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Fusion of Multisubject Imaging Data Using Independent Component Analysis

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The brain is an incredibly complex highly inter-connected organ. As techniques improve and are able to collect images faster, more studies collecting multiple types of imaging information from the same participants are being used to study connectivity in healthy controls and pathological states. However, each existing modality for imaging the living brain can only report upon a limited domain. For example, functional imaging provides information about dynamic blood flow changes in response to a stimulus, whereas electroencephalography (EEG) provides information about the electrical activity of the brain with centimeter spatial and millisecond temporal resolution. Finally, gene array imaging can assess specific differences at the chromosomal level that are present in individuals, some of which have functional consequences. Combining or fusing these two techniques thus has the potential to provide simultaneous higher temporal and high spatial resolution. Even though all three of these modalities can easily be collected on the same set of individuals, methods for effectively combing these different types of information are still in their infancy. The current methods for the task are usually of an integrative nature (based on simple co-registration or using one image type to constrain another) rather than data fusion (incorporating joint interactions among image types). All of these modalities typically involve thousands of data points per subject, and thus simple correlative approaches are of very limited nature for uncovering hidden patterns and associations in these data and can easily be computationally overwhelming. In this update we present a framework for fusing data using independent component analysis (ICA) and demonstrate using EEG and FMRI collected during an auditory oddball task.

Project (or PI) Website

http://www.nrc-iol.org/mialab

Publications

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3. V. D. Calhoun, T. Adali, N. Giuliani, J. J. Pekar, G. D. Pearlson, and K. A. Kiehl, "A Method for Multimodal Analysis of Independent Source Differences in Schizophrenia: Combining Gray Matter Structural and Auditory Oddball Functional Data," Hum. Brain Map., vol. 27, pp. 47-62, 2005.

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