We propose novel computational techniques to analyze brain-behavior relationships underlying mechanisms of inhibitory control, focusing on performing classification of hard-to-categorize groups of subjects based on brain activation response patterns to behavioral challenges of inhibitory control using fMRI. These classification methods are applied on two distinct datasets: substance dependent individuals and individuals with a particular genotype (MAOA) conferring vulnerability to aggression. We hypothesize that unique patterns of variability in brain function can assist in identification of brain mechanisms rooted in compromised inhibitory control. Machine Learning techniques have been shown to be successful in discovering optimal features and patterns in complex high dimensional datasets. The diversity of the underlying questions and the subtlety of the effects that can be used for classification, motivate us to propose an integrated machine learning framework for the joint exploration of spatial, temporal and functional information for the analysis of fMRI signals: 1) A differential spatial brain pattern indicates a diagnosis of drug addiction and a membership in one or another level of MAOA genotype. Spatial information from static 3D contrast maps is input to PCA-based and Voxel-based methods, and Adaboosting with Side information 2) A temporally accounted intrasubject pattern of response to the inhibitory control challenge conditions in the fMRI paradigms reveals group membership in both data sets. 3) A connectivity map corresponding to brain circuits functionally subserving inhibitory control is revealed with indications of directionality of influence between brain regions by analyzing functional information with Dynamic Bayesian Networks.

Project (or PI) Website

http://www.cs.sunysb.edu/~ial/brain.html
