

# Physiological signal analysis for cognitive state estimation

## Abstract

The purpose of this paper is to identify inconsistency in human physiological signals based on cognitive states by measuring and analyzing bio-signals. In this paper, the cognitive states are estimated using physiological signal analysis. The parameters are electrocardiogram (ECG), electromyogram (EMG), electroencephalogram (EEG) and blood pressure (BP). The signals have been collected using BIOPAC system in which the subjects were induced to undergo the specific sequence of the cognitive state. For getting physiological signals during different conditions, we utilized power point slide show, video clips and question answer method which elicits mental reactions from the subjects. Data is taken before and after four tasks that encompassed the motor action (MA), thought (TH), memory related (MR) and emotion (EM). These measured values are analyzed using BIOPAC Acknowledge software. It was found that the motor action and thought states have effects on BP while MR and EM state mainly affect the ECG measurement. The decibel value and frequency found for EM state in ECG are minimum compared to relaxed state (RS) condition. Similarly, the maximum frequency and dB value is found for MR state. No significant variation was seen for MA and TH states. Thus it was decided that the MR and EM states mainly affect the ECG measurement. For BP the value increases in MA state and decreases in TH state. The MA state mainly affects the EMG signal while other states have no significant changes. The EEG mainly detects the signal of task performed by the specific brain region where the electrodes are placed. In EEG analysis, the electrodes are placed in occipital lobe region which gives mainly the variation in alpha amplitude of EEG with eyes closed and eyes opened. Alpha wave amplitudes vary with the subjects attention to mental tasks performed with eyes closed.