

Elina Robeva, University of British Columbia

NESTED COVARIANCE DETERMINANTS IN GAUSSIAN GRAPHICAL MODELS

Abstract: Directed graphical models specify noisy functional relationships among a collection of random variables. In the Gaussian case, each such model corresponds to a semi-algebraic set of positive definite covariance matrices. For models given by directed acyclic graphs, which represent settings where all relevant variables are observed, there is a complete theory: All conditional independence relations can be found via graphical d-separation and are sufficient for an implicit description. The situation is far more complicated, however, when some of the variables are hidden (or in other words, unobserved or latent). We consider models associated to mixed graphs that capture the effects of hidden variables through correlated error terms. The notion of trek separation explains when the covariance matrix in such a model has submatrices of low rank and generalizes d-separation. However, in many cases, such as the infamous Verma graph, the polynomials defining the graphical model are not determinantal, and hence cannot be explained by d-separation or trek-separation. In this paper, we show that these constraints often correspond to the vanishing of nested determinants and can be graphically explained by a notion of restricted trek separation.

This talk is based on a joint work with Mathias Drton and Luca Weihs

References:

- [1] M. Drton, E. Robeva, and L. Weihs (2018) Nested Covariance Determinants and Restricted Trek Separation in Gaussian Graphical Models. *arXiv:1807.07561*.