Cornell University $\mathbb{I}$*nformation,* $\mathbb{S}$*ystems, and* $\mathbb{N}$*etworks seminar*

Exact Sparse Recovery with L0 Projections

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Abstract

We consider the problem of recovering a K-sparse signal vector X in length N. In the mainstream framework of compressed sensing (CS), the signal vector is recovered from M non-adaptive linear measurements Y = XS, where S is typically a Gaussian (or Gaussian-like) design matrix, through some optimization procedure. In our proposed method, the design matrix S is generated from an α-stable distribution with α about 0. Our decoding algorithm mainly requires one linear scan of the coordinates, followed by a couple of iterations on a small number of coordinates which are "undetermined" in the previous iteration. Our practical algorithm consists of two estimators. The (absolute) minimum estimator is able to identify whether any coordinate, using essentially KlogN measurements. The gap estimator can accurately recover the magnitudes of the nonzero coordinates. The gap estimator is applied in each iteration to improve the estimates. Comparisons with two strong baselines, linear programming (LP) and orthogonal matching pursuit (OMP), demonstrate that our algorithm can be significantly faster in decoding speed and more accurate in recovery quality, for the task of exact spare recovery. Our procedure is highly robust against measurement noise. Also, we can show that in an idealistic setting, the logN factor can be removed.

Biography

Ping Li is an assistant professor in the Department of Statistical Science (DSS) under the Faculty of Computing and Information Science (CIS). His research interests include BigData and statistical learning. He received the ONR Young Investigator Award in 2009 and AFOSR Young Investigator Award in 2013. Ping Li's research has been supported by Google, Microsoft, NSF, and DoD. He also won a prize in the 2010 Yahoo! Learning to Rank Grand Challenge using his own boosting and tree algorithm/code.