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Dependence Density of Vine copulas.*

Multivariate extremes can be described by intensity measure or tail dependence function, but these tools become intractable for high-dimensional dependence models, such as vine copulas, which are constructed via successive mixing from bivariate linking copulas according to tree structures. To overcome this problem, we introduce the tail dependence density function to describe the density distribution of multivariate extremes. We show that the tail dependence density function enjoys some desirable operational properties, such as homogeneity, and is equivalent to the intensity measure in analyzing multivariate extremes. In particular, we show that the tail dependence density function of a vine copula can be expressed recursively by the tail dependence density of each pair of adjacent nodes and the tail density functions of linking copulas in lower-dimensions. Such a recursion is especially useful for high-dimensional data analysis. Some examples involving Archimedean copulas are also presented to illustrate the results. (Received September 20, 2010)