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Editorial

Choice of Wavelets for Electrogastrogram (EGG)

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Abstract

From the research background of corresponding author and co-author shows some promising analysis and interpretation on Electrogastrogram (EGG). EGG is the biological signal of stomach in order to empty the stuffs which was taken by the subjects orally. This signal is sort of bio-electric signal which will clearly depicts the functional information of stomach by capturing its ionic potentials by surface electrodes. These potentials will be influenced by the consumed food, subject's movement, choice of filter and position of electrode. This EGG acquisition will be helpful in diagnosing stomach activity non-invasively by analysing its characteristics. The ideal and normal EGG pattern holds 3 cycles per minute with low distortion. In order to take this technology forward, EGG is tested with wavelets for compressing the signal to implement the telemedicine technology by transferring the signal from one end to another. There are many compression technique is used for transferring, but each technique has some drawbacks like poor compression ratio, information loss etc. The purpose of this editorial note is to choose the significant and low error wavelet for EGG compression. After this preliminary study (by finding the suitable wavelets), the results are taken for further research by analysing the performance of each wavelet in EGG compression.

Keywords: Electrogastrogram (EGG); Wavelets; Compression; Telemedicine

Introduction

The normal 3 cycles per minute EGG pattern is acquired by placing surface electrodes on the stomach wall externally [1]. EGG acquired in this study is based on the acquisition showed in Gokul., *et al* [2]. The acquired EGG is digitized and further analysed in PC by wavelet transforms (WT). The application of WT here is to achieve good compression while transferring EGG signal from one platform to other [3]. WT makes it conceivable to apply a multi-resolution to biological signal for analysing its characteristics. This examination, which it is fitting to call time-scale, by utilizing a very large scope and range of scales to dissect the biological signal like ECG, EEG, EGG [4] etc. In this Editorial, we have concentrated on EGG signal alone which is highly used for diagnosing gastric disorder patients and diabetes patients with gastroparesis [7]. The choice of wavelets with low error rate is calculated in this editorial which can be used for further studies to check the performance of each wavelet individually.

Materials and Methods

Here, we are applying for EGG [4], where the WT of a signal is the family C (a, b) coefficients of wavelet, which relies upon the two boundaries a and b. As per the requirements for the investigation of the signal, the boundaries (a, b) can be utilized discretely or continuously, which are termed as DWT or CWT [5]. The investigation of the choice of the wavelet, mother wavelet will be tested with some basic functions. This will be done on the investigation to find the error or distortion between the input or original signal [1] (typical case) and the synthesis signal (signal after recreation/ reconstruction). Toward this path, a boundary of mistake portrays the reconstructing (or synthesised signal) [6]. The error that will be determined each time in the continuation of the examination is given by the accompanying equation:

$$\sum_{i=1}^{N} |soi\text{-}sor|/N$$

Where, so is the input or original signal; soi is sample of so; sr is synthesised signal; and sri is the sample of sr. Examining the wavelet picked will be the one which will introduce the least mistake recreation regarding the characteristics and particularities of typical EGG signal. The boundary joined with attributes of the ideal EGG signal will choose for additional examination. Multi-resolution examination is applied by utilizing the investigating wavelet for various orders (N) [6].

Results and Discussion

The investigating wavelets under this study are Coiflet, Daubechies, Bi-orthogonal and reverse biorthogonal WT [5]. A few orders of the wavelet are applied and tested; in each order test average error is calculated to find the best wavelet choice for EGG. The average errors calculated for various orders of wavelets are shown in following figure 1-4.

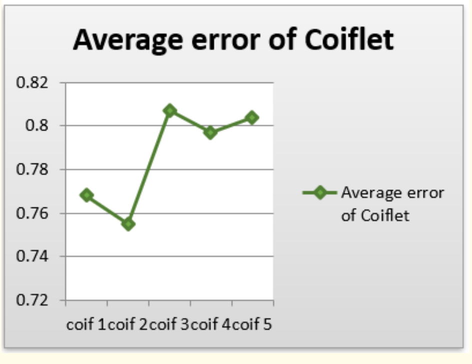

Figure 1: The average error calculated for various orders of Coiflet wavelets.

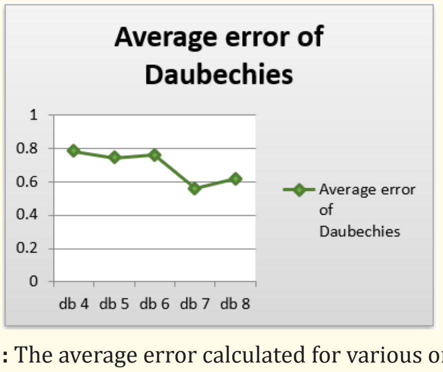

Figure 2: The average error calculated for various orders of Daubechies wavelets.

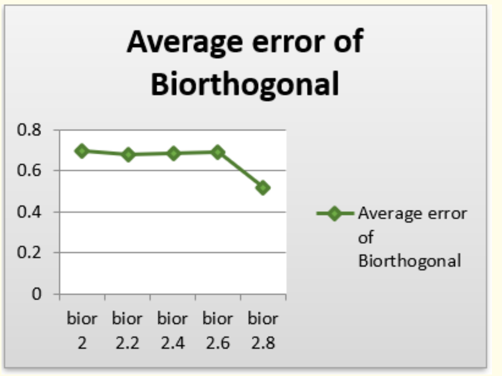

Figure 3: The average error calculated for various orders of bi-orthogonal wavelets.

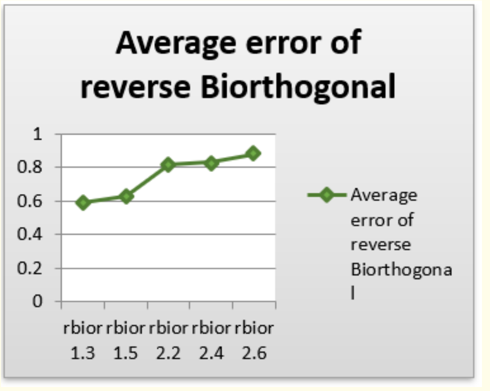

Figure 4: The average error calculated for various orders of reverse bi-orthogonal wavelets.

Conclusion

From the average calculation of error, figure 1 shows that Coiflet Wavelet in order 2 (coif 2) has low average error among all other orders. From figure 2, we can see that Daubechies Wavelet in order 7 (db7) has low average error among all other orders. Figure 3 shows that Bi-orthogonal Wavelet in order 2.8 (bior 2.8) has low average error among all other orders. From figure 4, we can easily see that reverse bi-orthogonal Wavelet in order 1.3 (rbior 1.3) has low average error among all other orders. As per the objective of this editorial note, the suitable choice of wavelet of Electrogastrogram analysis is found in this study. Based on this study, the future work is to test the performance of each suitable wavelet in EGG compression.

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