Network-Based Classification of ADHD Patients Using Discriminative Subnetwork Selection and Graph Kernel PCA

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Computerized Medical Imaging and Graphics, 2016
DOI: http://dx.doi.org/10.1016/j.compmedimag.2016.04.004

Abstract

Background
Attention Deficit Hyperactivity Disorder (ADHD) is one of the most prevalent behavioral disorders in childhood and adolescence. Recently, network-based diagnosis of ADHD has attracted great attentions due to the fact that ADHD disease is related to not only individual brain regions but also the connections among them, while existing methods are hard to discover disorder patterns related with several brain regions.

New Method
To overcome this drawback, a discriminative subnetwork selection method is proposed to directly mine those frequent and discriminative subnetworks from the whole brain networks of ADHD and normal control (NC) groups. Then, the graph kernel principal component (PCA) is applied to extract features from those discriminative subnetworks. Finally, support vector machine (SVM) is adopted for classification of ADHD and NC subjects.

Results
We evaluate the performances of our proposed method using the ADHD200 dataset, which contains 118 ADHD patients and 98 normal controls. The experimental results show that our proposed method can achieve a very high accuracy of 94.91% for ADHD vs. NC classification. Moreover, our proposed method can also discover the discriminative subnetworks as well as the discriminative brain regions, which are helpful for enhancing our understanding of ADHD disease.

Comparison with Existing Method(s)
The accuracy of our proposed method is 9.20% higher than those of the state-of-the-art methods.

Conclusions:
A lot of experiments in ADHD200 dataset show that, our proposed method can improve the performance significantly comparing to the state-of-the-art methods.