Applying the Q_n Estimator Online

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Abstract. In statistical online monitoring e.g. in intensive care noisy time series are measured with high sampling frequencies. The aim is to extract the time-varying level underlying the time series describing the state of the system and to detect relevant changes in it.

The task of online level extraction is complicated by frequent measurement problems leading to many atypical observations. Therefore, robust methods should be applied for reliable automatic monitoring. However, such methods can be computationally too demanding for online application if efficient algorithms are not available.

The Q_n is a robust scale estimator which possesses a breakdown point of 50%, i.e. it can resist up to almost 50% large outliers without becoming extremely biased. Additionally, the Gaussian efficiency of the Q_n estimator in large samples is 82% which is much higher than for most other robust scale estimators such as e.g. the median absolute deviation (MAD). Comparative studies show that this larger efficiency strongly increases the power of rules for level shift detection which apply a robust scale estimator.

We motivate the application of the Q_n to time series data and show its good performance via simulations. Further, we present a new and fast online algorithm for the Q_n which can also be applied to compute the Hodges Lehmann location estimator. The algorithm is easy to implement and improves the online applicability of these estimators.

References

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Keywords

Computational statistics, robust regression, Q_n, Hodges Lehmann estimator