Department of Decision Sciences

Statistics Seminar

Spatial Bayesian Latent Factor Regression Modeling of Coordinate-based Meta-analysis Data

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Abstract

Now over 20 years old, functional MRI (fMRI) has a large and growing literature that is best synthesised with meta-analytic tools. As most authors do not share image data, only the peak activation coordinates (foci) reported in the paper are available for Coordinate-based Meta-analysis (CBMA). Neuroimaging meta-analysis is used to 1) identify areas of consistent activation; and 2) build a predictive model of task type or cognitive process for new studies (reverse inference). To simultaneously address these aims, we propose a Bayesian point process hierarchical model for CBMA. We model the foci from each study as a doubly stochastic Poisson process, where the study-specific log intensity function is characterised as a linear combination of a high-dimensional basis set. A sparse representation of the intensities is guaranteed through latent factor modeling of the basis coefficients. Within our framework, it is also possible to account for the effect of study-level covariates (meta-regression), significantly expanding the capabilities of the current neuroimaging meta-analysis methods available. We apply our methodology to synthetic data and a neuroimaging meta-analysis dataset.

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