Recent Trends and Open Challenges in EEG based Brain-Computer Interface Systems

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Abstract. Recent advances in computer hardware and signal processing have made possible the use of electroencephalogram (EEG) for communication between human brain and computers and this technology is known as brain-computer interface (BCI). Locked-in patients have now a way to communicate with the outside world using BCI technology. Nowadays, BCIs are getting popularity among the researchers to control devices using brainwaves especially in providing good assistance to disabled people. Impressive development and integration of both hardware and software in BCI have been carried out in the last two decades. However, some open challenges and limitations have also been exposed in the previous researches. In this paper, we have tried to mention some critical issues of EEG based BCI system including EEG modalities, EEG acquisition, signal processing algorithm and performance evaluation. These issues need to be solved to develop error-free BCI system. In addition, possible solutions and future directions have also been discussed.

Keywords: Electroencephalogram (EEG), Brain-Computer Interface (BCI), Brain-Machine Interface (BMI), Assistive Technology.

1 Introduction

Brain-computer interface (BCI) aims to provide a direct communication pathway between brain and external devices[1][2]. In recent years, this new brain-computer interaction method has attracted people's attention for its potential applications in rehabilitation engineering, intelligent assistive robot and so on. [3]. More specifically, it is very helpful to assist people with damaged motor functions, or completely paralyzed people. Currently, BCIs are employed in many non-medical fields such as gaming, virtual reality control, biometric identification etc. It is an interesting, vibrant and highly interdisciplinary research topic which involves medicine, psychology, neurology, signal processing and machine learning. Despite its expected success, BCI needs

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