Tutorial on Noninvasive Brain Computer Interfaces

(Abstract)

Petia Georgieva
Institute of Electronic Engineering and Telematics of Aveiro (IEETA)
Department of Electronics Telecommunications and Informatics (DETI)
University of Aveiro, 3800 - 193 Aveiro, Portugal
http://sweet.ua.pt/petia/
E-mail: petia@ua.pt

During the last decade advances in many scientific fields have supported the idea that a direct interface between the human brain and an artificial system, called Brain Computer Interface (BCI), is a viable concept, although a significant research and development effort has to be conducted before these technologies enter routine use.

The principal reason for the BCI research is the potential benefits to those with severe motor disabilities, such as brainstem stroke, amyotrophic lateral sclerosis or severe cerebral palsy. However, recent advances in sensor technology and machine learning assert that using our brain for communication may have a significant impact in the way people will operate computers, wheelchairs, prostheses, robotic systems and other devices in the future.

A promising way to analyze the brain physiological activity is the electroencephalogram (EEG) measurements from the cortex whose sources are the action potentials of the nerve cells in the brain. Over the last years, the interest in extracting knowledge hidden in the EEG signals is rapidly growing, as well as their applications.

This tutorial will present the state of the art in the EEG-based Noninvasive BCI. The talk will highlight research on noninvasive BCI for motor control, reconstruction of brain active zones based on EEG and learning to decode human emotions with Echo State Networks.