APPLIED CONVEX OPTIMIZATION

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PROJECT DESCRIPTION

Semidefinite Programming Relaxation as a strategy to MIMO detection

The idea is to study the field of semidefinite programs as a convex relaxations of NP-hard QCQP (Quadratically constrained quadratic programs), which are non-convex in many cases. In the signal processing community, a problem of interest that belongs to the class of non-convex QCQP is MIMO detection. The SDR (Semidefinite relaxation) approach is considered and it has been shown that is very efficient and high-performance (near optimal solutions) in this MIMO channels.

Our objective is to reproduce and study in depth some of the main results of the different papers of this theme and play around with relaxations approaches available in the literature that can be applied. The main focus is to study and implement the convex optimization tools, while trying to cover all theoretical results (at least the fundamental). We also plan to simulate the MIMO setting with a simple signaling scheme (e.g. BPSK, QPSK, M-QAM) to highlight and illustrate the performance of the SDR approach compared to other strategies and some of the practical implications of this convexifying tool.

Problem Statement

$$\min_{x \in R^n} \|y - Hx\|_2^2$$

$$subject\ to\ x_i^2 = 1\ , i = 1, \dots, n$$

Where $y = Hs + v, H \ \in \mathbb{C}^{nxn}$ has i.i.d standard complex Gaussian entries, $s_i^2 = 1$ for $i = 1, \dots, n$; and $v \ \in \mathbb{C}^n$ has i.i.d complex mean zero Gaussian entries with variance σ^2.