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Graphical-model-based multivariate analysis for neuroimaging biomarker detection

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Abstract

One of the central tasks in investigating brain disorders is to detect brain regions that characterize a disease process, and use these brain regions as biomarkers to build diagnostic or prognostic models. The GrAphical-Model-based Multivariate Analysis (GAMMA) suite provides a set of tools to facilitate the neuroimaging biomarker detection. In neuroimaging, each image volume includes thousands of spatial points (voxels) and each voxel is a variable. This is called high-dimensional data. GAMMA uses two techniques to handle the high-dimensional small sample size data. Firstly, GAMMA can group the voxels into brain regions based on their probabilistic association. This step helps to reduce the dimensionality of the variable space. Secondly, GAMMA uses the re-sampling approach to stabilize the model. The rationale is to reduce variability in the model generation process via averaging. GAMMA has the ability to generate stable and models that can be generalized for imaging studies with a million voxels. The models resulting from the GAMMA suite are declarative. This is considered to be an important quality for interpretation. GAMMA has been applied to the differentiation of mild cognitive impairment and normal elderly based on structural MR images, the differentiation of young, normal elderly, and elderly with dementia based on functional MR (fMR) data, and lesion-deficit data for acute stroke patients. The GAMMA suite is released as an open-source Bayesian data mining software on NITRC.

Biography

Chen obtained his PhD in Electrical and Computer Engineering from Washington State University in 2003. He obtained his MS in Translational Research in 2012 from the University of Pennsylvania (UPenn), during which time he won the ITMAT Fellowship. Dr. Chen completed a postdoctoral fellowship in the Radiology department of UPenn from 2004 to 2005. He has worked as a Research Assistant Professor of Radiology at UPenn from 2007 to 2012. He is a tenure-track assistant professor in the Radiology department and co-direction of the biomedical data mining lab, University of Maryland. He has published more than 30 research articles.