ZHENAN FAN, University of British Columbia
Polar deconvolution of mixed signals

The signal demixing problem seeks to separate a superposition of multiple signals into its constituent components. We propose a two-stage approach that first decompresses and subsequently deconvolves the noisy and undersampled observations of the superposition. Probabilistic error bounds are given on the accuracy with which this process approximates the individual signals. The theory of polar convolution of convex sets and gauge functions plays a central role in the analysis and solution process. If the measurements are random and the noise is bounded, this approach stably recovers low-complexity and mutually incoherent signals, with high probability and with optimal sample complexity. We also develop an efficient algorithm, based on level-set and conditional-gradient methods, that solves the convex optimization problems with sublinear iteration complexity and linear space requirements. Numerical experiments on both real and synthetic data confirm the theory and the efficiency of the approach.