Development of a Brain-Computer Interface Based on Visual Stimuli for the Movement of a Robot Joints

This paper presents a brain computer interface (BCI) to control a robotic arm by brain signals from visual stimuli. The following signal processing steps were established; acquisition of brain signals by electroencephalography (EEG) electrodes; noise reduction; extraction of signal characteristics and signal classification. Reliable brain signals were obtained by the use of the Emotiv EPOC® commercial hardware. The OpenViBE® commercial software was used to program the signal processing algorithms. By using Matlab® together with an Arduino® electronic board, two servo motors were controlled to drive two joints of a 5 degrees-of-freedom robot commanded by P300-type evoked potential brain signals from visual stimulation when a subject concentrates on particular images from an image matrix displayed in the computer screen. The experiments were conducted with and without hearing and visual noise (artifacts) to find out the noise influence in the signal classification outcome. The obtained experimental results presented an efficiency in the identification stage up to 100% with and without hearing noise conditions. However, under visual noise conditions a maximum efficiency of 50% was reached. The experiments for the servomotors control were carried out without noise, reaching an efficiency of 100% in the identification stage.