Machine-based classification of ADHD and nonADHD participants using time/frequency features of event-related neuroelectric activity.

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Abstract

OBJECTIVE:
Attention-deficit/hyperactivity disorder (ADHD) is the most frequent diagnosis among children who are referred to psychiatry departments. Although ADHD was discovered at the beginning of the 20th century, its diagnosis is still confronted with many problems.

METHOD:
A novel classification approach that discriminates ADHD and nonADHD groups over the time-frequency domain features of event-related potential (ERP) recordings that are taken during Stroop task is presented. Time-Frequency Hermite-Atomizer (TFHA) technique is used for the extraction of high resolution time-frequency domain features that are highly localized in time-frequency domain. Based on an extensive investigation, Support Vector Machine-Recursive Feature Elimination (SVM-RFE) was used to obtain the best discriminating features.

RESULTS:
When the best three features were used, the classification accuracy for the training dataset reached 98%, and the use of five features further improved the accuracy to 99.5%. The accuracy was 100% for the testing dataset. Based on extensive experiments, the delta band emerged as the most contributing frequency band and statistical parameters emerged as the most contributing feature group.

CONCLUSION:
The classification performance of this study suggests that TFHA can be employed as an auxiliary component of the diagnostic and prognostic procedures for ADHD.

SIGNIFICANCE:
The features obtained in this study can potentially contribute to the neuroelectrical understanding and clinical diagnosis of ADHD.