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Table of contents (74 papers)

Front Matter

[Download chapter PDF](#)

Pages i–xxii

Multi-tumor Detection and Analysis Based on Advance Region Quantitative Approach of Breast MRI

U. Ravi Babu

Pages 1–10

Categorizing Kidney Stones Using Region Properties and Pixel Intensity Matrix

Punal M. Arabi, Gayatri Joshi, Surekha Nigudgi

Pages 11–18

Security Measures in Distributed Approach of Cloud Computing

K. Shirisha Reddy, M. Bala Raju, Ramana Naik

Pages 19–30

Performance of Time-Varying Particle Swarm Optimizer to Predict Cancers

T. R. Vijaya Lakshmi

Pages 31–37

An Analytical Review of Different Approaches for Detection and Analysis of Electrocardiographic ST Segment

Akash Kumar Bhoi, Karma Sonam Sherpa, Bidita Khandelwal, Pradeep Kumar Mallick

Pages 39–51

Survey on Sentiment Analysis Methods for Reputation Evaluation

P. Chiranjeevi, D. Teja Santosh, B. Vishnuvardhan

Pages 53–66

A Cognitive Approach for Design of Smart Toilet in Healthcare Units

Mohan Debarchan Mohanty, Mihir Narayan Mohanty

Pages 771–780

Autonomic Nervous System for Sympathetic and Parasympathetic for Cardiac Event Coherence

Noel G. Tavares, R. S. Gad, A. M. Hernandez, Uday Kakodkar, G. M. Naik

Pages 781–794

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

Noel G. Tavares, R. S. Gad

Pages 795–805

Back Matter

Pages 807–809

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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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795