

Adaptive density estimation using the blockwise Stein method

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We study the problem of nonparametric estimation of a probability density of unknown smoothness in $L_2(\mathbb{R})$. Expressing mean integrated squared error (MISE) in the Fourier domain, we show that it is close to mean squared error in the Gaussian sequence model. Then applying a modified version of Stein's blockwise method, we obtain a linear monotone oracle inequality. Two consequences of this oracle inequality are that the proposed estimator is sharp minimax adaptive over a scale of Sobolev classes of densities, and that its MISE is asymptotically smaller than or equal to that of kernel density estimators with any bandwidth provided that the kernel belongs to a large class of functions including many standard kernels.

Keywords: adaptive density estimation; blockwise Stein rule; kernel oracle; monotone oracle; oracle inequalities