Bayesian quantile regression for discrete observations

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Quantile regression, i.e. modeling conditional quantiles of some covariates and other effects through the linear predictor, has typically been carried out exploiting the asymmetric Laplace distribution (ALD) as a working "likelihood". In the Bayesian framework, this is highly questionable as the posterior variance is affected by the artificial ALD "likelihood". With continuous responses, we can reparameterize the likelihood in terms of a α-quantile, and let the α-quantile depend on the linear predictor. We can then do model based quantile regression with little effort using the `R-INLA` package (`www.r-inla.org`) doing approximate Bayesian inference for latent Gaussian models, and trust the quantile regression posterior in the same way as when doing parametric mean regression.

For discrete variables, like Poisson and (negative) Binomial, there is no continuous relationship between quantiles and distributions parameters, hence model based quantile regression seems no longer possible. In this talk I will discuss how to resolve this issue, so that we can do model based quantile regression also for discrete responses. I will present some examples that also demonstrate how the parametric approach almost resolves the quantile crossing problem.

This is joint work with Tullia Padellini, Sapienza University of Rome, Italy.