Announcing the Final Examination of Pouria Saidi for the degree of Master of Science

Time & Location: June 18, 2015 at 10:00 AM in Harris Corporation Engineering Center 450
Title: Motor Imagery Classification Using Sparse Representation of EEG Signals

Abstract

The human brain is unquestionably the most complex organ of the body as it controls and processes its movement and senses. A healthy brain is able to generate responses to the signals it receives, and transmit messages to the body. Some neural disorders can impair the communication between the brain and the body preventing the transmission of these messages. Brain Computer Interfaces (BCIs) are devices that hold immense potential to assist patients with such disorders by analyzing brain signals, translating and classifying various brain responses, and relaying them to external devices and potentially back to the body. Classifying motor imagery brain signals where the signals are obtained based on imagined movement of the limbs is a major, yet very challenging, step in developing Brain Computer Interfaces (BCIs). Of primary importance is to use less data and computationally efficient algorithms to support real-time BCI. To this end, an algorithm that exploits the sparse characteristics of EEGs is proposed to classify these signals. Different feature vectors are extracted based on the projected EEG trials, wavelet coefficients and energies in different frequency sub-bands of the Wavelet Packet decomposition of EEG trials recorded only by five electrodes near the sensorimotor cortex. In this method, features from a small spatial region are approximated by a sparse linear combination of few atoms from a multi-class dictionary constructed from the features of the EEG training signals for each class. This is used to classify the signals based on the pattern of their sparse representation using a minimum residual decision rule. The results obtained from real data demonstrate that the combination of energy and entropy features enables efficient classification of motor imagery EEG trials related to hand and foot movements. This underscores the relevance of the energies and their distribution in different frequency sub-bands for classifying movement-specific EEG patterns in agreement with the existence of different levels within the alpha band.

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Approved for distribution by George Atia, Committee Chair, on November 18, 2017.

The public is welcome to attend.