

Brain Computer Interfaces and disorders of consciousness

Marian Dovgialo

Abstract

Brain-computer interfaces (BCIs) have been used in laboratories all over the world for decades, offering hope for solving important problems in modern medicine and psychology. Unfortunately, their application in the real-world environments (e.g. clinical) still show limited maturity and insufficient stability of operation, and interpretation of the EEG derived variables can be still ambiguous even in healthy volunteers.

This thesis proposes a complete solution to some of these problems in the form of:

1. complete, stable codebase, starting from BCI framework, which implements near real-time communication of modules, to advanced methods of signal analysis and statistics, which estimate users intentions based on EEG (chapter 2),
2. complete signal processing pipeline for the analysis of EEG recorded within the aforementioned BCI framework during the research conducted in „The Alarm Clock” clinic, which allows to assess statistical significance of the hypothesis about patients ability to consciously communicate using BCI. In the absence of other means of communication, EEG analysis is the main source of objective information about the state of patients brain (chapter 4).