Clustering fMRI meta data to identify significant regions of brain activation.

Meredith Ray[1], Hongmei Zhang[2], and Jian Kang[3]

[1]University of South Carolina, Department of Epidemiology and Biostatistics

[2]University of Memphis, Division of Epidemiology, Biostatistics and Environmental Health

[3]Emory University, Department of Biostatistics and Bioinformatics

We developed a Bayesian clustering method for identifying significant regions of brain activation (foci). Coordinate-based meta data originating from functional magnetic resonance imaging (fMRI), which has the ability to measure the intensity of blood flow and oxygen to a location within the brain that was activated by a given thought or emotion, was of primary interest. FMRI studies have small samples sizes and therefore low testing power and reproducibility, so meta-analyses are implemented to increase the latter. We clustered on two levels, latent foci center and study activation center, with a spatial Poisson point process utilizing the Dirichlet process to describe the distribution of foci. Intensity was modeled as a function of distance between the focus and the center of the cluster of foci using Gaussian kernels. Simulation studies were conducted to evaluate the sensitivity and robustness with respect to cluster identification and underlying data distributions. An additional application of the proposed method modeled meta data of emotion foci. Both simulations and real data application produced promising results that highlighted the ability to correctly cluster.

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