Automated and ERP-Based Diagnosis of Attention-Deficit Hyperactivity Disorder in Children

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Abstract

Event-related potential (ERP) is one of the most informative and dynamic methods of monitoring cognitive processes, which is widely used in clinical research to deal with a variety of psychiatric and neurological disorders such as attention-deficit/hyperactivity disorder (ADHD). In this study, there were 60 participants including 30 patients with ADHD and 30 subjects as a control group. Their ERP signals were recorded by three electrodes in two modalities. After a preprocessing step, several features such as band power, fractal dimension, autoregressive (AR) model coefficients and wavelet coefficients were extracted from recorded signals. The aim of this study is to achieve a high classification rate. The results show that the fractal dimension–wavelet combination features provided a good discriminative capability; it should be noted that this improvement was achieved by combining all sets of features and applying a feature selection algorithm, which resulted in a maximum accuracy rate of 88.77 and 95.39% in support vector machine (SVM) and v_SVM classification algorithms using a 10-fold cross-validation approach, respectively. ERP has been widely used for clinical diagnosis and cognitive processing deficits in children with ADHD. To increase the accuracy of the diagnostic process of ADHD, ERP signals were recorded to extract some specific ERP features related to this disease for classifying the two groups. The results show that the Fra-wave characterization produced the best average accuracy with an efficiency of 99.43% for v_SVM classifier, compared with 97.65% efficiency for the wavelet features and the other features.