



JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Department of Biostatistics

BIOSTATISTICS SEMINAR

Multiscale Adaptive Smoothing Method for Neuroimaging Data

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ABSTRACT

Neuroimaging studies aim to analyze imaging data with complex spatial patterns in a large number of locations (called voxels) on a two-dimensional (2D) surface or in a 3D volume. We propose various multiscale adaptive smoothing models (MASM) to integrate the spatially adaptive smoothing with statistical modeling at each voxel for spatial and adaptive analysis of neuroimaging data from multiple subjects. MASM has many features: being spatial, being hierarchical, and being adaptive. MASM avoids the difficulty in modeling the complex spatial correlation structure in the existing spatial statistic literature, while it allows to model both long-distance and short distance correlations. We use a multiscale adaptive estimation and testing procedure (MAET) to utilize imaging observations from the neighboring (or long-distance) voxels of the current voxel to adaptively calculate parameter estimates and test statistics. Theoretically, we establish consistency and asymptotic normality of the adaptive parameter estimates and the asymptotic distribution of the adaptive test statistics. Our simulation studies and real data analysis confirm that MASM significantly outperforms conventional analyses of imaging data.

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