Multivariate Distributional Regression

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We propose a unified Bayesian approach for multivariate structured additive distributional regression comprising a huge class of continuous, discrete and latent multivariate response distributions, where each parameter of these potentially complex distributions is modelled by a structured additive predictor. The latter is an additive composition of different types of covariate effects e.g. nonlinear effects of continuous covariates, random effects, spatial effects, or interaction effects. As a flexible approach for constructing tailor-made multivariate response distributions, we consider copula-based regression models since they enable the separation of the marginal response distributions and the dependence structure summarised in a specific copula model. Inference is realised by a generic, computationally efficient Markov chain Monte Carlo algorithm based on iteratively weighted least squares approximations and with multivariate Gaussian priors to enforce specific properties of functional effects. Applications to illustrate our approach include a joint model of risk factors for chronic and acute childhood malnutrition in India and ecological regression studying the drivers of election results in Germany.