Gaussian DAG models with symmetries

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Abstract

A Gaussian DAG model is a family of multivariate normal distributions where the zero elements of the modified Cholesky matrix, the triangular matrix obtained by the Cholesky decomposition of the covariance matrix, are determined by a directed acyclic graph (DAG). In this talk, we introduce a new subclass of Gaussian DAG models by imposing further restrictions on the elements of the Cholesky matrix, resulting in more parsimonious models with much fewer parameters. This research is motivated by the work of Lauritzen and Højsgaard, which introduced undirected graphical Gaussian models with edge and vertex symmetries. We will explain how color graphs naturally represent these restricted DAG models and discuss the estimation problem. We will focus on the maximum likelihood estimation of the parameters. Estimating parameters for these models presents several challenges due to the additional constraints imposed by the color graphs. One significant difficulty is ensuring that the restrictions are appropriately incorporated into the estimation process, which can complicate the optimization algorithms used.