Elsevier Editorial System(tm) for Neurocomputing
Manuscript Draft

Manuscript Number: NEUCOM-D-14-02069R2

Title: Improving Classification of Epileptic and Non-Epileptic EEG Events by Feature Selection

Article Type: Full Length Article (FLA)

Keywords: epileptic seizures, PNES, vasovagal syncope, classification, machine learning

Corresponding Author: Mrs. Evangelia Pippa, M.D.

Corresponding Author's Institution: University of Patras

First Author: Evangelia Pippa, M.D.

Order of Authors: Evangelia Pippa, M.D.; Evangelia I Zacharaki; Iosif Mporas; Vasiliki Tsirka; Mark P Richardson; Michael Koutroumanidis; Vasileios Megalooikonomou

Abstract: Correctly diagnosing generalized epileptic from non-epileptic episodes, such as psychogenic non epileptic seizures (PNES) and vasovagal or vasodepressor syncope (VVS), despite its importance for the administration of appropriate treatment, life improvement of the patient, and cost reduction for patient and healthcare system, is rarely tackled in the literature. Usually clinicians differentiate between generalized epileptic seizures and PNES based on clinical features and video-EEG. In this work, we investigate the use of machine learning techniques for automatic classification of generalized epileptic and non-epileptic events based only on multi-channel EEG data. For this purpose, we extract the signal patterns in the time domain and in the frequency domain and then combine all features across channels to characterize the spatio-temporal manifestation of seizures. Several classification algorithms are explored and evaluated on EEG epochs from 11 subjects in an inter-subject cross-validation setting. Due to large number of features feature ranking and selection is performed prior to classification using the ReliefF ranking algorithm within two different voting strategies. The classification models using feature subsets, achieved higher accuracy compared to the models using all features reaching 95% (Bayesian Network), 89% (Random Committee) and 87% (Random Forest) for binary classification (epileptic versus non-epileptic). The results demonstrate the competitiveness of this approach as opposed to previous methods.