

Abstract

Electrocardiogram (ECG) signal receives many attentions from researchers because it is the main parameter to determine the condition of the heart. The measurement of the ECG signal can be used for determining the early symptoms of heart disease; and it can reduce mortality of cardiac patients. The results of measurement using the ECG signal, however, are often affected by unwanted noise which cannot be removed with a simple filter method. Some previous studies have developed ECG denoising technique, but no studies have comprehensively evaluated the performance of these techniques. As the results, the performance of these techniques are questionable due to the lack of validation of the results obtained from these studies. To address the above issues, this research conducts validation by testing and comparing the performance of denoising methods especially in wavelet transforms. Validation is performed by analyzing these methods using Matlab with metrics: Signal to Noise Ratio (SNR), Mean Square Error (MSE) and Peak Signal to Noise Ratio (PSNR). In the evaluation, Gaussian White noise, Noise Muscle artifact, Noise Baseline wander, and Noise Electrode Movement have been added to the ECG signal before applying denoising techniques. Furthermore, the calculation of the value of SNR, PSNR and MSE is performed on the denoising-generated signals. This study has been successfully analyzed five thresholding methods on four different types of noise with the results Soft thresholding method has the best performance for the three noises, namely noise muscle artifact, baseline wander and electrode movement. While Hard thresholding method has the best performance for denoising AWGN. For noise muscle artifact, Soft thresholding method generates the value of MSE, SNR and PSNR of 0.05774875db, 7.891579 db, and 15.64563db. At noise baseline wander, Soft thresholding method generates MSE of 0.001955db, while the value of SNR and PSNR are respectively 22.98395 db and 30.738 db. Last but not least, Soft thresholding generates MSE of 0.00107db, SNR of 25.46912 db and PSNR of 33.22317db in noise electrode movement. On the other hand, Hard thresholding method has the best performance at denoising Additive White Gaussian Noise (AWGN) with MSE, SNR and PSNR are 0.000352db, 29.64059528 db, and 37.39465db, respectively.

Keyword : ECG, Wavelet, Noise, Denoising, Signal Noise Ratio, Mean Square Error.