Journal of Statistical Theory and Practice (2020) 14:64
https://doi.org/10.1007/s42519-020-00130-7

ORIGINAL ARTICLE

Density Deconvolution in a Non-standard Case of Heteroscedastic Noises

Cao Xuan Phuong[1] · **Le Thi Hong Thuy**[2]

Accepted: 6 September 2020

Abstract
We study the density deconvolution problem with heteroscedastic noises whose densities are known exactly and Fourier-oscillating. Based on available data, we propose a nonparametric estimator depending on two regularization parameters. This estimator is shown to be consistency with respect to the mean integrated squared error. We then establish upper and lower bounds of the error over the Sobolev class of target density to give the minimax optimality of the estimator. In particular, this estimator is adaptive to the smoothness of the unknown target density. We finally demonstrate that the estimator achieves the minimax rates when the noise densities are supersmooth and ordinary smooth.

Keywords Density deconvolution · Heteroscedastic noises · Fourier-oscillating density · Minimax rate

Mathematics Subject Classification 62G07 · 62G20

1 Introduction

In this paper, we consider the additive noise model

$$Y_j = X_j + \varepsilon_j, \quad j = 1, \ldots, n, \tag{1.1}$$

where Y_j's are independent observations, X_j's are independent and identically distributed (i.i.d.) random variables with unknown common density f, and ε_j's are independent random noises. Assume that all the variables X_1, ..., X_n, ε_1, ..., ε_n are

✉ Cao Xuan Phuong
caoxuanphuong@tdtu.edu.vn

Le Thi Hong Thuy
lethihongthuy@vanlanguni.edu.vn

[1] Faculty of Mathematics and Statistics, Ton Duc Thang University, Ho Chi Minh City, Vietnam

[2] Faculty of Basic Sciences, Van Lang University, Ho Chi Minh City, Vietnam

Published online: 01 October 2020