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**Correlation between graphs with an application to brain network analysis.** (English)

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Summary: The global functional brain network (graph) is more suitable for characterizing brain states than local analysis of the connectivity of brain regions. Therefore, graph-theoretic approaches are natural methods to use for studying the brain. However, conventional graph theoretical analyses are limited due to the lack of formal statistical methods of estimation and inference. For example, the concept of correlation between two vectors of graphs has not yet been defined. Thus, the introduction of a notion of correlation between graphs becomes necessary to better understand how brain sub-networks interact. To develop a framework to infer correlation between graphs, one may assume that they are generated by models and that the parameters of the models are the random variables. Then, it is possible to define that two graphs are independent when the random variables representing their parameters are independent. In the real world, however, the model is rarely known, and consequently, the parameters cannot be estimated. By analyzing the graph spectrum, it is shown that the spectral radius is highly associated with the parameters of the graph model. Based on this, a framework for correlation inference between graphs is constructed and the approach illustrated on functional magnetic resonance imaging data on 814 subjects comprising 529 controls and 285 individuals diagnosed with autism spectrum disorder (ASD). Results show that correlations between the default-mode and control, default-mode and somatomotor, and default-mode and visual sub-networks are higher in individuals with ASD than in the controls.

**MSC:**

62 Statistics

**Keywords:**

network; correlation; fMRI; functional brain network; autism

**Software:**

GENREG

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