

Selection of mother wavelet functions for multi-channel EEG signal analysis during a working memory task

ABSTRACT

We performed a comparative study to select the efficient mother wavelet (MWT) basis functions that optimally represent the signal characteristics of the electrical activity of the human brain during a working memory (WM) task recorded through electro-encephalography (EEG). Nineteen EEG electrodes were placed on the scalp following the 10–20 system. These electrodes were then grouped into five recording regions corresponding to the scalp area of the cerebral cortex. Sixty-second WM task data were recorded from ten control subjects. Forty-five MWT basis functions from orthogonal families were investigated. These functions included Daubechies (db1–db20), Symlets (sym1–sym20), and Coiflets (coif1–coif5). Using ANOVA, we determined the MWT basis functions with the most significant differences in the ability of the five scalp regions to maximize their cross-correlation with the EEG signals. The best results were obtained using “sym9” across the five scalp regions. Therefore, the most compatible MWT with the EEG signals should be selected to achieve wavelet denoising, decomposition, reconstruction, and sub-band feature extraction. This study provides a reference of the selection of efficient MWT basis functions.

Keyword: Electroencephalography; Memory; Wavelet; Multi-resolution analysis; Cross-correlation