

Discovering underlying dynamics in time series of networks

Carey Priebe

Johns Hopkins University

Abstract:

We study a model for time series of networks where the generating mechanism for the underlying latent positions exhibit low-dimensional manifold structure under a suitable notion of distance. This distance can then be approximated by a measure of separation between the networks themselves. When a Euclidean realization of this distance exists, we can find consistent Euclidean representations for the underlying network distributions at any given time. This permits the visualization of network evolution over time, which yields a flow in Euclidean space. Moreover, it transforms important network inference questions, such as change-point and anomaly detection, into a more classically familiar setting and reveals underlying temporal dynamics of the network. We illustrate our methodology with simulated and real data examples, and in the latter case, we are able to precisely formulate and identify a change point, corresponding to a massive shift in pandemic policy, in a communication network of a large organization.