Hsu, Daniel; **Sabato, Sivan**

Loss minimization and parameter estimation with heavy tails. (English) Zbl 1360.62380

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Summary: This work studies applications and generalizations of a simple estimation technique that provides exponential concentration under heavy-tailed distributions, assuming only bounded low-order moments. We show that the technique can be used for approximate minimization of smooth and strongly convex losses, and specifically for least squares linear regression. For instance, our d-dimensional estimator requires just $\tilde{O}(d\log(1/\delta))$ random samples to obtain a constant factor approximation to the optimal least squares loss with probability $1-\delta$, without requiring the covariates or noise to be bounded or subgaussian. We provide further applications to sparse linear regression and low-rank covariance matrix estimation with similar allowances on the noise and covariate distributions. The core technique is a generalization of the median-of-means estimator to arbitrary metric spaces.

MSC:

62J05 Linear regression; mixed models
62F10 Point estimation
62J07 Ridge regression; shrinkage estimators (Lasso)

Keywords:

heavy-tailed distributions; unbounded losses; linear regression; least squares

Full Text: Link