
Online conditional variance estimation for massive functional ergodic processes

Mohamed Chaouch

Department of Statistics, United Arab Emirates University; m.chaouch@uaeu.ac.ae

Abstract. *In this paper, we are interested in nonparametric estimation of the conditional variance when the predictor takes values in an infinite dimensional space and the response variable is scalar. In the statistical literature, a lot of attention has been given to the nonparametric estimation of the regression function when the covariate is of functional nature. Many authors studied its asymptotic properties such as the almost complete consistency with rate and the asymptotic distribution when the underlying process satisfies an α -mixing condition (see Ferraty and Vieu (2006) and the references therein). Recently Laib and Louani (2010) and Laib and Louani (2011) generalized those results to ergodic processes. However, almost nothing has been done for the conditional variance estimation with functional stationary ergodic processes. Firstly, a kernel-type estimator of the conditional variance function is defined, then a uniform almost sure consistency rate as well as the asymptotic distribution are established.*

Nowadays, with the progress of measurement apparatus and the development of automatic sensors, we can get access to large samples of observations taking values in high dimensional spaces. Therefore, within this new framework of "Massive Data", the computation of the nonparametric estimator of the conditional variance presented in first part will be a challenge. To deal with this constraint, recursive algorithm will be introduced to perform the conditional variance estimation without any full data storage requirement. More precisely, when the data arrive sequently the value of each successive estimator is obtained from its value at the previous step by a simple adjustment that takes into account the recently received data. A mean square consistency of the Robbins-Monro type conditional variance estimator is then established. Finally, a simulation study will be given to show how the recursive estimator performs better than the static one in term of computation time without affecting significantly the accuracy.

Keywords. *Conditional variance; functional ergodic data; massive data; nonparametric estimation; Robbins-Monro approximation*

References

- Ferraty, F. and Vieu, P. (2006). *Nonparametric Modelling for Functional Data. Methods, Theory, Applications and Implementations*. Springer-Verlag, London.
- Laib, N. and Louani, D. (2011). Rates of strong consistencies of the regression function estimator for functional stationary ergodic data. *J. Statist. Plann. Inference*, **141**(1), 359–372.
- Laib, N. and Louani, D. (2010). Nonparametric kernel regression estimation for functional stationary ergodic data: asymptotic properties. *J. Multivariate Anal.*, **101**(10), 2266–2281.