Mammogram Enhancement Using Wavelet Transform and Sigmoid Function

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Abstract. Mammogram enhancement is important for the radiologist to diagnose and screen breast cancer. This paper proposes a method to improve contrast and denoising in mammogram using wavelet transform and sigmoid function. First, mammogram is decomposed using wavelet transform and detail coefficients are decreased in order to remove noises by soft thresholding. Inverse wavelet transform is then applied to obtain the denoised image. Finally, sigmoid function is applied to the image to enhance mammogram. Experimental results illustrate that the proposed method can improve contrast and denoise mammogram effectively.

Introduction

In the present, breast cancer is becoming the leading cause of death in the world. The National Cancer Institute [1] indicates that the amount of new cases and deaths of breast cancer patients in the United States of America were rapidly increasing in 2013. Mammography is a common technique for screening and diagnosis breast cancer in the early detection stage. The result of the early detection has significance for the survival rates of the breast cancer patients. However, mammograms are low contrast and noisy because low-dose radiation from x-ray machine that makes radiologists difficult to discern breast cancer and miss the diagnosis. Therefore, mammograms need to enhance the visual quality of the image to help the experts when they screen mammograms.

For many years, many researchers are interested in medical image enhancement as mammogram have been developed various techniques to enhance mammogram. Dabour [2] proposed mathematical morphology and wavelet based thresholding method to increase contrast in digital mammograms. The proposed method shows that higher image quality than the other methods. Mencattini et al. [3] introduced enhancement and denoising technique for mammograms using dyadic wavelet transform which can be enhanced microcalcifications and suppress noise. Heinlein et al. [4] presented integrated wavelet which design for enhanced fine details in digital mammography and can be applied for detecting microcalcifications. Tang et al. [5] developed a new contrast enhancement technique in wavelet domain which radiologist can be adjusted contrast of mammograms by using a single parameter. Recently, Beheshti et al. [6] proposed wavelet transform, piecewise linear and nonlinear coefficient mapping to enhance edge and some details in different lesion types. However, mammograms enhancement still challenging topics for researchers because of the characteristic of mammogram is complex due to mammogram consists of different tissue as fat, mass, and microcalcification.