Growth Charting of Brain Connectivity Networks and the Identification of Attention Impairment in Youth

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Outline

Motivation

Pediatric Growth Charts

- Long history for height, weight, etc

Intrinsic Connectivity Networks

- Attention & ADHD connection
- DMN vs TPN balance

Background

Focus today: processing pipeline, modeling, and analysis

Sample

- Philadelphia Neurodevelopmental Cohort
- Resting state fMRI
- Penn Continuous Performance Task
- N = 519 (after QC & exclusions)

Task: PCPT

- Penn Continuous Performance Test
- 180 trials
- 1s to respond
- "Go" on digit/letter (varies by phase)
- Measure: Acc (as %age)

Clinical Interview

MRI Measures

- T1-weighted image (structural contrast)
- Resting State fMRI

Standard fMRI Prepocessing

1. Slice-time Correction
2. Motion Correction
3. Normalization
4. Smoothing

Slice-time Correction

- Each fMRI volume is acquired sequentially in slices
- Volume not acquired simultaneously
- Correct (through interpolation) s.t. all slices w/in volume temporally aligned

Motion Correction

- Participants move their head over the scan

Normalization

Smoothing

Preprocessing & Connectome Generation

Preprocessing

- Linearly detrended
- COMPCor
- Bandpass Filtering
- Motion Scrubbing

Connectome Generation

- Isomorphic grid
- 12mm spacing
-
- 1068 Regions of Interest (ROIs)

Data Cleansing

α

$a^2 = b$

Preprocessing & Connectome Generation

Independent Components Analysis

Network Growth Charting Analyses

Network Growth Charting to Predict Task Accuracy

Shifting DMN-TPN Architecture Among Maturing Components

Shallow vs Lagged Dysmaturation and Task Accuracy

Biomarker of Attention Dysfunction from Network Growth Charting

Biomarker of ADHD from Network Growth Charting

Unraveling miswired connectomes

ICN interplay

Dysmaturation Predicts Dysfunction

Differential Dysmaturation

Conclusions

Brain network growth charting predicts attention functioning.