The curse of dimensions and simplified vine copula approximations

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In many scientific disciplines problems can become extraordinarily more difficult if the number of variables increases. This curse of dimensions also has a great impact on statistical modeling because data becomes sparse in high-dimensional spaces. As a result, the performance of non-parametric estimators, which are based on local information, rapidly deteriorates with the dimension. To overcome the curse of dimensions and to obtain a statistically sound result, structural assumptions on the data generating mechanism are required. Most of these model-based assumptions are inherently related to the concept of additivity.
We analyze so called simplified vine copula approximations (SVCAs) which constitute a quite different approach to overcome the curse of dimensions in estimating multivariate distributions. SVCAs are more flexible than other multivariate models and, in principle, their estimation is computationally feasible for arbitrary dimensions. Several results concerning optimal SVCAs are established. We introduce the partial vine copula approximation (PVCA), which provides a (functional) generalization of the partial correlation matrix, and investigate its properties. Moreover, we demonstrate how spurious conditional (in)dependencies may arise in SVCAs.