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COMPUTER AIDED DETECTION AND DIAGNOSIS FOR BREAST CANCER IMAGES

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ABSTRACT

Breast cancer detection is critically depending on early and accurate diagnosis. Machine learning technique can enhance the level of detection and classification of breast cancer images. Normally, radiologist will look at the potential abnormalities in mammogram and ultrasound images. However, the images are low in contrast and the features indicative of abnormalities are very subtle. Hence, it gives difficulties for radiologist to interpret those images. Therefore, in order to assist radiologist, a Computer Aided Detection and Diagnosis (CADx) is developed. This platform used Seed Based Region Growing (SBRG) as a segmentation technique for extracting a region of the images. For further analysis of the mammogram images, the classification platform was also developed using Enhanced Support Vector Machine (ESVM) that combines Discrete Wavelet Transform (DWT) and Principal Component Analysis (PCA) methods. The outcomes of this project can help the radiologists by marking the exact location of abnormalities and it is able to differentiate between benign or malignant tumor.

Keywords: segmentation, classification, seed based region growing, support vector machine

1. INTRODUCTION

Breast cancer is one of the major causes of death among women worldwide. Early detection of breast cancer is an initiative to reduce the number of deaths among women. Mammography and ultrasound machines are types 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 of abnormality becomes difficult due to low resolution and contrast, speckle noise, and blurry edges [1]. These difficulties can lead the radiologist to spend more time in detecting cancer cells. Normally, accurate diagnoses are based on the skill and expertise of the radiologist. Therefore, segmentation and classification methods are used to help the radiologist determine the exact shape of the abnormalities in the images. The aim of the segmentation process is to partition an image in order to extract useful information about the image while classification is a supervised learning algorithm which classifies future class or dataset into benign (non-cancerous) and malignant (cancerous) cases. In this study, the computer aided detection and diagnosis platform for mammography and ultrasound images was developed using mathematical methods.

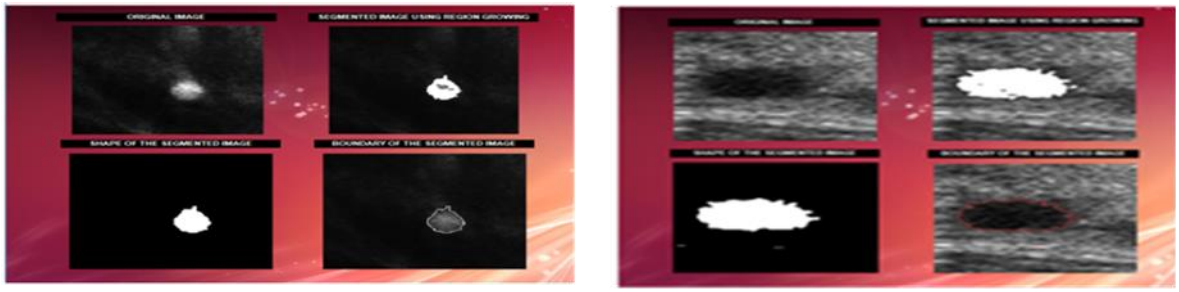
2. MATERIAL AND METHODS

The algorithm is tested on 50 mammograms and 30 ultrasound images obtained from National Cancer Society Malaysia (NCSM). The abnormalities in each images are confirmed by the radiologist to consist

microcalcification in mammogram and masses in ultrasound images. The implementation is carried out using MATLAB R2018 software.

2.1. Segmentation using Seed Based Region Growing Method

Seed-based region growing (SBRG) performs a segmentation of an image with respect to a point, known as seed. Starting with a seed point the region will grow by appending to each seed those neighboring pixels that have properties similar to the seed. The segmented image produced from SBRG method is then proceeded 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 [2]. The following figure shows segmentation results for mammogram and ultrasound images.



a) Mammogram image b) Ultrasound image

Figure 1. Segmentation Result using Seed Based Region Growing Method

Based on the shape in Figure 1, the radiologist can estimate the affected area, while the boundary can be used to distinguish cancer or non-cancer.

2.2. Classification using Enhanced Support Vector Machine

Support Vector Machine (SVM) is a supervised machine learning algorithm with the ability to build a classification model from a labeled dataset. This study used Enhanced Support Vector Machine (ESVM) that combines Discrete Wavelet Transform (DWT) and Principal Component Analysis (PCA) for better data classification accuracy. DWT is used for the extraction of statistical and textures features of mammogram image. Meanwhile, the employment of PCA is to reduce the dimensionality of the datasets to avoid overfitting thus better accuracy can be achieved. The interface of ESVM is shown in the following figure.

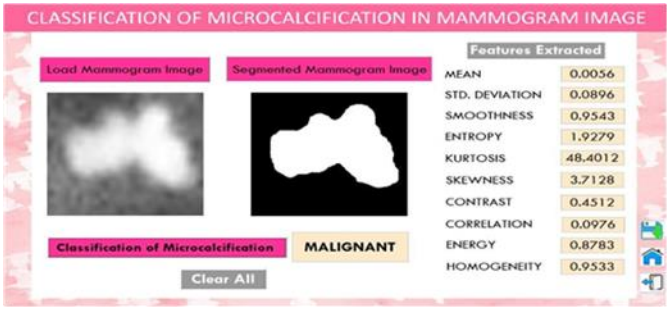


Figure 2. Classification Result using ESVM

Based on segmentation results, the statistical and texture features are used as inputs in classifier that assign them to the class whether it is benign or malignant cases. In conclusion, perhaps this project can provide 'second judgement' in making diagnostic decision.

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