Chapter 29

Segmentation of Mammography and Ultrasound Images by using Seed Based Region Growing Method

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Abstract

Early detection of breast cancer can save life. Normally, radiologist will look at the potential abnormalities in mammogram and ultrasound images such as microcalcification and masses. However, images from mammography and ultrasound are low in contrast and their features indicative of abnormalities are very subtle and extremely small which lead the difficulties for radiologist to interpret or read those images. Therefore, in order to assist radiologists to detect the abnormalities, a segmentation platform for mammography and ultrasound images analysis is developed. This platform used Seed Based Region Growing (SBRG) method as a segmentation technique for extracting a region of the image that is connected based on intensity information or edges in the image. The outcomes of this project can help the radiologists by marking the exact location of microcalcification and masses which will equips information for the radiologist. A reliable method that stipulates suspicious structures in mammogram and ultrasound images can allow the radiologists to focus rapidly on the relevant part of the mammogram and ultrasound images for further treatment and diagnosis. Thus, it can diminish the rate of mortality amongst women and can avoid disfiguring surgeries.

Introduction

Breast cancer is one of the major causes of death among women worldwide. It is a fatal disease that forms in tissues of the breast, which starts in the inner lining of milk ducts where tubes that carry milk to the nipples called ductal carcinoma. The National Cancer Registry of Malaysia stated that in 2011, there were 18,206 cases registered among women which accounted for 32.1% per 100,000 populations (National Cancer Registry, 2016). The highest incidence of breast cancer in Malaysia is among Chinese, followed by Indians and Malays.

Currently, early detection of breast cancer is an initiative to reduce the number of deaths among women. Mammography and ultrasound machine are type of imaging modalities that can be used for detection of abnormalities such as microcalcification in mammogram images and masses in ultrasound images. However, the detection become difficult due to low resolution and contrast, speckle noise and blurry edges among various organs (Malek, Rahman, Haris & Jalil, 2017).

Image segmentation methods may help the radiologist in giving a second opinion to improve breast cancer diagnosis especially at the early stage. The aim of this technique is to partition an image in order to extract useful information and to segment out different areas in medical images. One of the methods that can be used to segment the images is known as Seed Based Region Growing (SBRG). It is a technique for extracting a region of the image that is connected based on some predefined

criteria. These criteria can be based on intensity information or edges in the image (Gonzalez & Woods, 2008). In this study, segmentation platform for mammography and ultrasound images was developed by using SBRG method.

Content

A set of 30 images obtained from the National Cancer Society Malaysia (NCSM). The images are first segmented by using Seed Based Region Growing and then proceeded with the Mathematical Morphology method as the post-processing technique. The whole processes are implemented using MATLAB R2014a Software. The segmentation processes are illustrated in Figure 1

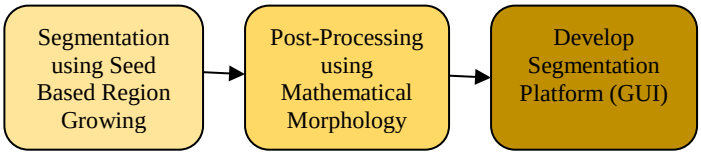

Figure 1: The flowchart of segmentation processes.

Based on Figure 1, the first process is segmentation by using Seed Based Region Growing method. Starting with an initial point, the similarity of the region will obtained by comparing the minimum difference of four connected neighbourhood with mean of the region. These processes are recursively until no more pixel can be added to the region. The segmented image produced from SBRG method is then proceed with the post-processing technique. The aim of this technique is to fill any holes and to obtain the shape and boundary of the image. Finally, the Graphical User Interface (GUI) is developed.The main interface is shown in Figure 2 below.

Figure 2: The Main Interface of Graphical User Interface (GUI)

The main interface consists of two components namely segmentation for mammogram and ultrasound images as shown in Figure 3 and 4 respectively.

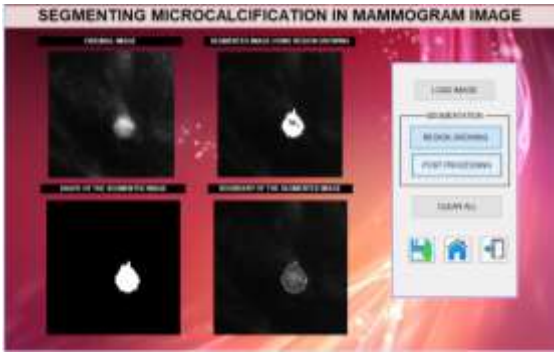

Figure 3: Segmentation of Mammogram Image

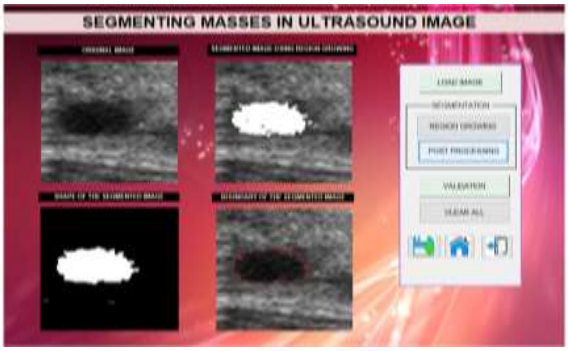

Figure 4: Segmentation of Ultrasound Image

Based on Figure 3 and 4, the segmentation platform produces shape and boundary of the segmented images. The radiologist can estimate the affected area based on the shape while the boundary can be used in identifying cancerous or non-cancerous condition. According to Liu, Cheng, Huang, Tian, Tang and Liu (2010), the non-cancerous condition often to have round or ellipsoid shapes and smooth borders; whereas cancerous tumour often to have branch pattern, speculations and angular borders. Thus, this segmentation results will help the radiologist and other pratitioners in detecting any abnormalities efficiently before further treatment is given.

Conclusion

The Seed Based Region Growing (SBRG) method provides mobile and accurate method of detecting boundaries of abnormalities. So it provides the second eye for radiologist and is beneficial to both new and experience radiologist. Beside that, a user friendly navigated interface of this method can easily be used by any non-technical radiologist.

References

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