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Recovering networks from distance data

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Abstract A fully probabilistic approach to reconstructing Gaussian graphical models from distance data is presented. The main idea is to extend the usual central Wishart model in traditional methods to using a likelihood depending only on pairwise distances, thus being independent of geometric assumptions about the underlying Euclidean space. This extension has two advantages: the model becomes invariant against potential bias terms in the measurements, and can be used in situations which on input use a kernel- or distance matrix, without requiring direct access to the underlying vectors. The latter aspect opens up a huge new application field for Gaussian graphical models, as network reconstruction is now possible from any Mercer kernel, be it on graphs, strings, probabilities or more complex objects. We combine this likelihood with a suitable prior to enable Bayesian network inference. We present an efficient MCMC sampler for this model and discuss the estimation of module networks. Experiments depict the high quality and usefulness of the inferred networks.

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