Abstract

For a d-dimensional correlation matrix with d>3, the d*(d-1)/2 correlations are not algebraically independent in the interval (-1,1) because of the positive definite matrix constraint. For Gaussian model applications where the correlation matrix is a parameter, it is convenient to reparametrize in terms of d-1 correlations and (d-1)*(d-2)/2 partial correlations that are algebraically independent. These are the partial correlation vines and have a graphical representation.

Some important applications are the following:
1) The partial correlation vine extends to vine copulas for flexible non-Gaussian dependence.
2) The partial correlation vine provides a simple method to generate random correlation matrices uniformly over the set of dxd positive definite correlation matrices.

Byproducts are: (a) For a uniform distribution over the space of dxd correlation matrices, the marginal distribution of each correlation is Beta (d/2, d/2) on (-1,1). (b) An identity is obtained for the determinant of a correlation matrix R via partial correlations on a vine. (c) A formula is obtained for the volume of the set of dxd positive definite correlation matrices in d(d-1)/2 dimensional space.