Notizia dell'AFNI

How to Handle Multiple Comparisons in "Connectivity" Analysis?

Poster #: T542

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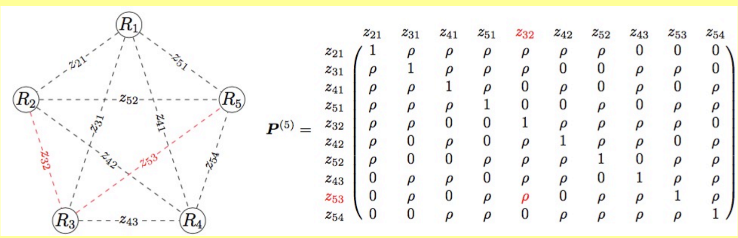
Multiple comparisons in "connectivity" analysis

Data Structure

- Correlation matrices appear in lots of MRI analyses
  - among regions (e.g., anatomical parcellations of subjects)
  - among subjects (inter-subject correlation)
- There is an intricate relatedness among pairs of matrix elements.



Standard approach: massively univariate modeling

- As many models as pairs
- **Assumption**: no information shared across regions and pairs

… and so we then need a penalty for multiplicity

- "Correction" via neighborhood leverage
  - Pair cluster size
  - Permutation

Challenges for this standard approach

- Do we incur an excessive penalty? (→ probably!)
- Do we discriminate against small pair clusters? (→ probably!)
- Is there some arbitrariness: artificial dichotomization? (→ usually!)

Can we do a better job? (→ Definitely!)

Demo dataset #1

Resting-state

- Subjects: n = 41
- Individual level: correlation matrix among m = 16 ROIs

Conventional group analysis

- Element-wise GLM
- Handling multiplicity: NBS, CONN, FSLnets, GIFT

Demo dataset #2

Naturalistic scanning

- Subjects: n = 68
- 2278 ISC matrices at m = 268 ROIs
- Variables: SRS (Social Responsiveness Scale-2), Age, and Sex

Conventional group analysis

- Whole brain voxel-wise LME
- Handling multiplicity: clustering

References

Chen et al., 2019. An Integrative Approach to Matrix-Based Analyses in Neuroimaging. Human Brain Mapping. In press. doi: https://doi.org/10.1101/459545

Chen et al., 2019. Untangling the Relatedness among Correlations, Part III: Extending Model Capabilities of Inter-Subject Correlation Analysis for Naturalistic Scanning. Under review.

New approach: dissolving multiplicity

Use one model to integrate everything

- Bayesian multilevel (**BML**) modeling

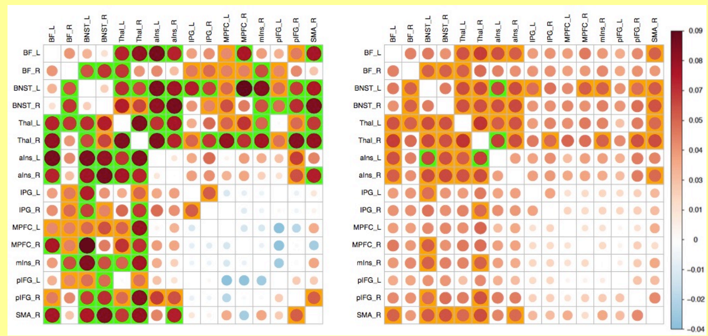
$$z_{ijk} = b_0 + \xi_i + \xi_j + \eta_{ij} + \zeta_{ik} + \zeta_{jk} + \pi_k + \epsilon_{ijk}, \quad i,j = 1,2,...,m \ (i \neq j), k = 1,2,...,n$$

- Assumption: Gaussian distribution across regions or subjects

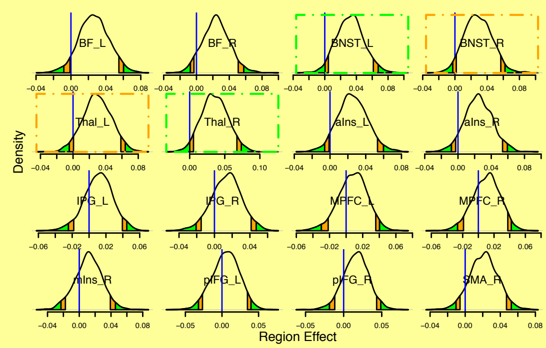
BML applied to dataset #1: correlation matrix

- Region pair modeling

GLM (and none survives correction) BML (no extra correction needed!)

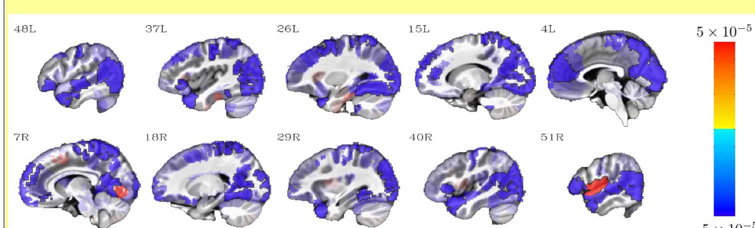


- Regional Posterior Distributions

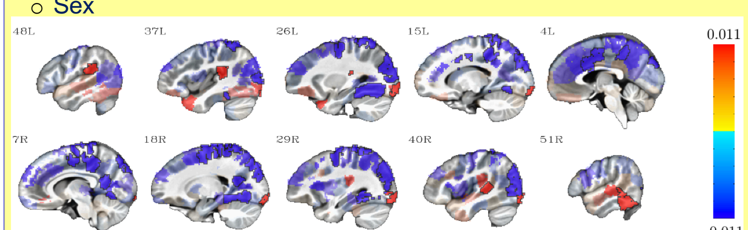


BML applied to dataset #2: ISC data

- SRS



- Sex



This new approach/program available in AFNI: MBA (= "matrix-based analysis")

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