Estimates and intervals for effect-size of detected regions (clusters) in FMRI experiments

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Abstract: Functional magnetic resonance imaging (fMRI) studies often search for associations between localized brain activity and specific changes in cognition or behavior.

In cluster-wise analysis, the researcher tries to simultaneously (a) group neighbouring voxels that display a strong response to the experiment to a cluster and (b) estimate the strength of the response in the cluster.

However, using the same data for both steps creates a "selective inference" bias, where the observed effect diminishes in validation experiments.

Currently, methods that account for this selection bias focus on testing and do not give estimates or intervals for non-null effects.

In this talk I will present a method that can give both a point estimate and a confidence interval for each region separately, based on the distribution of the data conditional on being selected.

The method uses fast stochastic gradient sampling algorithms to compute the maximum likelihood estimate for the mean effect, and construct a post-selection confidence interval based on a profile likelihood approach.

I will give examples based on simulation and on realistic sets generated from resting-state fMRI recordings from the 1000 Functional Connectomes Project repository.

This is joint work with Amit Meir.