Brain-Computer Interface Control System for People with Disabilities

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Abstract
Continuous evolution in neuroscience and neurotechnology underlines the need for continuous updating of knowledge, with significant implications for individuals, society and healthcare professionals. Brain-computer interface (BCI) is one of these emerging technologies, facilitating direct communication between the brain and external devices, avoiding the usual neuromuscular pathways. Brain-computer interface CI is not limited to the medical field, but has extensive applications in various aspects of human life, including entertainment, gaming, education, self-control, and marketing. However, along with its benefits, BCI also presents challenges, including technological, neurological, and ethical ones. This abstract summarizes the importance and diversity of BCIs' use in human-machine interaction, highlighting their implications in various fields and highlighting the challenges associated with this promising technology. In the paper, we used EEG (Electroencephalogram) as the primary method of recording brain electrical activity in real time. EEG is a non-invasive technology that uses electrodes placed on the scalp to detect and record electrical signals emitted by neural activity in the brain. To use the EEG in the context of BCI headphones for controlling people with disabilities, we selected a standard set of electrodes and applied a special conductive gel to ensure good conductivity of electrical signals. We took care to position the electrodes at strategic points of the scalp according to the international electroencephalography system (10-20) to record signals from cortical regions relevant for motor control and communication. We developed testing protocols and experimental paradigms that involved participants performing specific tasks, such as controlling a cursor on a screen or selecting mental commands, while recording their brain's EEG activity. We used an EEG amplifier to amplify and filter the recorded signals and specialized software to analyzeand interpret EEG data to detect specific patterns and signals that indicate movement intentions or mental commands. The results obtained from the EEG recording were used to train algorithms to decode participants' intentions and calibrate the BCI headphones so that they correctly transmit the commands generated by EEG signals. By using EEG in this work, we were able to provide an efficient and accurate interface between brain activity and BCI headphones, allowing participants to control devices with great accuracy and reliability.

Keywords: Brain-Computer Interface (BCI); Electroencephalogram (EEG); Neuroscience; Marketing; Software