Sparse and modular networks using exchangeable random measures[*]

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Abstract

Statistical network modeling has focused on representing the graph as a discrete structure, namely the adjacency matrix, and considering the exchangeability of this array. In such cases, it is well known that the graph is necessarily either dense (the number of edges scales quadratically with the number of nodes) or trivially empty. Here, we instead consider representing the graph as a measure on the plane. For the associated definition of exchangeability, we rely on the Kallenberg representation theorem (Kallenberg, 1990). For certain choices of such exchangeable random measures underlying the graph construction, the network process is sparse with power-law degree distribution, and can accommodate an overlapping block-structure. I then present a Markov chain Monte Carlo algorithm for efficient exploration of the posterior distribution and demonstrate that we are able to recover the structure of a range of networks graphs ranging from dense to sparse based on our flexible formulation.

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http://arxiv.org/abs/1401.1137
http://arxiv.org/abs/1602.02114