Identifying local cognitive representations in the brain across age spans through voxel searchlights and representational similarity analysis

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Abstract

Localizing function in the brain has been an elusive long-term goal in the study of cognition. Prior studies have utilized four reference abilities (RAs) to capture cognition (Salthouse, 2009). Full-brain cortical networks have been tied to these abilities using common multi-voxel patterns across subjects in distinct age groups. Using voxel searchlights the current study explores purely local cortical representations of cognition, less commonly explored. This work analyzes 240 subjects' responses to cognitive tasks from the four RAs. The current study further employs representational similarity analysis (RSA, Kriegeskorte, Mur, & Bandettini, 2008) to the similarity of brain activities from tasks within the same RA; RSA can capture representational consistencies within each subject even when exact voxel pattern may vary across subjects. We found distinct topographical localizations for each RA that were mostly consistent across age and suggested refinements of broader functional divisions of the brain from prior literature.