Inferring Functional Connectivity in fMRI data

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36-757 ADA I

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Outline

1. Data
2. Goals
3. Methods

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1. Data - multiple views
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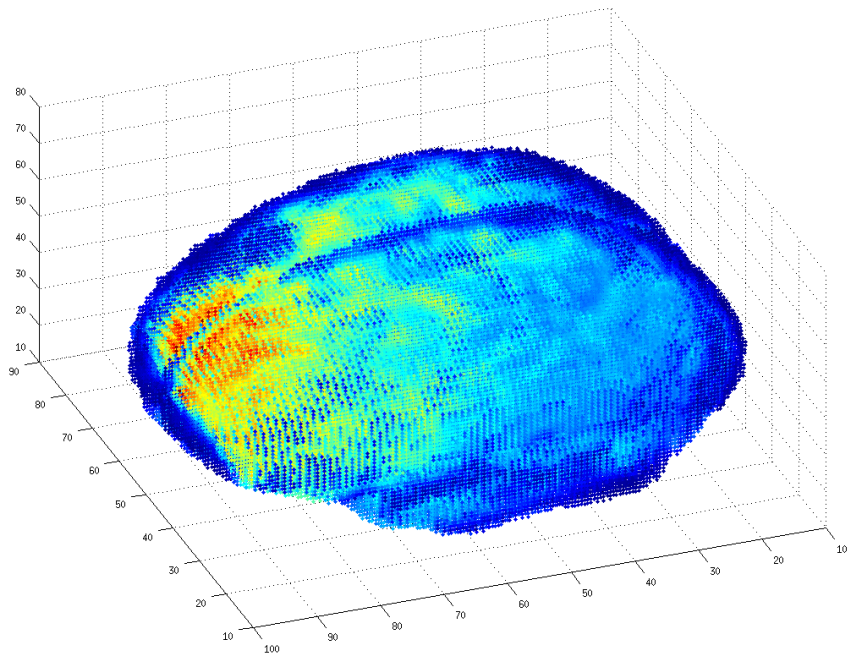
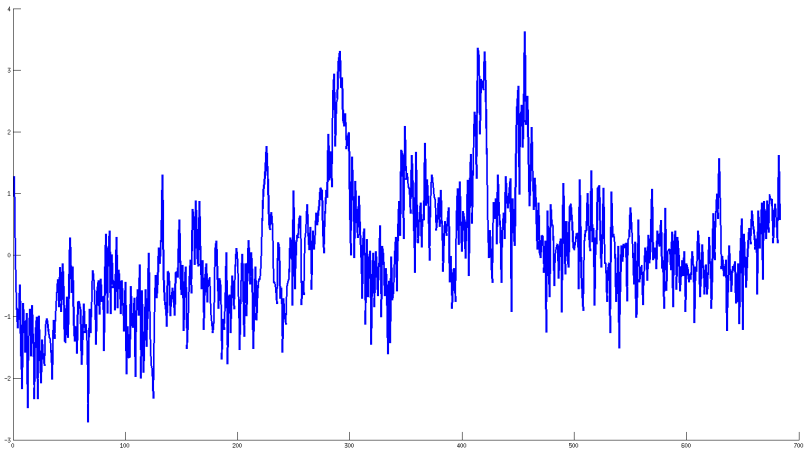
Local Brain Activity View



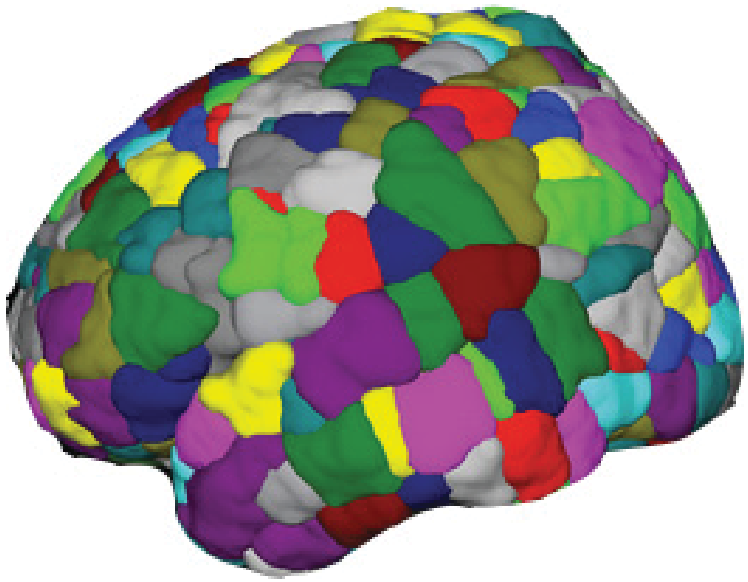
Each time frame is a snapshot of $V \approx 1.6 \times 10^5$ voxel activities.

Time Series View



Each voxel is 683 point time series.

Brain Parcellation



Parcellate to reduce dimension ($R = 600$).

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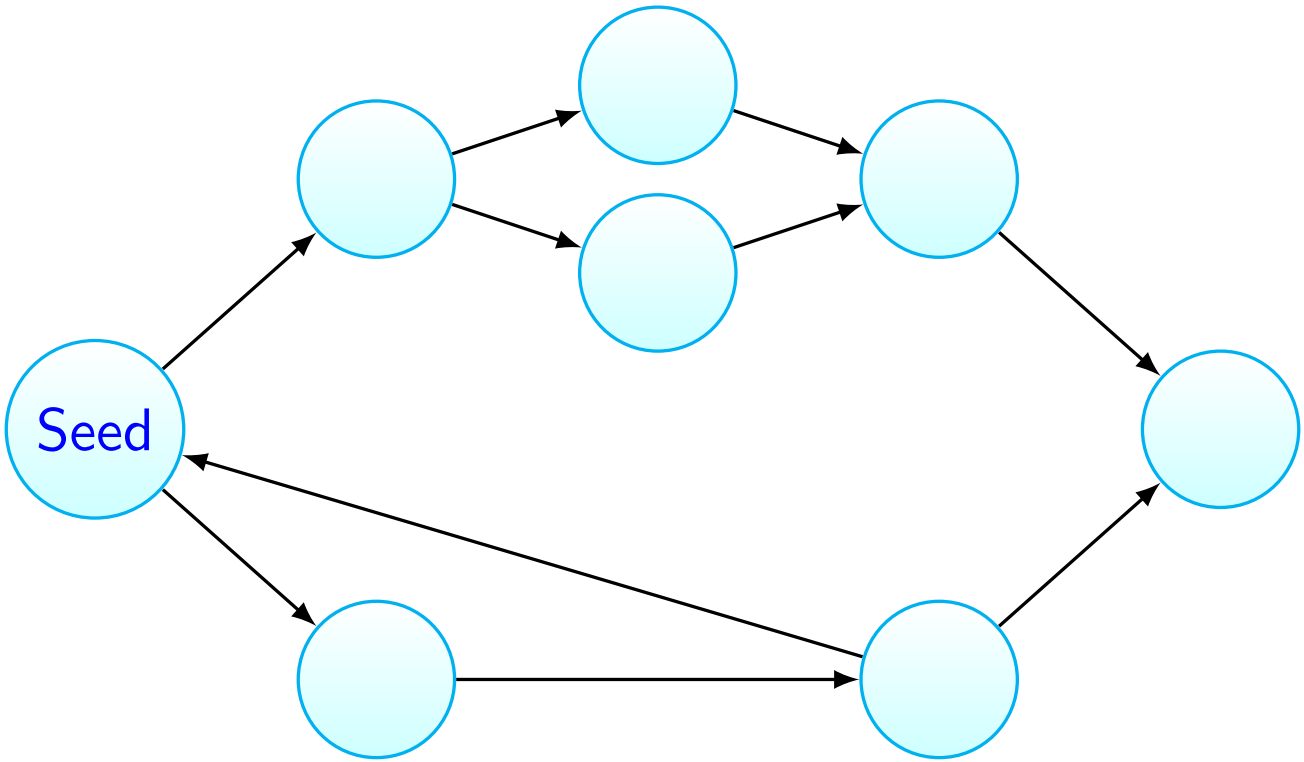
Higher-Order Connectivity and Information Flow

Want to test for (conditional) dependence between voxels



Goals

- Want to evaluate methods for inferring functional connectivity
  - "whole-brain" (high-dimensional) context
  - account for vascular anatomy
  - Want to distinguish higher-order (indirect) connectivity

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Statistical Methods

1. Time Series Methods
   - Granger Causality/Transfer Entropy

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2. Sparse Prediction Methods
   - Lasso/Elastic Net, FuSSO

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1. Time Series Methods
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2. Sparse Prediction Methods
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3. Graphical Model Learning Methods
   - Chow-Liu/PC algorithms with novel independence tests

Thanks!

Questions?