions, and I've fixed the size of images to have more efficient comparison.

A. 3D Slicer segmentation

After I use this tool on the 3 images I've got the following results:
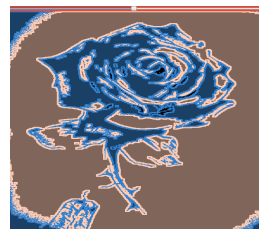

Figure 2: picture that is segmented by slicer using threshold tool

So we can see that the segmentation using 3D SLICER threshold tool is not god at all because the edges of the objects are not clear and objects are not separated (we can't recognize the objects) and the tool make all the same Gradients in the image with the same color so object will be Overlapped and non-specified.

B. GIMIAS segmentation

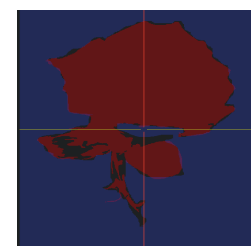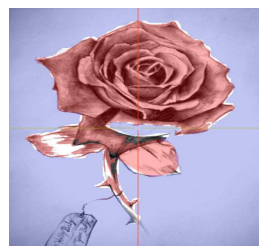By using manual segmentation, the following pictures were resulted:

Figure 3: picture that is segmented by manual GIMIAS

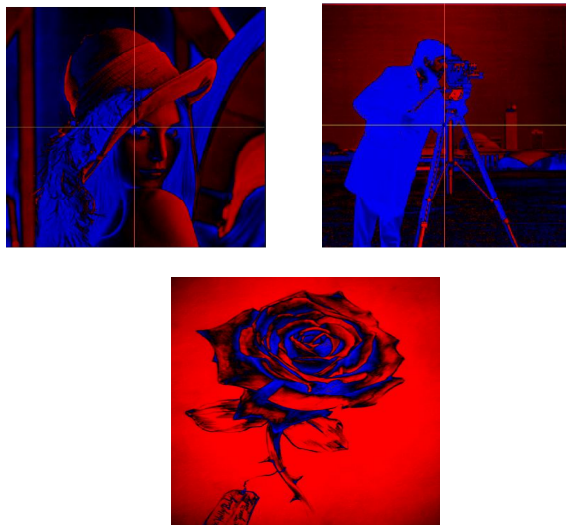By using automated segmentation, the following pictures were resulted:

Figure 4: picture that is segmented by auto GIMIAS

As a result of using auto and manual segmentation we can see that the auto one can't define objects perfectly and the manual tool is more efficient cause it determines and separate the object in perfect way.

Also automatic segmentation doesn't need heavy intervention as manual but its need more refinements like Reduce Noise and edge enhancements.

So from the above segmented images we can conclude below table.

Table 1:Comparison between programs based on human standards

Criterion	SLICER	GIMIAS
Type of images worked with	Worked with colored and grayscale images (JPG,PNG, TIFF,JPG)	Just with grayscale images (JPG)

Easy to use	(yes) Easy to use	Not at all
Accuracy of objects separation	Moderate accuracy	more accuracy ,when we use automated segmentation
Disadvantages	identifies object based on color scale in all the image not in the Neighboring pixels	When we use interactive segmentation (region growth) in the first segment we can't use it in the second one we have to use manual add tool.

IV. CONCLOSION

From the above segmentation results and from the table that compares between the tools we can conclude:

1. SLICER tool is easy to use more than GIMIAS and the interface is more harmonious.

2. SLICER more flexible than GIMIAS, but the segmented images that is resulted from GIMIAS tool is identifies object Better than SLICER specially when we use manual segmentation.

3. Auto-segmentation tool makes the segmentation easier and more flexible.

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