

The Relative Improvement of Bias Reduction in Density Estimator Using Geometric Extrapolated Kernel

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Extended Abstract

Paper pages (211-228)

Introduction

The probability density function is a basic concept in statistics, which can be used to study all behaviors of a random variable; several nonparametric methods have been used to estimate the probability density function. One of a nonparametric procedure used to estimate densities is the kernel method. In this paper, to reduce bias of kernel density estimation, methods such as usual kernel (UK), geometric extrapolated usual kernel (GEUK), a bias reduction kernel (BRK) and a geometric extrapolated bias reduction kernel (GEBRK) are introduced. Theoretical properties, including the selection of smoothness parameter and the accuracy of resultant estimators are studied. Accordingly, the mean integrated squared error of GEBRK method achieves a faster convergence rate when kernels are symmetric.

Material and methods

This scheme focus on reduce bias of kernel density estimators.. First, a bias reduction kernel density estimator is introduced and investigated. Then a geometric extrapolation of the bias reduction kernel estimator introduced above is proposed. To evaluate the performance of these new estimators, a Monte Carlo simulation study is conducted. The obtained results are illustrated by analyzing a real data.

Results and discussion

The results show that the bias in the proposed BRK and GEBRK methods significantly decreases. Also, the numerical results reported in the tables indicate that the bias decrease by increasing the sample size. Therefore, to get more accurate results, using the larger sample size are recommended. Notice that, obtained results confirm that proposed methods enable us to find some more reasonable approximate solutions than UK method.

Conclusion

The following conclusions were obtained from this research.

- From Tables and Figures 1-4 we can see that BRK and GEBRK methods consistently have smaller bias than UK and GEUK methods.
- Our simulation study at Tables and Figures 1-4 shows that for finite sample size both estimators UK and GEUK perform approximately similar.

- When the two estimators with geometric extrapolation are compared, GEBRK estimator generally has smaller bias than GEUK estimator. Accordingly, the bias of the GEBRK estimator is reduced significantly.
- Therefore, the BRK and GEBRK estimators are consistently better than UK and GEUK estimators.

Keywords: Density estimation, Smoothness parameter, Geometric extrapolation, Symmetric kernel, Bias.

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