ON THE ADAPTIVE NADARAYA-WATSON KERNEL REGRESSION ESTIMATORS

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Abstract

Nonparametric kernel estimators are widely used in many research areas of statistics. An important nonparametric kernel estimator of a regression function is the Nadaraya-Watson kernel regression estimator which is often obtained by using a fixed bandwidth. However, the adaptive kernel estimators with varying bandwidths are specially used to estimate density of the long-tailed and multi-mod distributions. In this paper, we consider the adaptive Nadaraya-Watson kernel regression estimators. The results of the simulation study show that the adaptive Nadaraya-Watson kernel estimators have better performance than the kernel estimations with fixed bandwidth.

Keywords: Nonparametric regression, Nadaraya-Watson kernel estimator, Adaptive kernel estimation, Kernel density estimation.

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1. Introduction

For given data points \( \{(X_i, Y_i)\}_{i=1}^{n} \in \mathbb{R} \), let us assume that the regression model is

\[
Y_i = m(X_i) + \varepsilon_i, \quad i = 1, \ldots, n,
\]

with observation errors \( \varepsilon_i \) and unknown regression function \( m \). Assume that the response variable \( Y \) depends on an independent random variable \( X \). Also that \( \varepsilon \) is a random variable with mean 0 and variance \( \sigma^2 \). As is well known, \( m(x) \) is a conditional mean curve

\[
m(x) = \mathbb{E}(y/x) = \int \frac{y f(x, y)}{f(x)} dy,
\]