Making a network from fMRI data: Always a small-world with correlations

Lourens Waldorp*†[1], Verena Schmittmann[2], Sara Jahfari[2], and Denny Borsboom[2]

[1]Department of Psychological Methods, University of Amsterdam (UvA) – Weesperplein 4 Amsterdam, Netherlands

[2]Department of Psychological Methods, University of Amsterdam (UvA) – Weesperplein 4 Amsterdam, Netherlands

Abstract

Connectivity measures of large-scale networks of the brain can reveal many interesting features like which brains are efficient and therefore lead to high IQ. These results often rely on a network constructed from time series of functional magnetic resonance imaging (fMRI). A network is obtained from pairwise correlations between regions (or voxels) and a connection between two regions is set if the absolute correlation is higher than a chosen threshold. From this network average pathlength, degree distribution, small-worldness, and other measures can be computed. In this presentation we will show that using pairwise correlations to determine the network nearly always results in a small-world, even if the underlying network is not a small-world. The obvious reason is that using correlations to determine connections yields many spurious connections. Spurious connections can be avoided by using partial correlations. In large-scale networks, however, the partial correlations are difficult to obtain. We compare three different methods to determine the partial correlation network. Partial correlations partially solve the issue: when hubs are present in the network any method fails to be highly accurate.

*Speaker

†Corresponding author: waldorp@uva.nl