Nonparametric Kernels for Multivariate Density Estimation

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Abstract

We propose a nonparametric approach for the construction of multivariate kernels adapted to the configuration of the sample, for density estimation in $\mathbb{R}^d$, d moderate. The motivation behind the approach is to break down the construction of the kernel into two parts: determining its overall shape, and then its global concentration. In both steps we consider approaches that are essentially nonparametric, as opposed to the usual bandwidth matrix parametrization, employing integral and differential operators related to integral geometry and convolution. It is seen that the kernel estimators thus developed are easy and extremely fast to compute, and perform at least as well in practice as parametric kernels with cross-validated or otherwise tuned covariance structure. They are seen to posses properties that cannot be captured by the usual matrix parametrization. The approach is illustrated under a wide range of scenaria in two and three dimensions.

Keywords: *Bandwidth matrix; Bandwidth selection; Deconvolution; Integral geometry; Smoothing.*