The Hong Kong University of Science and Technology

Department of Mathematics

PhD THESIS EXAMINATION

Efficient Recovery of Sparse Signal from Phaseless Measurements

By

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ABSTRACT

The sparse phase retrieval problem is to recover an s-sparse signal $x^\natural \in \mathbb{R}^n$ $(s << n)$ from m phaseless samples $y_i = |\langle x^\natural, a_i \rangle|$ for $i = 1, \ldots, m$. Sparse phase retrieval problem arises in many applications related to signal and image processing. The task of the work is to develop efficient algorithms and theories for the problem using few number of measurements, especially in case $m < n$. In this talk, I will present two efficient algorithms for sparse phase retrieval problem under standard Gaussian model. Existing gradient descent type methods for sparse phase retrieval are first-order and hence converge at most linearly. In my work, firstly, a second-order Newton's approach named HTP for sparse phase retrieval has been introduced, which is guaranteed to find the underlying signal in finite steps using only $m \sim O\ (s\ \log n/s)$ Gaussian samples and the initialization is in a neighborhood of the underlying sparse signal. Together with a spectral initialization, HTP is guaranteed to have an exact recovery from $O\ (s^2\ \log n)$ samples. While the computational cost per iteration is the same order as first order methods, the proposed algorithm is quite efficient in terms of cpu time and numerical experiments illustrates that the proposed HTP is several times faster than state-of-the-art algorithms. Further, based on a standard alternating minimization for sparse phase retrieval, I have proposed novel a stochastic version of alternating minimization for the problem. By introducing a generalized RIP condition on the sensing matrix, theoretical justification for the finite step convergence (in at most $\log m$ steps) of the proposed stochastic algorithm is provided. Numerical experiments show that the proposed stochastic algorithm requires less measurements than state-of-the-art algorithms.

Date: **17 May 2021, Monday**

Time: **9:00 a.m.**

Venue: **Online via Zoom**
https://hkust.zoom.com.cn/j/4531771981 (Passcode: 20210517)

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The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).