LEARNING TOOL OF IMAGE SEGMENTATION TECHNIQUES FOR NEW LEARNERS

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UNIVERSITI TEKNOLOGI MALAYSIA
LEARNING TOOL OF IMAGE SEGMENTATION TECHNIQUES FOR NEW LEARNERS

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Specially dedicated to my family, lecturers, fellow friends and those who have guided and inspired me throughout my journey of education
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ABSTRACT

Image segmentation is an essential step for other image processing steps. There are plenty of image processing tools in the market but most of them are not research and education based. There are only few from the remaining ones which are suitable and widely being used by new leaner and MATLAB is one of them. Although MATLAB is open source and well established but limited interactive applications focusing on image segmentation targeting for new learners. Discussion and open forum are mostly reviewing advance image processing techniques. However, the fundamental of image segmentation cannot be neglected as it affects all other image processing applications later. Most of the time, new learner spent longer time understanding the tool instead of familiarize with the algorithm and theory behind the image segmentation. The purpose of the project is to develop an interactive learning tool for image segmentation targeting for new learners. In this project, an interactive Graphical User Interface, GUI which is based on MATLAB is being introduced as survey shows that undergraduates from Universiti Teknologi Malaysia, UTM prefer and more frequent to use MATLAB solving image processing related issues. The Learning Tool of Image Segmentation covering most of the fundamental images segmentation techniques; such as point detection, line detection, edge detection, thresholding, region growing, Watershedding and K-Mean clustering. Information displayed on each and every step helps users to understand better the algorithm, theory and Application Programming Interface, API for the method. Guidance and questions at Message Window increase the curiosity of image segmentation and custom segmentation options motivates new learners for trial and error.
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<td>Graphical User Interface</td>
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<td>API</td>
<td>Application Programming Interface</td>
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<td>2D</td>
<td>2 Dimensional</td>
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<td>LoG</td>
<td>Laplacian of a Gaussian</td>
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<td>ITK</td>
<td>Insight Segmentation and Registration Toolkit</td>
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<td>ILASTIK</td>
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CHAPTER 1

INTRODUCTION

1.1 Introduction

Segmentation is the process of dividing images into constituent regions or objects [1]. As manual image segmentation is time consuming and the size and numbers of medical images have increased, therefore automatic methods are widely being discussed and applied. Until today, image segmentation is still a top and challenging topic. Segmentation accuracy determines the eventual success or failure of computerized analysis procedures. The level of detail to which the subdivision is carried depends on the problem being solved because there is no point to continue subdivision the image if the detail required to identify those elements has obtained [2, 3].

In general, there are two groups of image segmentation techniques; which are discontinuity and similarity. The top three image segmentation techniques which are widely being applied according to a research paper on medical image segmentation methods and software [1] are thresholding, region growing and edge tracing. Segmentation using threshold value is a simple yet effective method which may apply in gray scale or color images to distinguish regions with contrasting intensity levels. Segmentation on biomedical images by using region growing method separates particles that touch each other. It shrinks objects to seed points, and grows to original size with the pixels that touching neighbor object to be white. Where edge detection forms an edge image after which edge pixels with adjacent neighbor
connectivity are followed sequentially and collected into a list to represent an object boundary [1, 3].

Each of the image segmentation methods has own advantages and disadvantages and so most of the time they are not applied individually. Different algorithms or models may apply together on each method in order to cover each other to complete a full image processing application [2]. As image segmentation is an essential topic on image processing techniques, it is always being included for subject digital image processing. New learner will first need to understand the fundamental of image segmentation before moving on to explore other advance topic.

A good image processing learning tool cultivates interest of users and motivates them to explore advance techniques. Although there are uncountable image processing tools in the market but most of them are commercialized and do not meant for research and education purposes. In the following, an image segmentation learning tool is being introduced which meeting the criteria of a good learning tool; which are high performance, high output quality, interactive and user friendly.

1.2 Problem Statement

The analysis of biological high content images often requires segmentation as a first step. The important of image segmentation promoted it to become the compulsory subject in digital image processing subject. A good image segmentation learning tool motivates new learners to achieve higher with shorter time. Although there are plenty of image segmentation tools in the market, however most of them are not developed for research and education purposes. As a result, new learners spending much more time dealing with the tool rather than beneficial the time with deepen the knowledge in image segmentation algorithm and theory. Besides that, most of the image processing tool do not have all fundamental image segmentation techniques but only covers some which are needed for their applications. This situation is worse for new learners who do not familiar with programming languages.
As a result, new learners like undergraduates always depend on the experience tutor to complete their assignments.

1.3 Objectives

The objective of this project is to develop a learning tool focusing on image segmentation, which is user friendly, high performance, effective and easy to understand. The image segmentation learning tool covers most of the fundamental techniques of image segmentation. The output image is effective with high performance. Info message and guidance benefit new learners to understand image algorithm and theory of segmentation better. An interactive Graphical User Interface, GUI is developed with clear instruction and functions so that it is user friendly.

1.4 Scope of Work

In order for the project to achieve its objectives within the duration of the given timeline, it would be best that we list down the breadth and depth of the scope of work so that effort and focus will not go astray.

1. This learning tool is focusing on fundamental image segmentation techniques and do not covers advance techniques or other image processing applications due to the limited resources.
2. This learning tool is targeting the undergraduates who is studying biomedical and digital image processing subject.
3. This learning tool is developed based on MATLAB as MATLAB is commonly used by most of the undergraduates in Malaysia. This tool should be able to runs with OS Window 7 and it should be able to run for all 2D biomedical images that being used as teaching materials in Universiti Teknologi Malaysia, UTM.
1.5 **Significance of Study**

This study provides a user friendly and interactive interface based on MATLAB for new learners to apply fundamental image segmentation techniques on given assignments so that they can understand and familiarize with algorithm and theory behind image segmentation.

1.6 **Thesis Overview**

This thesis comprises of five chapters with each discussing in detail on the aspects related to this project. Chapter 1 consists of the introduction, objectives, scope of work as well as significance of the project. Furthermore it also provides a brief introduction on the project environment and specifies the object of interest. Chapter 2 provides literature review on few published paper, thesis and digital image processing book that study on the digital image segmentation on 2D images. It reviews the common image segmentation methods and software that commonly used.

Chapter 3 mainly describes the methodology, theory and approaches in completing the project. Design flow on the project is reviewed as well. Results and discussions are presented in chapter 4. The functionality of the options in GUI and the expected outcome are being discussed in this chapter. Lastly, Chapter 5 summarizes the entire project together with some suggestions for future works.
REFERENCES


