

Homework for “Algorithms For Big Data Analysis”

Zaiwen Wen

Beijing International Center for Mathematical Research

Peking University

May 17, 2021

1 Submission Requirement

1. Prepare a report including
 - detailed answers to each question
 - numerical results and their interpretation
2. The programming language can be either matlab, Python or c/c++.
3. Pack all of your codes named as “phase-ID-name.zip” and upload the file to
<https://file.admin.cluster-bicmr.com/u/d/045d80868f524d0bab11/>
作业提交需要统一打包成压缩文件，命名格式为：phase-学号-姓名，文件类型随意。文件名中不要出现空格，最好不要出现中文。
4. 请勿大量将代码粘在报告中，涉及到实际结果需要打表或者作图，不要截图或者直接从命令行拷贝结果。
5. 提交word的同学需要提供word原文件并将其转换成pdf文件。
6. If you get significant help from others on one routine, write down the source of references at the beginning of this routine.

2 Algorithms for phase retrieval

One popular formulation of the phase retrieval problem is solving a system of quadratic equations in the form

$$(2.1) \quad y_r = |\langle a_r, z \rangle|^2, \quad r = 1, 2, \dots, m,$$

where $z \in \mathcal{C}^n$ is the decision variable, $a_r \in \mathcal{C}^n$ are known sampling vectors, $\langle a_r, z \rangle$ is the inner product between a_r and z in \mathcal{C}^n , $|a|$ is the magnitude of $a \in \mathcal{C}$, and $y_r \in \mathcal{R}$ are the observed measurements.

Choose either a) or b). Write down and implement the algorithm.

- a) Problem (2.5) on page 206 of “E. J. Candes, Y. Eldar, T. Strohmer and V. Voroninski. Phase retrieval via matrix completion. SIAM J. on Imaging Sciences 6(1), 199–225.”

Try one of the following test problems:

- The problems in sec. 4.4.1.

- try the data in

`https://bitbucket.org/charms/sparsepr/src/master/tests/CPRL_runtime_measurements_cvx.m`

- b) The gradient method (II.2) starting from z_0 constructed in Algorithm 1 on page 1986 of “E. J. Candes, X. Li and M. Soltanolkotabi. Phase retrieval via Wirtinger flow: theory and algorithms. IEEE Transactions on Information Theory 61(4), 1985–2007.”

Try the 1D test problems in

`http://www-bcf.usc.edu/~soltanol/WFcode.html`

- c) **DO NOT** copy the codes online directly!