Modeling Vine Copulas Without Simplifying Assumption

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Abstract

We propose a novel framework for modeling complex dependence structures using non-simplified vine copulas. In conventional vine copula models, the simplifying assumption, that is, the conditional copula is independent of the conditional variable, is typically imposed. However, this approach may not adequately capture more sophisticated dependence patterns in the data. To address this issue, we apply the regression association measures to detect complex dependencies in the pair-copula construction, allowing the vine structure to be estimated without the simplifying assumption. By employing a data-driven partitioning strategy, we further propose a flexible conditional copula model that allow the dependence structure to vary across the conditioning variable, thereby facilitating the assembly of a non-simplified vine structure. Simulation studies reveal improved performance in modeling complex dependence structures. An real-data application to the Uranium dataset illustrates the practical advantages of our method in terms of model fit.

Keywords: Directional association, Kendall’s tau, Nonparametric, Simplifying assumption, Vine copula