A multivariate resting-state fMRI technique for subject-specific parcels and sub-networks



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1. Introduction

Background

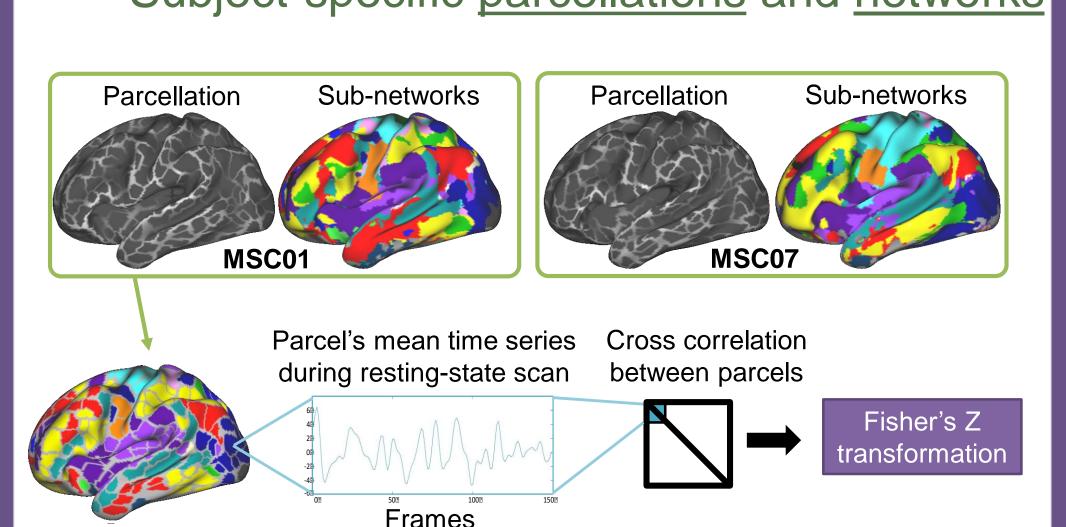
- Recent work in resting-state fMRI (rsfMRI) analysis can derive subject-specific parcellations and sub-networks.
- Standard approaches for rsfMRI:
- Graph/network analysis accommodates different number of parcels/sub-networks, but requires correction for multiple comparisons when examining subnetworks.
- Multivariate analysis (e.g., MDS, DISTATIS) requires same number of parcels/sub-networks
 - Usually achieved by using a shared template
 - Biases against individuals that varies 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

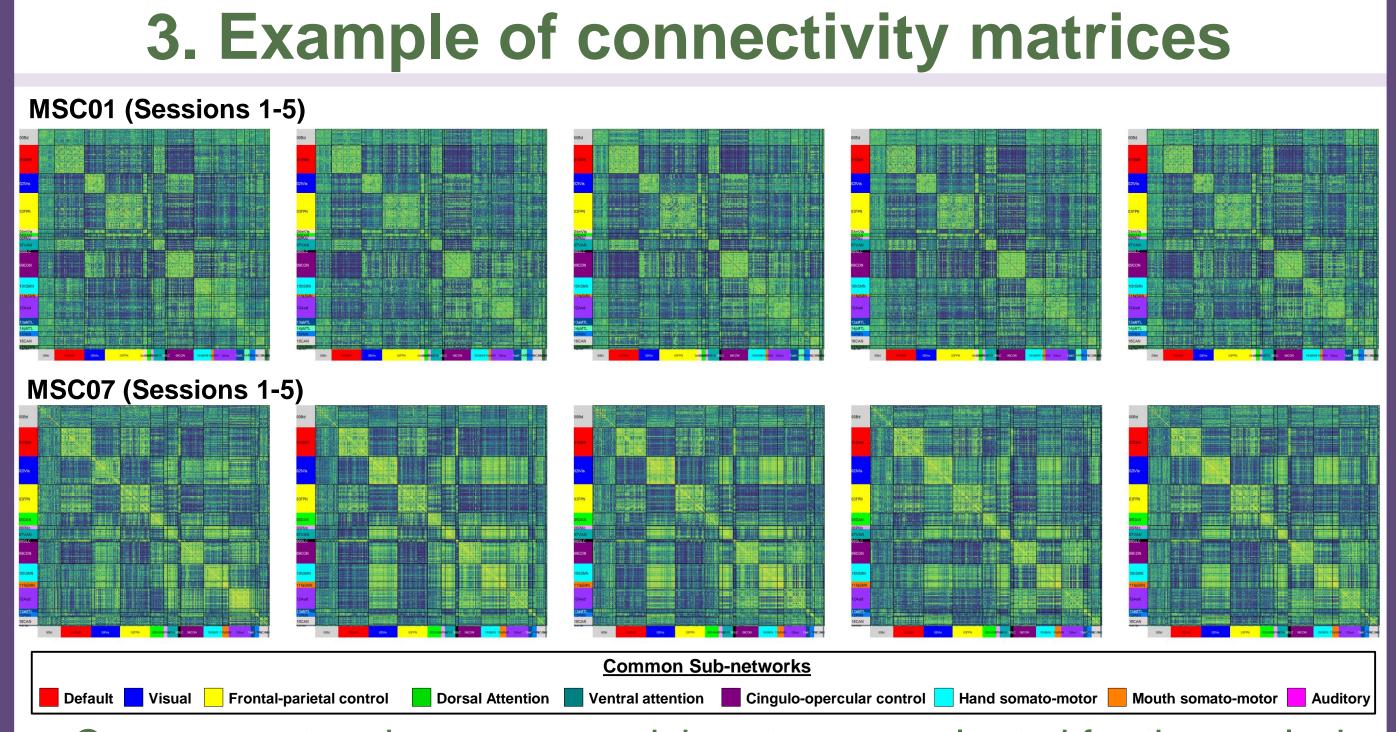
To develop a new multivariate technique that allows different numbers of parcels/sub-networks.

2. Resting-state data set

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



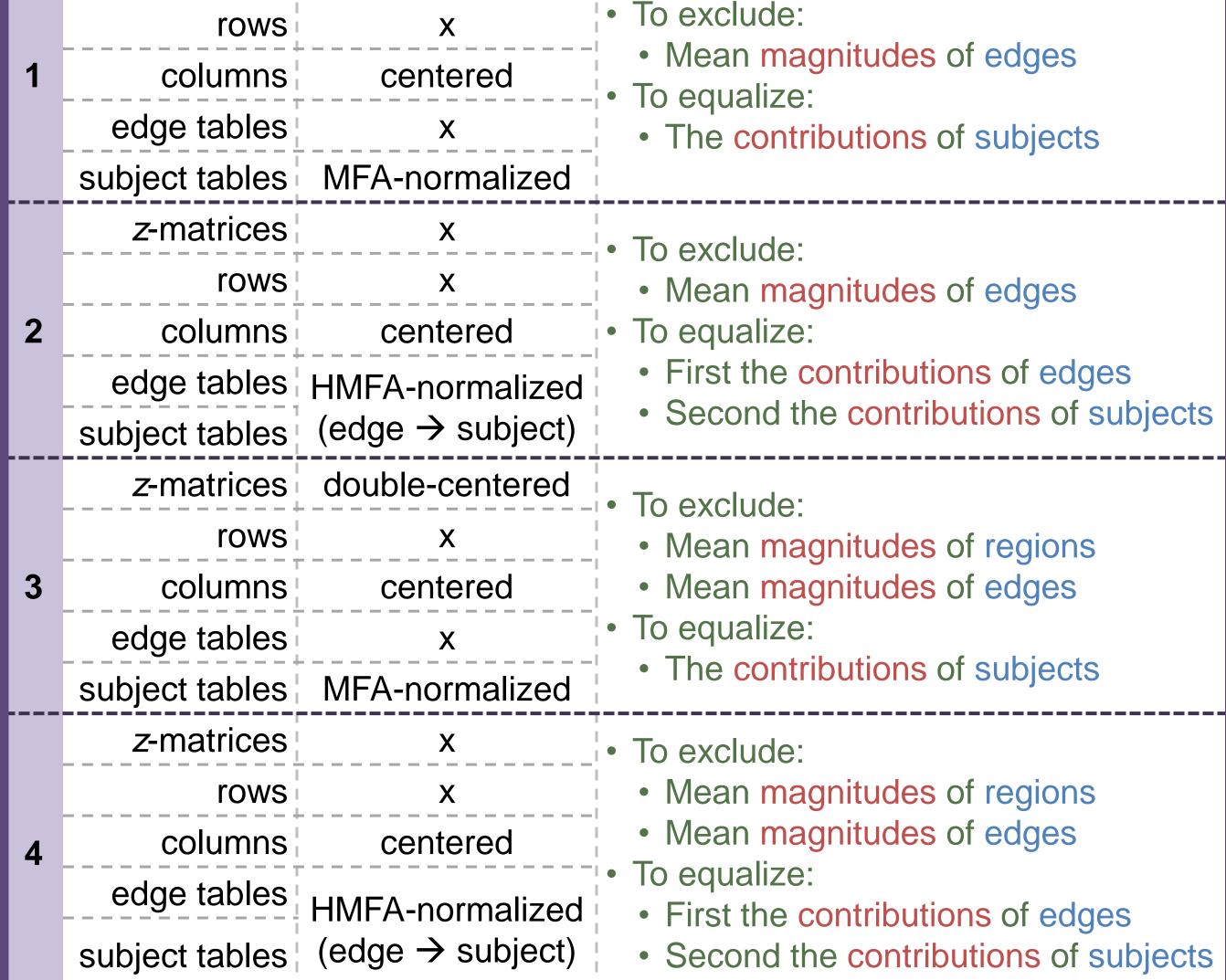
Extract time series and create correlation matrix for each session of each subject.



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

4. Proposed method Centering: exclude the effect of magnitudes Normalization: exclude units MFA-normalization: equalize contributions to the first component Double-centering the z matrix: exclude the magnitudes of regions Preprocessed Subj N SVD

5. Choices of preprocessing steps **Dimensions** Preprocessing *z*-matrices To exclude: Mean magnitudes of edges To equalize: edge tables The contributions of subjects subject tables MFA-normalized z-matrices Mean magnitudes of edges To equalize: centered First the contributions of edges edge tables | HMFA-normalized Second the contributions of subjects subject tables (edge → subject) z-matrices double-centered



Justifications and thoughts

- Normalizations were not applied to rows or columns because their units are the same.
- The rows were unprocessed because we want to apply this technique to the data where the differences in both magnitudes and variances of rows are of interest.
- The choices of the preprocessing steps should be optional and decided based on the research question.

