Offline EEG-based DC Motor Control for Wheelchair Application

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Abstract. Brain-computer interface (BCI) connects the brain of human with computer, where it allows people with physical disabilities to operate different electronic devices with the help of brain waves. The process can be performed without any involvement of human touch. This system will provide an easy use and operation of certain device by disabled people. The system is fit for people, who have no control over their normal muscular body to use the peripheral devices. In addition, due to the good feature of this technology namely, user friendly and low cost, it is getting more popularity recently. The application of BCI is very wide which cover medical and non-medical application. for instant, playing games, BCI speller, cursor control, social interactions by detecting emotions, robotic arm control, wheelchair control, home appliances control or smart phone operation using Electroencephalogram (EEG) signals are all applications of BCI technology. In this research, the possibility of DC motor control using single channel EEG headset has been investigated. The research aims to find the best EEG features and classifier where the output of the classifier can provide a correct device command to control DC motor movement. Here, EEG feature in terms of power spectral density has been extracted and classified using support vector machine (SVM) with the classification accuracy achieved at 92%. Then, the classified EEG features had been translated into three devices command to control the direction of DC motor. The DC motor can be driven in three direction namely forward, right and left direction. Data collection from EEG headset and sending commands to dc motor, the entire process has been done wirelessly. The multi direction of DC motor will enhance the wheelchair application by disabled people.

Keywords: BCI, EEG, motor control, EEG features, EEG classification, device command

1 Introduction

Human brain is definitely the control unit of the entire body. The neuron movement in the brain due to the change of cognitive or neural state will produce electrical signals and these signals can be measured using device called electroencephalogram (EEG). Brain signals are often called EEG signals. Thus, the EEG signals can be used to study the brain-related disease, mental condition, intelligence quotient (IQ), and to allow human to communicate with the machine which is currently known as Brain-Computer Interface (BCI) and become emerging technique in Biomedical Engineering Field [1]. However, human brain can be affected by some severe neuromuscular disorders, for example, amyotrophic lateral sclerosis (ALS) spinal cord injury, and

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