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Chapter 4 - Denoising and enhancement of medical images by statistically modeling wavelet coefficients

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Abstract

At present, medical imaging plays an important role in health monitoring system, mainly in diagnosis and detection of various diseases. Preprocessing of medical image modalities is highly essential for accurate estimation of diseases. Generally ultrasound and optical coherence tomography (OCT) images are affected by speckle noise and MR images are affected by random noise. This chapter presents an image denoising and enhancement algorithm for medical image modalities, such as ultrasound image, magnetic resonance (MR) image and OCT image. First the speckle noise is converted to additive noise by applying homomorphic filter, and then the medical images are wavelet decomposed using Haar wavelet, and the resulted wavelet coefficients are modeled using Gaussian scale mixture (GSM) model to extract the original image variance. Next, a median absolute deviation (MAD) estimator is used to find the Gaussian noise variance of the noisy images. At last the minimum mean square error (MMSE) estimator is used to efficiently reduce the noise by recovering the accurate wavelet coefficients. The experimental results demonstrate that the proposed scheme achieved promising results than the state-of-the-art methods.

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Keywords

Optical coherence tomography (OCT); Gaussian mixture model; MMSE estimator; wavelet decomposition

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