Robust and efficient modeling of extremes with the generalized Pareto distribution.

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The generalized Pareto distribution (GPD) is an extreme value distribution widely used for modeling excesses over high thresholds. The GPD has shape and scale parameters. The most common estimator for the parameters is maximum likelihood, however other estimators are available including robust alternatives. In this talk we present a general class of estimators called minimum density power divergence estimators (MDPDE) for the GPD. The MDPDE produces robust estimators for the parameters of the GPD that at the same time retain high efficiency with respect to the maximum likelihood estimators (MLE). Asymptotic calculations show that the MDPDE for the GPD is robust to gross errors (bounded influence function) while maintaining good asymptotic relative efficiencies with respect to the MLE.

Finite-sample results, via Monte Carlo simulation, agree with these asymptotic calculations. We also compare the MDPDE with other two robust estimators, Dupuis' optimally-biased robust estimator (OBRE) and Peng and Welsh's Medians estimator, and Zhang's efficient empirical Bayes estimator (EBE). The Monte Carlo simulations indicate that for models contaminated with gross errors, OBRE is in general the best estimator. However, the MDPDE performs almost as well as the OBRE and outperforms the MLE and the EBE. Under ideal conditions, MLE has the highest efficiency. The results, at the end of the day, indicate that MDPDE responds effectively in situations requiring estimators that are robust to outlying observations and that do not experience a serious loss of efficiency. Finally, some applications are included.