Identifying Neuroimaging and Proteomic Biomarkers for MCI and AD via the Elastic Net

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Abstract

Multi-modal neuroimaging and biomarker data provide exciting opportunities to enhance our understanding of phenotypic characteristics associated with complex disorders. This study focuses on integrative analysis of structural MRI data and proteomic data from an RBM panel to examine their predictive power and identify relevant biomarkers in a large MCI/AD cohort. MRI data included volume and thickness measures of 98 regions estimated by FreeSurfer. RBM data included 146 proteomic analytes extracted from plasma and serum. A sparse learning model, elastic net logistic regression, was proposed to classify AD and MCI, and select disease-relevant biomarkers. A linear support vector machine coupled with feature selection was employed for comparison. Combining RBM and MRI data yielded improved prediction rates: HC vs AD (91.9%), HC vs MCI (90.5%) and MCI vs AD (86.5%). Elastic net identified a small set of meaningful imaging and proteomic biomarkers. The elastic net has great power to optimize the sparsity of feature selection while maintaining high predictive power. Its application to multi-modal imaging and biomarker data has considerable potential for discovering biomarkers and enhancing mechanistic understanding of AD and MCI.