Additional Experiments for Paper 5433

July 31, 2022

In this report we present the additional experiments for `DSPL/DSEPL` on robust nonlinear regression problem with larger size. We also kindly remind the reviewer of our additional experiments on blind deconvolution problem, which is available in the appendix section **C**.

Given sample data $\{a_i \in \mathbb{R}^n\}_{i=1,\dots,m}$ and corresponding observations $\{y_i\}_{i=1,\dots,m}$, the robust nonlinear regression problem aims to fit y_i using nonlinear model $y = f(\langle a, x\rangle)$ by solving

$$\min_{x\in\mathbb{R}^n} \quad \frac{1}{m}\sum_{i=1}^m |f(\langle a_i, x\rangle) - b_i|,$$

where f is a given nonlinear function. When $f(x) = x^2$, we get the robust phase retrieval problem. We report the performance in asynchronous environment.

Experiment setup

1) Dataset. We take $m = 7500, n = 2500$ in the experiment. Given some nonlinear function f, we generate sample data $A \in \mathbb{R}^{m\times n}$, true signal x^* as in phase retrieval and let $y_i = f(a^\top x)$.

2) Initial point. We generate $x' \sim \mathcal{N}(0, I_n)$ and start from $x^0 = x^1 = \frac{x'}{\|x'\|}$.

3) Stepsize. We tune the stepsize parameter setting $\gamma = \sqrt{K/\alpha}, \alpha \in \{0.1, 0.5, 1.0\}$ for asynchronous environment and $\alpha \in [10^0, 10^1]$ for the simulated experiment.

4) Nonlinear function. We choose functions $f \in \{f_1 = 2x + \cos x, f_2 = 10 + e^x, f_3 = x^3 + x^2, f_4 = x^2\}$ to characterize the nonlinear relation. Note that f_4 corresponds to larger phase retrieval data.

5) Others. The rest of the setup is consistent with phase retrieval.

Asynchronous environment

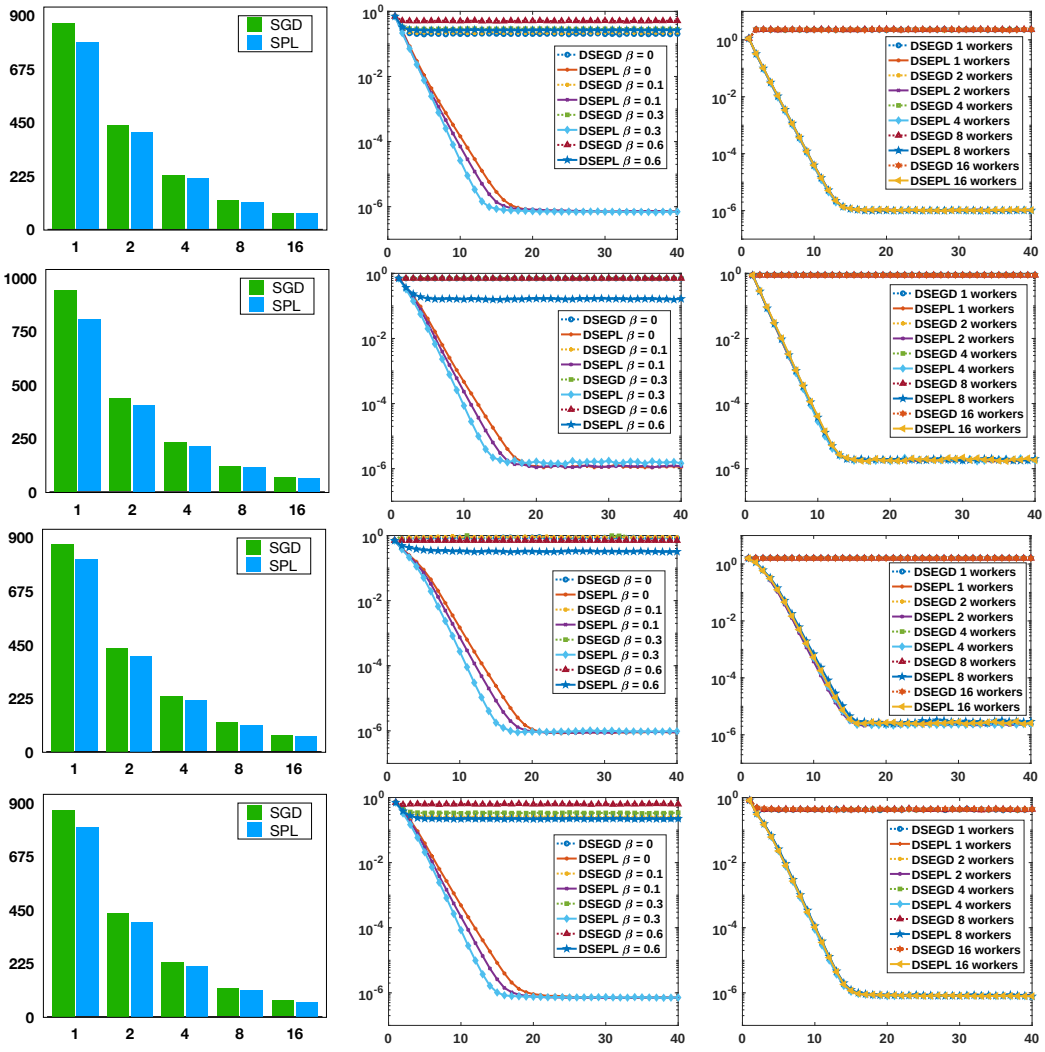

Figure 1: From the first row to the last: $f_1 = 2x + \cos x, f_2 = 10 + e^x, f_3 = x^3 + x^2, f_4 = x^2$. In each row, the first figure indicates speedup as the number of workers increases; the second plots $\|x^k - x^*\|$ for $\alpha = 0.5$ and different β; the last plots $f(x^k) - f^*$ for $\alpha = 0.5, \beta = 0.3$ (f_4 uses $\alpha = 0.1$).

Simulated delay

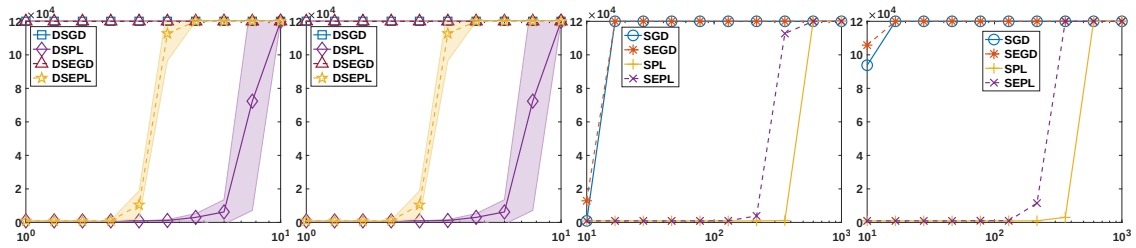

Figure 2: Experiments of simulated delay for the robust nonlinear regression problem using $f_2 = 10 + e^x, \kappa = 10, p_{\text{fail}} = 0.25$. Two figures on the left: the number of iterations with different stepsize α and $\beta = 0.3, \tau \in \{216, 360\}$; Two figures on the right: the number of iterations with different $\tau \in [1, 1000]$ and $\beta = 0.3, \alpha \in \{3.60, 4.65\}$.