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A structured brain-wide and genome-wide association study using ADNI PET images

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Abstract

Background: Detecting association signals between the brain and the genome using ultrahigh-dimensional PET neuroimaging scans and GWAS SNP data

Method: A multi-stage variable selection method is introduced for detecting association signals in structured brain-wide and genome-wide association studies (brain-GWAS). Validity of the proposed approach is demonstrated by both theoretical investigation and numerical simulations. We apply our proposed method to a brain-GWAS using ADNI PET imaging and genomic data.

Result: We confirm previously reported association signals (e.g. IL8RB and COLEC12 genes) and also uncover several novel SNPs and genes (e.g. GALNT4 and RIN2 genes) that either are associated with brain glucose metabolism or have their association significantly modified by Alzheimer's disease status.

Conclusion: Compared to conventional single-voxel-to-single-SNP methods, our approach is more efficient and powerful in selecting the important signals by integrating anatomic and gene grouping structures in the brain and the genome, respectively. It avoids resorting to large number of multiple comparisons while effectively controlling the false discoveries.