**Introduction**

Functional MRI activation studies compare activation patterns across groups by accounting for all sources of variability including intra-subject and inter-subject variability using random effects test statistics. Recent interest in studying the networks of brain activation has led to a plethora of studies comparing edges, nodes, and community network structures across groups. Unfortunately, current approaches to testing network features ignore the fact that network effects test statistics. Recent interest in studying the networks of brain activation has led to a plethora of studies comparing edges, nodes, and community network structures across groups. Unfortunately, current approaches to testing network features ignore the fact that network effects test statistics.

**Objectives & Motivation**

**Objectives:** Two Group Comparisons of Graph Topological Features

- **Edge Level:** Does a single edge test suffice to test for differences in edge structure between two groups?

- **Node Level:** Does a node have differential connectivity compared to the control group?

- **Community Level:** Do different subjects belong to different communities?

- **Result:** The graph testing framework is inadequate.

**Results:** Using Novel Statistical Framework to Account for All Sources of Uncertainty in Multi-Subject Network Estimates

**Markov Networks for Functional Connectivity**

- **Graphical Model Estimation and Model Selection:**
  - PH: Partial Correlation: Covariance
  - HI: High-dimensional statistical networks
  - GD: Graphical Lasso

- **Graphical Model Estimation and Model Selection:**
  - PH: Partial Correlation: Covariance
  - HI: High-dimensional statistical networks
  - GD: Graphical Lasso

- **Motivation:** The standard hypothesis testing framework is inadequate.

- **Objective:** The goal is to find differences in edge structure between two groups.

**Results:** Using Novel Statistical Framework to Account for All Sources of Uncertainty in Multi-Subject Network Estimates

**Resampling:** Rebooting bootstrap based on resampling and second effects test statistics.

**Randomization:** In high dimensions and for selected network features such as edges, randomize sparse penalty parameter for each resampling to reduce graph selection bias and variability.

**Differential Testing:** Random effects test statistics for every network feature such that it incorporates both intra-subject variability and inter-subject variability.

**Conclusion:**

- A novel framework is presented for accurately identifying functional network differences between groups.

- The framework is demonstrated on real and simulated data, showing improved power and accuracy compared to existing methods.

- The framework provides a robust and flexible approach for studying network differences in brain activation.

**References:**


**Images:**

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**Abstract:**

The aim of this study was to develop a novel framework for accurately identifying functional network differences between groups. The framework is demonstrated on real and simulated data, showing improved power and accuracy compared to existing methods. The framework provides a robust and flexible approach for studying network differences in brain activation.

- A novel framework is presented for accurately identifying functional network differences between groups.

- The framework is demonstrated on real and simulated data, showing improved power and accuracy compared to existing methods.

- The framework provides a robust and flexible approach for studying network differences in brain activation.

**Keywords:**

- Functional MRI
- Network analysis
- Graphical models
- Resampling
- Randomization

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