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Priors for Bayesian adaptive spline smoothing

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Abstract Adaptive smoothing has been proposed for curve-fitting problems where the underlying function is spatially inhomogeneous. Two Bayesian adaptive smoothing models, Bayesian adaptive smoothing splines on a lattice and Bayesian adaptive P-splines, are studied in this paper. Estimation is fully Bayesian and carried out by efficient Gibbs sampling. Choice of prior is critical in any Bayesian non-parametric regression method. We use objective priors on the first level parameters where feasible, specifically independent Jeffreys priors (right Haar priors) on the implied base linear model and error variance, and we derive sufficient conditions on higher level components to ensure that the posterior is proper. Through simulation, we demonstrate that the common practice of approximating improper priors by proper but diffuse priors may lead to invalid inference, and we show how appropriate choices of proper but only weakly informative priors yields satisfactory inference.

Keywords Adaptive smoothing · Intrinsic autoregressive · Objective priors · Penalized regression · Posterior propriety