

# Density Estimation with Replicate Heteroscedastic Measurements

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**Abstract** We present a deconvolution estimator for the density function of a random variable from a set of independent replicate measurements. We assume that measurements are made with normally distributed errors having unknown and possibly heterogeneous variances. The estimator generalizes well-known deconvoluting kernel density estimators, with error variances estimated from the replicate observations. We derive expressions for the integrated mean squared error and examine its rate of convergence as  $n \rightarrow \infty$  and the number of replicates is fixed. We investigate the finite-sample performance of the estimator through a simulation study and an application to real data.

**Keywords** Bandwidth · Bootstrap · Deconvolution · Hypergeometric series · Measurement error