A multivariate approach to analyze connectivity matrices with individual-specific parcellation

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1. Introduction

Background

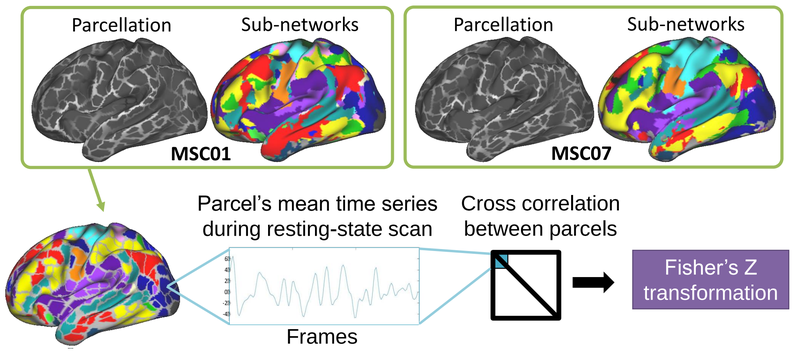
- Recent work in resting-state *f*MRI (rs*f*MRI) analysis can derive subject-specific parcellations and sub-networks.
- Standard approaches for rs*f*MRI:
  - **Graph/network analysis** accommodates different numbers of parcels/sub-networks.
    - Requires correction for multiple comparisons when examining sub-networks.
  - **Multivariate analysis** (e.g., MDS, DISTATIS) requires the same number of parcels/sub-networks.
    - Usually achieved by using a shared template.
    - Biases against individuals that vary greater from the target template.
- The above issues from standard approaches are particularly problematic for studies involving subjects that exhibit larger variance in brain structure and function (e.g., elderly, lesion patients, children).

Aim

To develop a new multivariate technique that allows different numbers of parcels and sub-networks.

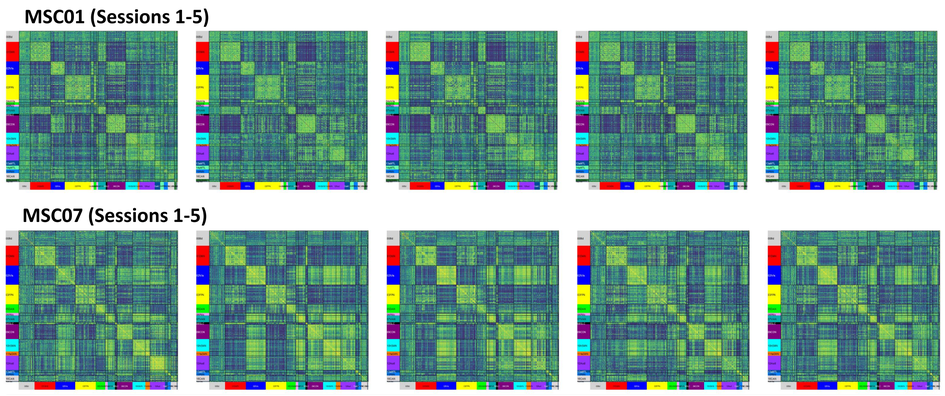
2. Resting-state data set

- **Midnight Scan Club (MSC; Gordon et al, 2017)**
  - Resting-state *f*MRI (30 minutes)
  - 10 participants x 10 sessions
  - Subject-specific parcellations and sub-networks

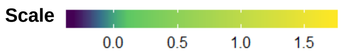


- Extract time series and create correlation matrix for each session of each subject

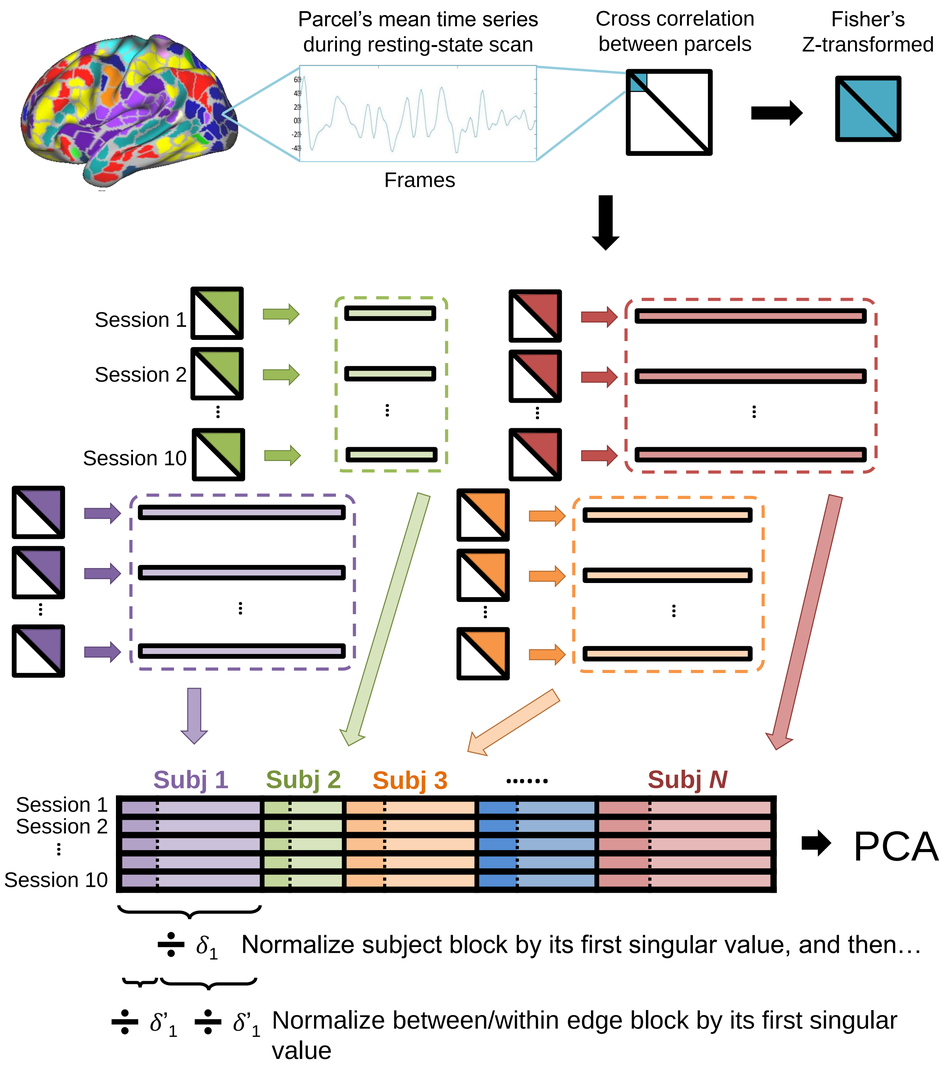
3. Examples of connectivity matrices



- Common networks across participants were selected for the analysis.
- Negative and perfect *z*-transformed correlations were excluded from further analysis.



4. Hierarchical multiple factor analysis



- Each participant contributes equal amount of variance to the first component.
- Between- and within-network connectivity of each participant also contribute equal amount of variance to the first component.

5. Simulations

- **Sessions selection**
  - 4 sessions from MSC were kept
  - Only the second and the fourth sessions were simulated
- **Simulating aging effect**
  - Decreased within DMN
  - Increase between DMN and FPN
  - Increase between DMN and DAN

6. Results