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Steady-State Visual Evoked Potential-Based Real-Time BCI for Smart Appliance Control

Noel G. Tavares and R. S. Gad

Abstract Brain–Computer Interface (BCI) provides an alternative way for humans to communicate with the external environment. BCI systems can be of great help to people with severe motor disabilities who cannot perform normal daily activities. In this paper, we introduce a novel steady-state visual evoked potential (SSVEP)-based brain–computer interface system that control home appliances like electric fan, tube light, etc. Designed system aim is to extract the SSVEP signal and then classify them using PCA. We confirmed the generation of SSVEP frequencies in the online analysis using Fast Fourier Transform. The classification of SSVEP signals is done using Principal Component Analysis.

Keywords Brain–computer interface (BCI) · Steady-state visually evoked potentials (SSVEP) · Electroencephalogram (EEG) · Fast fourier transform (FFT) Principal component analysis (PCA)

1 Introduction

Human beings communicate with the external world through the motor and sensory pathways. But damage to these pathways makes it difficult to communicate with the external world. Humans who suffer from neuromuscular diseases like quadriplegic patients, amyotrophic lateral sclerosis cannot move their limbs due to damage to the spinal cord. Brain–computer interface-based systems can be of great help to such type of patients for communication [1]. BCI's have also been used in selective attention based studies, speller systems and prosthetics. There are normally two types, i.e., invasive and non-invasive BCI's. Invasive BCI's include ECoG, neural implants, single cell recording, etc.; whereas non-invasive BCI's include EEG,

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