

Implicit Copulas from Bayesian Regularized Regression Smoothers

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Abstract:

We show how to extract the implicit copula of a response vector from a Bayesian regularized regression smoother with Gaussian disturbances. The copula can be used to compare smoothers that employ different shrinkage priors and function bases. Three popular choices of shrinkage priors will be illustrated - a pairwise prior, the horseshoe prior and a g prior augmented with a point mass as employed for Bayesian variable selection - and both univariate and multivariate function bases. To evaluate the implicit copula we first construct a Gaussian copula by conditioning on the regularization parameters, and then mix over them using numerical or Monte Carlo methods. This greatly simplifies computation of the implicit copula compared to direct evaluation. The copulas are combined with non-parametric margins to extend the regularized smoothers to non-Gaussian data. Efficient Markov chain Monte Carlo schemes for evaluating the copula are given for this case. Using both simulated and real data, we show how such copula smoothing models can improve the quality of resulting function estimates and predictive distributions.