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1 METHODS

For each Functional connectivity metric, two network measures of centrality have been implemented: the Strength and the Betweenness centrality. The former is the weighted variant of the Degree and it is defined for each node as the sum of all neighboring link weights [A].

Weighted degree of a node i,

$$k_i^w = \sum_{j \in n} w_{ij}$$

The latter is defined as the fraction of all the shortest paths in the network that pass through a node[A].

Betweenness centrality of node i (e.g., Freeman, 1978)[B],

$$b_i = \frac{1}{(n-1)(n-2)} \sum_{h,j \in N, h \neq j, h \neq i, j \neq i} \frac{\rho_{hj}(i)}{\rho_{hj}},$$

where ρ_{hj} is the number of shortest paths between h and j, and $\rho_{hj}(i)$ is the number of shortest paths between h and j that pass through i

Furthermore, the functional integration of the networks has been estimated with the global efficiency (Latora and Marchiori, 2001)[C], defined as the average inverse shortest path length [A].

$$E^w = \frac{1}{n} \sum_{i \in N} E_i = \frac{1}{n} \sum_{i \in N} \frac{\sum_{j \in N, j \neq i} (d_{ij}^w)^{-1}}{n-1}$$

where E_i is the efficiency of node i.

Moreover, the small world properties of the networks have been investigated with the Small-Worldness (Humphries and Gurney, 2008)[D] and with an alternative version proposed by Muldoon et al. [E].

Small-Worldness:

$$S = \frac{C/C_{rand}}{L/L_{rand}},$$

where C and C_{rand} are the clustering coefficients, and L and L_{rand} are the characteristic path lengths of the respective tested network and a random network.

Small-World propensity:

$$SWP = 1 - \sqrt{\frac{\Delta_C^2 + \Delta_L^2}{2}}$$

The ratios Δ_C and Δ_L represent the fractional deviation of the metric (C_{obs} or L_{obs}) from its respective null model (a lattice or random network).

Finally, a normalized version of Strength and Global efficiency has been performed, dividing the original metric with one obtained from a random network (which preserves weight, degree and strength distributions of the original) and iterating the process 100 times for each subject.

2 References

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[C] Latora, V., & Marchiori, M. (2001). Efficient behavior of small-world networks. Physical review letters, 87(19), 198701.

[D] Humphries, M. D., & Gurney, K. (2008). Network 'small-world-ness': a quantitative method for determining canonical network equivalence. PloS one, 3(4), e0002051.

[E] Muldoon, S. F., Bridgeford, E. W., & Bassett, D. S. (2016). Small-world propensity and weighted brain networks. Scientific reports, 6, 22057.