

Robust Procedures for Multivariate Location and Scatter Monitoring in Economic Data Stream

Daniel Kosiorowski¹, Małgorzata Snarska²

¹Department of Statistics, Faculty of Management, Cracow University of Economics

²Department of Capital Markets, Faculty of Finance, Cracow University of Economics

Data streams (streaming data) consist of transiently observed, temporally evolving multidimensional data sequences that challenge our computational and/or inferential capabilities. In the Economics, data streams are among others related to fraud detection in retail banking (credit card transactions), electricity consumption monitoring, public eye or social networks monitoring, and the Internet users behaviours exploring. Analysis of the economic data streams introduces several new challenges to the statistical analysis (having Fisherian as well as Bayesian origins) involving need for online processing and online inference, and temporal adaptivity in the face of unforeseen changes, both smooth and abrupt, in the underlying data generation mechanism.

In this paper we propose a novel theoretical framework for analysis of the economic data stream which may contain outliers. We propose two methodological approaches for monitoring multivariate location and scatter of the stream. The first approach relates to an idea of nonparametric estimation of the ratio of probability densities and minimal distance tests. The second approach uses multivariate L- and R- statistics induced by the statistical depth functions and in particular is based on multivariate analogue of the well-known Wilcoxon rang test.

We show very good properties of our proposals by means of theoretical considerations, intensive simulation studies as well as using empirical examples concerning U.S. labour data. We compare properties of the proposals with alternatives which appeal to classical econometric modelling as well as to new approaches involving Bayesian online updating or online discrimination analysis with adaptive forgetting. We hope our approach could find several useful applications in online economy monitoring and process of decision making, conducted by governmental or financial authorities.