Multivariate Dependence Analysis Toolbox (MvDAT)

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We introduce a newly developed Multivariate Dependence Analysis Toolbox (MvDAT) which includes a wide range of copulas with different levels of complexity. MvDAT employs Bayesian analysis with a residual-based Gaussian likelihood function for inferring the parameters of copulas, and estimate the underlying uncertainties. The contribution of this study is threefold: (a) providing a Bayesian framework to approximate the predictive uncertainties of copulas, (b) introducing a hybrid Markov Chain Monte Carlo (MCMC) approach designed for numerical estimation of the posterior distribution of copula parameters, and (c) enabling the community to explore a wide range of copulas and evaluate them relative to the fitting uncertainties. We show that the commonly used local optimization methods often get trapped in local minima. The proposed method, however, addresses this limitation. MvDAT also allows evaluating uncertainties relative to length of record, which is fundamental to a wide range of applications such as multivariate frequency analysis.