Spectral Distance between Complex Networks using Graph Laplacians

Marina Herrera Sarrias[*]

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Abstract

In nature, there exist many complex networks with structures representing real system interactions and dynamics. Over the last two decades, the study and use of complex networks have extensively increased in many fields, such as biology, meteorology, neuroscience, and social studies. In order to establish a comparison between complex networks, a distance measure capturing the network structural differences has to be established. Many different distance measures, such as, the *Hamming distance*, have been proposed, although it is worth noting that most of them focus on comparing the number of nodes and edges between graphs rather than the structure and dynamics of the network. Amongst the research already initiated in the context of spectral similarity measures, Shimada *et al.* (2016), introduced in their paper "Graph distance for complex networks" a new graph distance called the *spectral graph distance* (SGD), defined in terms of the unnormalized graph Laplacian along with its associated eigenvectors. This thesis will investigate the statistical properties related to the spectral graph distance, both theoretically and by using simulated graphs. An overview of related topics in graph theory and network theory will also be presented.

[*]Postal address: Mathematical Statistics, Stockholm University, SE-106 91, Sweden.
E-mail: marina.sarrias@gmail.com. Supervisor: Chun-Biu Li.