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A SHORT NOTE ON STRONGLY CONVEX PROGRAMMING FOR EXACT MATRIX COMPLETION AND ROBUST PRINCIPAL COMPONENT ANALYSIS

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Abstract. In paper "Strongly Convex Programming for Exact Matrix Completion and Robust Principal Component Analysis", an explicit lower bound of τ is strongly based on Theorem 3.4. However, a coefficient is missing in the proof of Theorem 3.4, which leads to improper result. In this paper, we correct this error and provide the right bound of τ.

1. **An corrected lower bound of τ.** In the proof of Theorem 3.4 in [1], the authors missed the coefficient λ before $\|\mathcal{P}_{\Omega^\perp} H\|_1$. By taking back the missing λ, the corrected condition in Theorem 3.4 on the parameters α, β should be $\alpha+\beta \leq 1$, under which the correct bound τ in Theorem 3.5 becomes

$$\tau \geq \max\left(\frac{\gamma}{(\beta-\frac{1}{2})\lambda},\ \frac{\delta}{(\alpha-\frac{1}{4})\lambda},\ \frac{4(\gamma+\delta)}{\lambda}\right) \tag{1}$$

To obtain this, the corresponding adjustment for τ in the proof of Theorem 3.5 is as follows. According to the formula (40) (41) and (42) in the proof of Theorem 3.5, τ obeys

$$\frac{\lambda}{2}+\frac{\gamma}{\tau} \leq \beta\lambda, \text{ and } \frac{\lambda}{4}+\frac{\delta}{\tau} \leq \alpha\lambda$$

which gives out $\tau \geq \max\left(\frac{\gamma}{(\beta-\frac{1}{2})\lambda},\ \frac{\delta}{(\alpha-\frac{1}{4})\lambda}\right)$. Moreover, based on the condition $\alpha+\beta \leq 1$, we obtain $\frac{\lambda}{2}+\frac{\gamma}{\tau}+\frac{\lambda}{4}+\frac{\delta}{\tau} \leq \beta\lambda+\alpha\lambda \leq \lambda$ from which it holds $\tau \geq \frac{4(\gamma+\delta)}{\lambda}$.

In order to simplify the formula (1), we suppose $\alpha = 3/8$ and $\beta = 5/8$, which satisfy the conditions above. Therefore

$$\tau \geq \max\left(\frac{8\|\mathcal{P}_{\Omega^\perp} L_0\|_\infty}{\lambda},\ \frac{8\|\mathcal{P}_\Omega(L_0-S_0)\|_F}{\lambda}\right) \tag{2}$$

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However, note that the exact lower bound is very hard to get, because we only have the information about the given data matrix M. Note that

$$\|\mathcal{P}_{\Omega^\perp} M\|_\infty \leq \|M\|_\infty$$

And according to the paper [1], we have

$$\|\mathcal{P}_\Omega(L_0 - S_0)\|_F \quad \leq \quad \frac{\sqrt{15}}{3}\|M\|_F$$

Therefore, we can choose

$$\tau \geq \max\left(\frac{8\|M\|_\infty}{\lambda},\ \frac{8\sqrt{15}\|M\|_F}{3\lambda}\right)$$

Note that $\|M\|_\infty \leq \|M\|_F$, we can obtain the result as follows.

Theorem 1.1. *Assume*

$$\tau \geq \ \frac{8\sqrt{15}\|M\|_F}{3\lambda}$$

If the other assumptions of Theorem 2.2 of paper [1] *hold, we can obtain* (L_0, S_0) *is the unique solution to the strongly convex programming (6) in paper* [1]*, with high probability.*

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