

Event Related Brain Potentials on Visual Stimulus and Most Cognitive Tasks

R.M.L.M. Gunawardana* and S. Amarakeerthi

Department of Computing and Information Systems, Sabaragamuwa University of Sri Lanka, P.O. Box 02, Belihuloya 70140, Sri Lanka.

*Correspondence: lihini77777@gmail.com

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Brain Computer Interfaces (BCIs) are direct interfaces for communication between the Brain and the Computer. Event Related Potentials (ERPs) are a very important sub area of Brain Computer Interfaces which illustrate electrical potentials associated with the brain for auditory, sensory, motor or cognitive events. This is a newly spread area that can be used to provide better solutions for disabled people, diagnose diseases, credibility tests, virtual reality, robotic movements and so on. In this research, Electroencephalogram (EEG) based Event Related Potentials on two existing data sets have been used for picture-based visual stimulus and cognitive task. Preprocessing techniques such as filtering, segmenting, averaging are applied and decomposed independent components using Independent Component Analysis (ICA) to remove noisy and artifactual components. Common Spatial Pattern (CSP) as training model approach and Principal component Analysis (PCA) as feature extraction method are applied and Linear Discriminant Analysis (LDA), Quadratic Discriminant Analysis (QDA), and Log Regression Analysis (LOGREG) are applied as classification algorithms. Those processed datasets are used to identify most significant lobe areas, wave types and influence of P300 for visual picture stimulus & cognitive tasks and best classification algorithm for cognitive tasks. All findings are considered based on one subject is the limitation of the experiment. As the results of completing the above procedures, most significant lobe areas for picture visual stimulus were parietal lobe & occipital lobe, waves were P5, P3 and best classification method for cognitive tasks was Log Regression Analysis (LOGREG). P300 wave was mostly influence for the visual stimulus than the cognitive tasks. These findings can be used for developing devices for the people who are suffering with visual weaknesses and for the backward children. As ongoing research, based on ERP is creating a publicly available database for the credibility assessment and future work will be the experiments based on that database.

Keywords: Brain computer interface, filtering, heat maps, linear discriminant analysis (LDA), log regression analysis (LOGREG), quadratic discriminant analysis (QDA)