Approximate Bayesian analysis of (un)conditional copulas

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Abstract

Many proposals are now available to model complex data, in particular thanks to the recent advances in computational methodologies and algorithms which allow to work with complicated likelihood function in a reasonable amount of time. However, it is, in general, difficult to analyse data characterized by complicated forms of dependence. Copula models have been introduced as probabilistic tools to describe a multivariate random vector via the marginal distributions and a copula function which captures the dependence structure among the vector components, thanks to the Sklar's theorem, which states that any d-dimensional absolutely continuous density can be uniquely represented as the product of the marginal distributions and the copula function. Major areas of application include econometrics, hydrological engineering, biomedical science, signal processing and finance. Bayesian methods to analyse copula models tend to be computational intensive or to rely on the choice of a particular copula function, in particular because methods of model selection are not yet fully developed in this setting. We will present a general method to estimate some specific quantities of interest of a generic copula by adopting an approximate Bayesian approach based on an approximation of the likelihood function. Our approach is general, in the sense that it could be adapted both to parametric and nonparametric modelling of the marginal distributions and can be generalised in presence of covariates. It also allow to avoid the definition of the copula function. The class of algorithms proposed allows the researcher to model the joint distribution of a random vector in two separate steps: first the marginal distributions and, then, a copula function which captures the dependence structure among the vector components.