Midterm Report
Sparse Modeling, The University of Kitakyushu

Masaaki Nagahara (nagahara@kitakyu-u.ac.jp)

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Submit your answer via Moodle by 23:59, 10(Fri)/June/2022. (if you have no access to Moodle, then you can submit it via email to me)

Problem

Use MATLAB, Python, or any other programming languages to solve this problem. Submit not only the program but also the description of the method you use, the results, and discussions.

- Define the original signal:

$$\boldsymbol{x}_{\rm orig} \triangleq [1,1,1,1,1,0,0,0,0,0,-1,-1,-1,-1,-1,\underbrace{0,0,\ldots,0}_{985}]^\top \in \mathbb{R}^{1000}$$

- Define the matrix $\Phi \in \mathbb{R}^{100\times 1000}$ whose entries are drawn independently from $\mathcal{N}(0,1)$ (the normal distribution with mean 0 and variance 1).
- Generate the data

$$\boldsymbol{y} = \Phi \boldsymbol{x}^* + \boldsymbol{n},$$

  where $\boldsymbol{n} \in \mathbb{R}^{100}$ is a random vector whose elements are drawn independently from $\mathcal{N}(0, 0.1)$.
- Recover the original 1000-dimensional vector $\boldsymbol{x}^*$ from the 100-dimensional noisy vector $\boldsymbol{y}$ using optimization.