Resampling techniques in the optimal choice of the threshold in extremal index estimation

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Abstract

Classical extreme-value theory for stationary sequences of random variables has to deal with one of the parameters governing the behaviour of the extremes, the extremal index. This parameter plays a special role in the description of the dependence between exceedances over a high threshold.

The estimation of the extremal index is then performed on the basis of the k order statistics in the sample or on the exceedances over a high level u_n. The estimators considered in the literature, despite of having good asymptotic properties, present high variance for high levels and a high bias when the level decreases, showing then a strong dependence on the high threshold u_n, for finite samples. A compromise between these two measures is obtained by considering the mean squared error, MSE. A question that has been often addressed is the choice of u_n, that minimizes the mean squared error. The selection of that threshold is then required.

By using resampling techniques (i.e. bootstrap and/or jackknife) an heuristic approach for estimating the level u_n, that asymptotically gives the minimum MSE of an estimator of the extremal index is suggested, based on Lahiri *et. al.* (2007) method. The key idea of the method considers the bootstrap estimation of the variance and the bias of the block bootstrap estimator. The proposed rule is based on the Jackknife-after-Bootstrap (JAB) that yields a nonparametric estimator of the variance of a block bootstrap estimator.

A simulation study as well as a real case study are shown.

Keywords

Bootstrap, Estimation, Extremal index, Jackknife.

References

Lahiri, S.N., Furukawa, K., and Lee, Y.-D. (2007). A nonparametric plug-in rule for selecting the optimal block length for the block bootstrap methods. *Stat. Methodol. 4*, 292–321.