Asymptotic properties of posterior distributions in nonparametric regression with non-Gaussian errors

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Abstract We investigate the asymptotic behavior of posterior distributions in nonparametric regression problems when the distribution of noise structure of the regression model is assumed to be non-Gaussian but symmetric such as the Laplace distribution. Given prior distributions for the unknown regression function and the scale parameter of noise distribution, we show that the posterior distribution concentrates around the true values of parameters. Following the approach by Choi and Schervish (Journal of Multivariate Analysis, 98, 1969–1987, 2007) and extending their results, we prove consistency of the posterior distribution of the parameters for the nonparametric regression when errors are symmetric non-Gaussian with suitable assumptions.

Keywords Posterior consistency · Uniformly consistent tests · Kullback-Leibler divergence · Hellinger metric · Prior positivity · Symmetric density

1 Introduction

This paper presents asymptotic results of posterior distributions in nonparametric regression problems when the noise is assumed to have a symmetric non-Gaussian distribution such as the Laplace distribution. Specifically, in this paper, we verify almost sure consistency of posterior distributions in nonparametric regression problems with symmetric non Gaussian errors when suitable prior distributions are given on both the regression function and a scale parameter of noise distribution.

It is often the case that a regression model with Gaussian noises may not provide reasonable estimates to fit the data if the data contains outliers, due to the light tails...