***Extended Data Table 1-1. Pseudo-code for linear SC-to-FC completion***

**algorithm** linear SC-to-FC completion **is**

**external input:** empirical SC (SCemp)

**output:** linear virtual FC (FCSLM)

**fixed parameters:** noise level (), guess for optimal G (G\*ref)

**begin**

1. Evaluate the covariance matrix C from SCemp based on SLM theory for different range of G
2. Choose G\* as a G which rise to maximum correlation between FCemp and FCSLM for each subject
3. Choose G\*ref as the median of G\* for all subjects
4. Re-evaluate the covariance Matrix C for G\*ref

**return** FCSLM = C

**end**

***Extended Data Table 2-1. Pseudo-code for linear FC-to-SC completion***

**algorithm** linear FC-to-SC completion **is**

**external input:** empirical FC (FCemp)

**output:** linear virtual SC (SCSLM)

**fixed parameters:** noise level (), guess for optimal G (G\*ref)

**begin**

1. Evaluate the inverse matrix C-1 from FCemp
2. Build a matrix S proportional to C-1 according to SLM theory and drop its diagonal

**return** SCSLM = S

**end**

**Extended Data Table 3-1. Discriminating control and patient subjects in the ADNI subset with only SC connectomes.**

|  |  |  |  |
| --- | --- | --- | --- |
| *Tested on* | SCemp | FCMFM | SCbiMFM |
| *Trained on* |
| SCemp | 0.69 *[0.61 < AUC < 0.74]* | n.s. | 0.55 *[0.51 < AUC < 0.60]* |
| FCMFM | 0.54 *[0.50 < AUC < 0.59]* | 0.64 *[0.57 < AUC < 0.69]* | 0.62 *[0.54 < AUC < 0.68]* |
| SCbiMFM | 0.56 *[0.51 < AUC < 0.62]* | 0.62 *[0.53 < AUC < 0.68]* | 0.59 *[0.52 < AUC < 0.64]* |

*Indicated values are median and 5% and 95% percentiles over crossvalidation replicas of the indicated classification.*

**Extended Data Table 3-2. Discriminating control and patient subjects in the ADNI subset with only FC connectomes.**

|  |  |  |  |
| --- | --- | --- | --- |
| *Tested on* | FCemp | SCMFM | FCbiMFM |
| *Trained on* |
| FCemp | 0.75 *[0.70 < AUC < 0.79]* | 0.71 *[0.65 < AUC < 0.79]* | 0.65 *[0.58 < AUC < 0.71]* |
| SCMFM | 0.69 *[0.61 < AUC < 0.75]* | 0.73 *[0.67 < AUC < 0.78]* | 0.55 *[0.50 < AUC < 0.61]* |
| FCbiMFM | 0.70 *[0.65 < AUC < 0.76]* | n.s. | n.s. |

*Indicated values are median and 5% and 95% percentiles over crossvalidation replicas of the indicated classification.*

**Extended Data Table 5-1. Inter-subject distances for empirical – bivirtual pairs.**

|  |  |  |  |
| --- | --- | --- | --- |
| Type of completion | | Inter-distance correlation | |
| ADNI | Healthy aging |
| SCemp to SCemp vs | SCbiSLM to SCbiSLM | 0.39\*\*\* [0.37, 0.41] | 0.81\*\*\* [0.79, 0.83] |
| SCbiMFM to SCbiMFM | 0.39\*\*\* [0.36, 0.43] | 0.53\*\*\* [0.48, 0.57] |
| FCemp to FCemp vs | FCbiSLM to FCbiSLM | 0.06\*\*\* [0.5, 0.8] | 0.55\*\*\* [0.50, 0.58] |
| FCbiMFM to FCbiMFM | 0.43\*\*\* [0.42, 0.44] | 0.40\*\*\* [0.36, 0.44] |

*Indicated values are median and 5% and 95% percentiles over bootstrap with replacement replicas of correlation computation*