Computer Aided Diagnosis for Breast Cancer Screening

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Abstract

Mass segmentation and density classification is an important for breast cancer screening. The purpose of this study is to develop the computer aided diagnosis for mass segmentation and density classification according to the fourth edition of BI-RADS criteria in digital mammography. The digital mammography was digitized high resolution in the image acquisition phase. After the digitization process, an active contour algorithm was applied for mass segmentation. Finally, percentage of mammographic density was calculated for density classification according to the fourth edition of BI-RADS lexicon. The study includes 100 digital mammography of women aged 33-81 years. The results show that the overall accuracy of computerized method classification is 88%.

Keywords: mammography, mass segmentation, density classification, BI-RADS.

1. Introduction

In current mammography imaging practice, there are basically two types of normal tissue distinguishable in the images. One is dense tissue, which is a two component mixture of stromal and epithelial tissue, appearing bright in the image and other is fatty tissue, which appears dark. The fundamental difficulty in either human or computerized breast image analysis is that dense normal tissue and abnormal tissue often have similar x-ray attenuations with respect to the x-ray spectrum in conventional imaging practice, which results in similar image intensities; also the textures are similar. A sample mammogram displaying the breast anatomy is shown in figure 1.

Mammographic density is an important predictor of risk of breast cancer. Typically, the radiologists classify mammographic density according to fourth edition of Breast Imaging Reporting and Data System (BI-RADS) [1, 2], which developed by the American College of Radiology (ACR). BI-RADS descriptors are important factors for predicting malignancies that are assessed and provided by the radiologist. The fourth edition of BI-RADS criteria defined breast density in four categories:

-- BI-RADS I: the breast is almost entirely fatty.
-- BI-RADS II: there is some fibroglandular tissue.
-- BI-RADS III: the breast is heterogeneously dense.
-- BI-RADS IV: the breast is extremely dense.

The difference among experience and expertise of each radiologists causes and error of mammographic density classification. Discrepancies as high as 46% have been reported in mammographic density assessment by two different radiologists. Several researchers have pointed out the possibility to employ computer-aided diagnosis (CAD)