

# A general prediction model for the detection of ADHD and Autism using structural and functional MRI.

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## Abstract

This work presents a novel method for learning a model that can diagnose Attention Deficit Hyperactivity Disorder (ADHD), as well as Autism, using structural texture and functional connectivity features obtained from 3-dimensional structural magnetic resonance imaging (MRI) and 4-dimensional resting-state functional magnetic resonance imaging (fMRI) scans of subjects. We explore a series of three learners: (1) The LeFMS learner first extracts features from the structural MRI images using the texture-based filters produced by a sparse autoencoder. These filters are then convolved with the original MRI image using an unsupervised convolutional network. The resulting features are used as input to a linear support vector machine (SVM) classifier. (2) The LeFMF learner produces a diagnostic model by first computing spatial non-stationary independent components of the fMRI scans, which it uses to decompose each subject's fMRI scan into the time courses of these common spatial components. These features can then be used with a learner by themselves or in combination with other features to produce the model. Regardless of which approach is used, the final set of features are input to a linear support vector machine (SVM) classifier. (3) Finally, the overall LeFMSF learner uses the combined features obtained from the two feature extraction processes in (1) and (2) above as input to an SVM classifier, achieving an accuracy of 0.673 on the ADHD-200 holdout data and 0.643 on the ABIDE holdout data. Both of these results, obtained with the same LeFMSF framework, are the best known, over all hold-out accuracies on these datasets when only using imaging data-exceeding previously-published results by 0.012 for ADHD and 0.042 for Autism. Our results show that combining multi-modal features can yield good classification accuracy for diagnosis of ADHD and Autism, which is an important step towards computer-aided diagnosis of these psychiatric diseases and perhaps others as well.