



Beta/Alpha Power Ratio and Alpha Asymmetry Characterization of EEG Signals due to Musical Tone Simulation

Roy Francis Navea and Elmer Dadios of De La Salle University Manila, Philippines

Abstract

The complexity of EEG signals make it difficult to analyze and understand hence a common method is to create a mathematical model from which approximate measurable quantities can be derived. Statistical approaches are commonly used to describe stochastic systems that produce random data sets. This study aims to characterize EEG signals due to musical tone stimulation. The characterization is based on the statistical measures of the power spectrum in the beta and alpha frequency range. Measures of central tendencies were considered as well as the alpha asymmetric properties of the left and right hemispheres of the brain during stimulation. The EEG signals were obtained using a 14-node neuro-headset from Emotiv. For an initial study, seventeen volunteers joined the experiment producing 17, 102, 51 and 204 data samples for the Baseline, C, F and G, and s-Baseline segments, respectively. Data pre-processing, filtering and power spectrum feature extraction were performed to gather enough information for analysis. Results show that among the considered statistical measures, the skewness and kurtosis of the power spectrum were found to be significant in delineating the different segments of the audio stimuli. The inverse relationship between the beta and alpha waves was observed. During active segments of the audio stimulus, alpha power decreases and beta power increases and vice versa. Using the difference score method (DSM) and with the assumption that alpha waves are inversely proportional to activity, high DSM values were observed during the active segments of the stimuli thus implying higher left hemisphere activation. On the contrary, low DSM values were observed during the inactive segments of the stimuli thus implying a higher right hemisphere activation. A decreasing DSM trend was observed from the intermediate node between the frontal polar site and frontal node to the parietal node. This is indicative of more frontal activation towards a less activation on the parietal region.

Keywords

Power spectrum ratio, alpha symmetry, musical tone simulation, EEG