

EXTRACTING SINGLE TRIAL EVOKED POTENTIAL SIGNALS USING SPECTRAL POWER RATIO PRINCIPAL COMPONENTS

¹S.Andrews and ²Ramaswamy Palaniappan

¹Faculty of Information Science and Technology, Multimedia University, Malacca, Malaysia

²Biomedical Engineering Research Centre, School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore

Abstract

Spectral Power Ratio (SPR) is a novel technique proposed that selects only the specific principal components (PCs) in Principal Component Analysis (PCA) for single trial extraction of evoked potential (EP) signals. SPR technique is designed and implemented to overcome heavy electroencephalogram (EEG) contamination in the EP signals. By using SPR technique, increased signal to noise ratio (SNR) is obtained when applied on artificial Visual EP (VEP) signals contaminated by EEG. The EEG is added with factors of 2,4,6,8, and 10 times to test SPR's suitability to be used with real VEP. Assessment on these signals shows that application of SPR on contaminated signals outperformed the existing Kaiser (KSR) and Residual Power (RP) methods to select the PCs. The results proved SPR's consistent performance with an average SNR of 1.204 dB while RP and KSR gave -0.24 dB and KSR -0.36 dB, respectively where the original SNR was -7.08. Usefulness of SPR is confirmed using real VEP signals to analyse P3 amplitude and latency responses to matching and non-matching visual stimuli. SPR extracted P3 parameters resulted in faster and higher responses ($p < 0.05$) for the matched stimuli, which confirms existing neuroscience knowledge while KSR and RP methods fail to indicate significant differences.