

Assignment-2 (EE-626)

1. Evaluate the performance of wavelet weighted diagnostic distortion (WEDD), percentage root mean square difference (PRD) and multiscale entropy weighted PRD (MSEPRD) measures of ECG over baseline wandering noise filtering, power line interference noise filtering and Gaussian noise filtering frameworks.

The PRD measure is defined as

$$\text{PRD} = \frac{\|x-y\|}{\|x\|} \times 100$$

Where, 'x' is the original ECG and 'y' corresponds to the filtered ECG signal.

For WEDD and MSEPRD, please refer the following papers

- (a) M. Sabarimalai Manikandan, and S. Dandapat. "Wavelet energy based diagnostic distortion measure for ECG." *Biomedical Signal Processing and Control* 2.2 (2007): 80-96.
- (b) M. Sabarimalai Manikandan, and S. Dandapat. "Multiscale entropy-based weighted distortion measure for ECG coding." *Signal Processing Letters, IEEE* 15 (2008): 829-832.

2. Evaluate the clinical component distortion (CCD) measure for the filtered ECG signals. The CCD measure is evaluated by comparing the diagnostic features of original ECG and filtered ECG signals. First, you have to evaluate two diagnostic features such as R-wave amplitude and RR-interval for original ECG and filtered ECG. Then, the CCD measure is defined as the Mahalanobis distance between the diagnostic features of original ECG and filtered ECG.

Diagnostic features of original ECG, $\alpha = [\text{RR-amp}, \text{RR-interval}]$

Diagnostic features of filtered ECG, $\beta = [\text{RR-amp}, \text{RR-interval}]$

$$\text{CCD} = (\alpha - \beta)^T D (\alpha - \beta)$$

Where D is the diagonal weight matrix and it is given by $D = \begin{bmatrix} 0.75 & 0 \\ 0 & 0.25 \end{bmatrix}$

3. Evaluate the weighted cepstral distance (WCD) measure for the speech signals which are corrupted with Gaussian noise of similar SNR values. These noises are added in different regions of the speech signal. The signal files are given in MATLAB formats with annotations as sig1.mat (original signal), and noisy signals (sig2.mat, sig3.mat and sig4.mat). Each of the signal file has a sampling frequency of 8000 Hz.

You can use MATLAB or Python for implementation of WCD, CCD, PRD, WEDD and MSEPRD measures.