Dobrovidov, A. V.

On convergence of kernel estimators of density with variable window width by dependent observations. (English. Russian original) Zbl 1145.93046

Autom. Remote Control 68, No. 9, 1575-1582 (2007); translation from Avtom. Telemekh. 2007, No. 9, 113-121 (2007).

Summary: In [*I. S. Abramson*, Ann. Stat. 10, 1217–1223 (1982; Zbl 0507.62040) and *P. Hall* and *J. S. Marron*, Probab. Theory Relat. Fields 80, No. 1, 37–49 (1988; Zbl 0637.62036)] a new type of nonparametric kernel estimators of probability density was studied, whose window width varies depending on the sample, i.e., are data-based. These estimators were called adaptive. New estimators of density are superior in the rate of convergence to classical Rosenblatt-Parzen estimators. However, these valuable properties of estimators were obtained assuming that observations are independent. In this paper, we study properties of these adaptive estimators but assuming that the sample is realization of the stationary in the narrow sense random sequence. The simulation examples for the adaptive estimator constructed by dependent observations which is generated by autoregressive models are represented. The results of the investigation prove the advantage of the adaptive estimator over the classical Rosenblatt-Parzen estimator in the sense of the mean-square error. The rate of mean-square convergence of the limiting estimator (the so-called "ideal" estimator) to the true unknown density according to the dependent sample is found. The consistency of the adaptive estimator constructed by stationary dependent observations is proved.

MSC:

93E10 Estimation and detection in stochastic control theory
93B50 Synthesis problems
93E03 Stochastic systems in control theory (general)

Keywords:

data processing in stochastic systems; autoregression; sliding mean

Full Text: DOI

References:

[1] Abramson, I.S., On Bandwidth Variation in Kernel Estimates, Ann. Stat., 1982, vol. 10, pp. 1217–1223. · Zbl 0507.62040 · doi:10.1214/aos/1176345986

[2] Hall, P. and Marron, J.S., Variable Window Width Kernel Estimates of Probability Densities, Prob. Theory. Related Fields, 1998, vol. 80, pp. 37–49. · Zbl 0637.62036 · doi:10.1007/BF00348751

[3] Vasil'ev, V.A., Dobrovidov, A.V., and Koshkin, G.M., Neparametricheskoe otsenivanie funktsionalov ot raspredelenii statsionarnykh posledovatel'nostei (Nonparametric Estimation of Stationary Sequence Distribution Functionals), Moscow: Nauka, 2004. · Zbl 1068.62042

[4] Pracasa Rao, B.L.S., Nonparametric Functional Estimation, New York: Academic, 1983.

[5] Ibragimov, I.A. and Linnik, Yu.V., Nezavisimye i statsionarno svyazannye velichiny (Independent and Stationary Connected Quantities), Moscow: Nauka, 1965. · Zbl 0154.42201

[6] Leadbetter, M.R., Extremes and Local Dependence in Stationary Sequences, Z. Wahrscheinlichkeitstheorie Verw. Gebiete, 1983, vol. 65, pp. 291–306. · Zbl 0506.60030 · doi:10.1007/BF00532484

[7] Kluppelberg, C. and Pergamenchtchikov, C., Extremal Behavior of Models with Multivariate Random Reccurence Representation, Stochastic Proc. Appl., 2007, vol. 117,issue 4, pp. 432–456. · Zbl 1118.60060 · doi:10.1016/j.spa.2006.09.001

[8] Feigin, P.D. and Tweedie, R.D., Random Coefficient Autoregressive Processes: A Markov Chain Analysis of Stationarity and Finiteness of Moments, J. Time. Ser. Anal., 1985, vol. 6, pp. 1–14. · Zbl 0572.62069 · doi:10.1111/j.1467-9892.1985.tb00394.x

[9] Breiman, L., Meisel, W., and Purcel, E., Variable Kernel Estimates of Probability Densities, Technometrics, 1977, vol. 19, pp. 135–144. · Zbl 0379.62023 · doi:10.1080/00401706.1977.10489521