Robust statistics by means of scaled Bregman distances

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1 Abstract

We present a method for the goal-oriented design of outlier- and inlier-robust statistical inference tools. In particular, this includes the tasks of parameter estimation, testing for goodness-of-fit resp. homogeneity resp. independence, clustering, change-point detection, exploratory model search, and some Bayesian decision procedures.

In order to achieve this goal, we adapt the concept of scaled Bregman distances between two distributions, which was introduced in Stummer [2007], Stummer & Vajda [2012], and which generalizes the widely-used (partially non-robust) concepts of Kullback-Leibler information distance/relative entropy, Pearson’s chi-square distance, Hellinger distance, Csiszar-Ali-Slvey divergences, etc. The classical (i.e., unscaled) Bregman distances – such as the $L^2$—distance and the more general density power divergences – are covered as well.

In order to visualize effectively and transparently the corresponding robustness properties, we present 3D-plots of associated density-pair adjustment functions. Numerous special cases will be illustrated. For the discrete case, some universally applicable results on the asymptotics of the underlying scaled-Bregman-distance test statistics are derived as well. Furthermore, we give some application to the robust estimation of the tail dependence coefficient of bivariate heavy-tailed distributions.

This talk is mainly based on several joint works with A.-L. Kißlinger (Erlangen-Nürnberg) respectively with B.H. Roensch (Erlangen-Nürnberg).
References


