Partially Informative Normal and Bayesian Partial Spline Models

Dongchu Sun and Sifan Liu

University of Missouri

Abstract

There is a well-known Bayesian interpretation of function estimation by spline smoothing using a limit of proper normal priors. This limiting prior has the same form with Partially Informative Normal (PIN), which was introduced in Sun et al. (1999). We derive that, under certain conditions, the linear transformation of PIN random variable and the linear combination of PIN random variables both follow PIN distributions. We apply these results to two extensions of univariate smoothing spline problem. One is large p, small n regression problem associated with the first case. We discuss about the conditions that the smooth component and response curve are estimable. The other is partial spline models associated with the second case. We provide necessary and sufficient conditions for the propriety of the posterior for both linear and smooth components, with non-informative priors on the variance of noise and the noise-signal variance ratio. We develop MC algorithms, and perform simulation studies to show the advantages of partial splines. We also apply partial spline models to build multiple yield curves.