On Adapting to Sparse Design in Univariate and Bivariate Kernel Smoothing

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Abstract: Kernel smoothing is popular in nonparametric modeling. Local linear regression enjoys many nice theoretical properties such as automatic boundary correction and linear minimax optimality, and has become very popular in applications. In finite sample cases, the local least squares problem in local linear estimation becomes ill-posed when the design is sparse and, as a result, the local linear estimator either does not exist or exhibits drastic roughness in the sparse design regions. Many methods have been proposed to address this serious problem in the univariate case, however, they all require extra tuning parameters. We propose a new method to tackle this problem in both the univariate and the bivariate cases. The method is computationally simple and does not involve any extra tuning parameters. The finite sample variance of the modified local linear estimator is bounded above. We further show that it has the same asymptotic mean squared error as the original local linear estimator. Numerical studies demonstrate that it has very good finite sample performance.