Prediction of Alzheimer's disease by integrating local brain-network connectome

Yanming Li

University of Michigan
E-mail: liyanmin@umich.edu

Abstract: A novel approach for Alzheimer's disease (AD) prediction using brain-wide voxel-level imaging scans is presented. The proposed approach significantly improves the AD prediction accuracy by detecting and integrating the local predictive connectomic brain networks. A local predictive brain network contains not only marginally strong voxel signals, but also marginally weak signals in connection with the strong ones. Even though marginally weak signals by themselves exert no prediction effects, but they could exert strong prediction effect when in connection with the marginally strong signals. Marginally weak signals are usually ignored in the conventional brain-wide and voxel-level association or classification studies. The proposed approach detects both the marginally strong and weak signals and uncover their connected networks. The detected local brain network connectome provides biological insights on how the brain pathways attribute to AD development and prognosis.

We applied the approach to the Alzheimer's Disease Neuroimaging Initiative (ADNI) dataset. The proposed approach achieves a prediction accuracy of 96.5%, much higher than that from other contemporary approaches without incorporating the marginally weak features. The proposed approach can be applied to prediction of other cognitive diseases or cancer subtypes using ultrahigh-dimensional imaging or genomic predictors.