Automatic Threshold Measuring in Mammographic Density Screening

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Abstract and Objective

This paper proposes an improving approach to quantitative classification of mammographic image density. Since the mid-1980s, some of studies have shown a moderate to strong statistically significant association between percent breast density and breast cancer risk. We propose the use of agglomerative hierarchical clustering which means an automatic decision of the threshold of segmentation. Current quantitative methods have some problems such as an automatic decision of threshold, lower percent breast density in digital mammograms and limitation of the brightness or pixel depth in 2D mammography, accordingly proposed method may have a role in routine mammographic analysis for the purpose of automatic decision of threshold.

Keywords:

Mammographic density, Breast density, Agglomerative hierarchical clustering, Threshold.

Introduction

Fibrogladular tissue in the breast attenuates x-rays to a greater degree than does fat, causing area composed of significant amounts of the former to appear bright on a film mammogram, then this phenomenon has called 'mammographic density' or 'breast density'. Since the mid-1980s, some of studies have shown a moderate to strong statistically significant association between percent breast density and breast cancer risk. There are two methods for measuring breast density in traditional practice; BI-RADS categories in the U.S and Wolfe criteria in Europe and elsewhere. But both of the BI-RADS and Wolfe criteria suffer from only fair inter- and intra-observer agreements. Quantitative methods of assessing the percentage of the breast occupied by breast tissue are considerably more accurate. But computer assisted planimetry method has some problems which are interactive thresholding based on modification of computerized planimetry where the histogram of the mammographic pixel densities. In this study we propose the use of agglomerative hierarchical clustering which means an automatic decision of the threshold of segmentation.

Methods

Our proposed technique is composed of three block diagrams: Gaussian denoising as a preprocessing stage, followed by extraction of breast region based on subtraction, agglomerative hierarchical clustering to determine the threshold of segmentation, and breast density calculation based on former cluster features.

Agglomerative hierarchical clustering

Agglomerative hierarchical clustering can be used to group pixels into clusters based on the assumption that pixels that are closed to each other in the input feature space are similar. Agglomerative hierarchical clustering begins with all pixels as separate clusters and merges the closest clusters until some criterion is satisfied. The Euclidean distance that was used to measure the distance between pixels is calculated as average of the pair-wise distances between them. The distance between the clusters merged at each step was used to determine when to stop the clustering. A large distance between merged clusters indicates that the two clusters may be so dissimilar that it is inadvisable to merge them.

Results and Conclusion

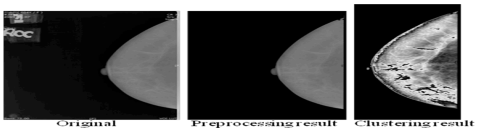

Figure 1- Proposed pilot test on each block module. (Just until agglomerative hierarchical clustering)

Figure 1 has shown the result of our proposed method in partial. Medical image processing has played an important role in diagnosis, which information always affects the results of diagnosis. Digital mammography is becoming increasingly more common, subsequently automated measurement of breast density using digital mammography would be ideal. Our proposed method will be expected to improve the quantitative measurement technique of breast density.