Testing the use of fingerprinting-informed pipelines to enhance brain-behaviour predictions

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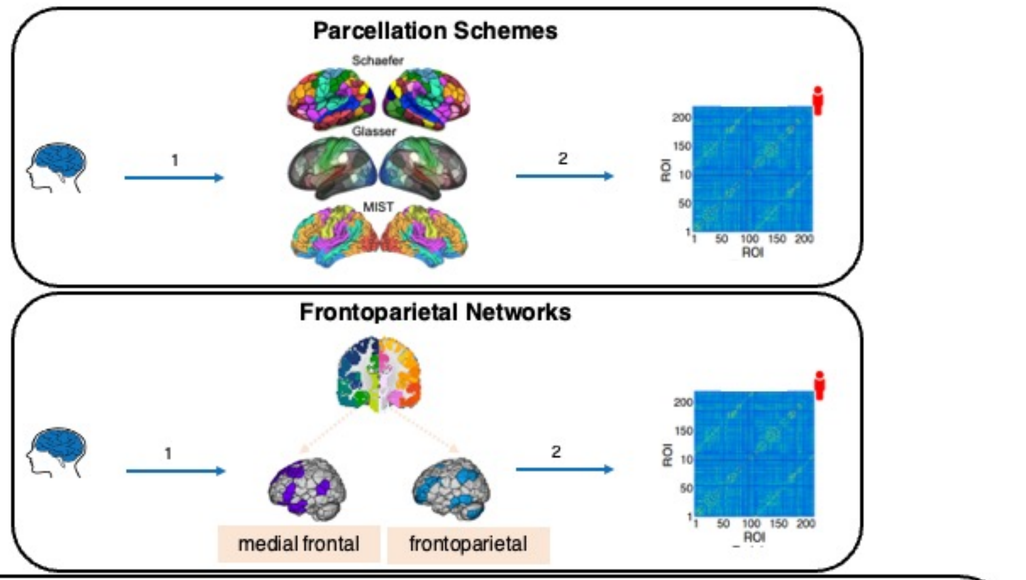
BACKGROUND

- Individual differences in functional connectivity (FC) patterns which are unique and stable like a "fingerprint", have shown to predict individual differences in behaviour[1,2].
- We build on prior work in which we identified pre-/post-processing factors (See Methods) that improved connectome fingerprint-based identification and reduced the number of participants excluded from FC-based analyses due to excessive motion by assessing whether the same factors can boost the robustness of brain-behaviour relationships.
- **To assess whether factors such as (1) dimensionality of parcellation schemes, (2) inclusion of cortical vs. subcortical regions, and (3) motion exclusion strategies such as scrubbing[3] and bagging[4,5] improve the predictive power of connectome-based predictive modelling (CPM) for the brain-behaviour relationships of age, general psychopathology [CBCL], and intellectual ability [FSIQ] in developing youths derived from the Healthy Brain Network[6].**

METHODS

- **Participants:** *N* = 540 Healthy Brain Network participants (198 F, 6-21yrs, M = 10.7±3yrs).
- **MRI data:** Siemens 3T Prisma scanner. T1-w MPRAGE (0.8 x 0.8 x 0.8 mm^3; 224 sagittal slices, TR = 2500 ms, TE = 3.15 ms, flip angle = 8°) and resting-state fMRI (EPI) data (60 slices; 2.4 x 2.4 x 2.4 mm^3, TR = 800 ms, TE = 30 ms, flip angle = 31°) were analysed.
- **Preprocessing:** Motion correction, grand mean scaling, linear & quadratic detrending, 36P confound regression (including GSR), spatial smoothing with σ = 6 mm, temporal filtering (0.009-0.1Hz). High-motion participants were defined as those with mean msFD[7] > 0.2 mm.



RESULTS

2. Baseline connectome-based predictive modelling of age, CBCL & FSIQ

- Baseline CPM were predictive of age [POS: r = 0.61, p < 0.001; NEG: r = 0.57, p < 0.001], CBCL [POS: r = 0.16, p = 0.019], and FSIQ [POS: r = 0.16, p = 0.027].

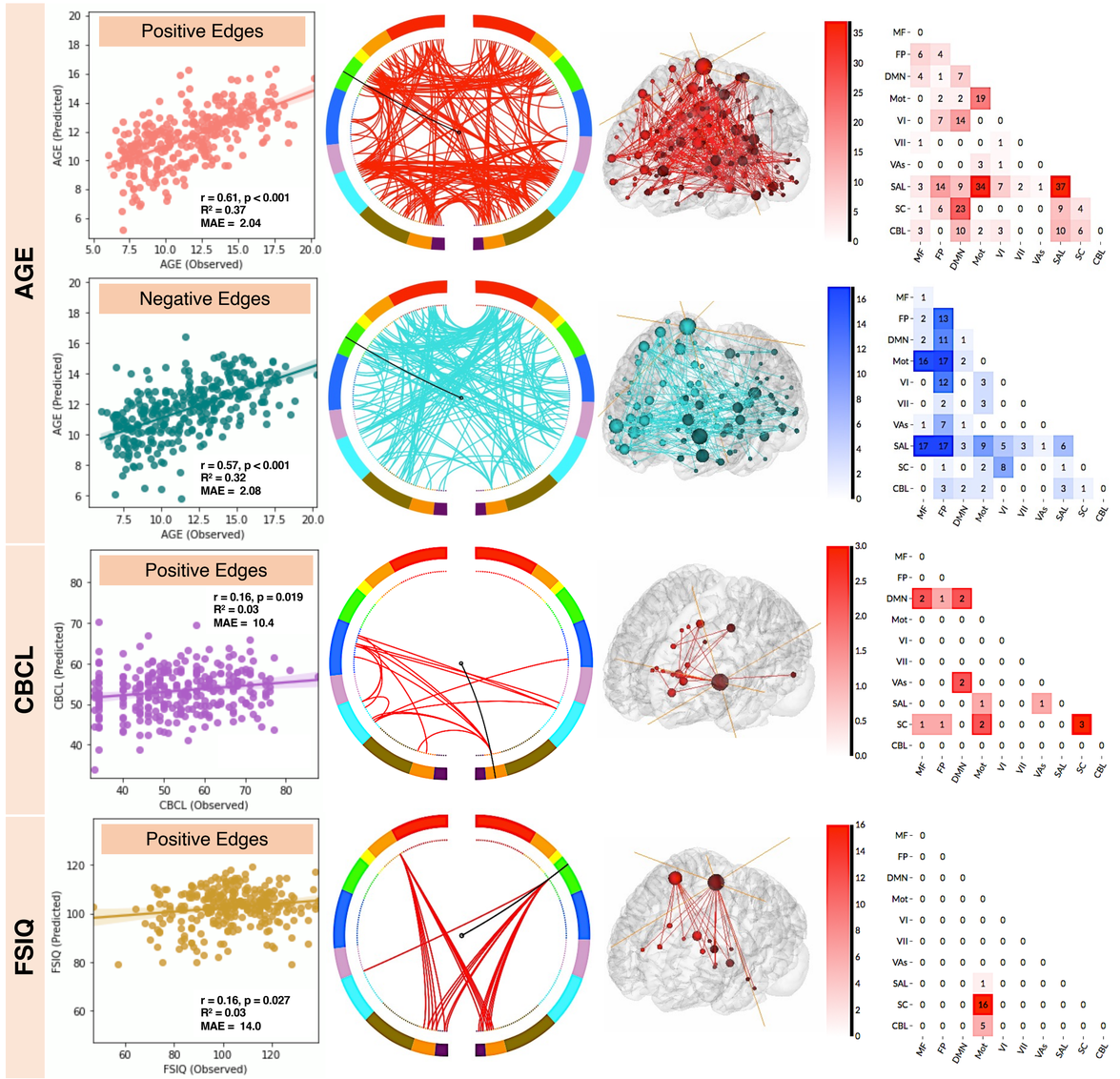


Fig. 2. Baseline CPM-based predictions of age, general psychopathology [CBCL], and intellectual ability [FSIQ]. The edge consistencies and contributions of the networks in predicting the behaviours are summarised using a 10-node definition[1].

3. Methodological implications on fingerprinting accuracy and CPM

- The relationships between observed and predicted behavioural phenotypes were maintained across several parcellation schemes and head motion mitigation strategies