

Additional Experiments for Paper 5433

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

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

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 $y_i = f(\langle a_i, x^* \rangle)$.

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

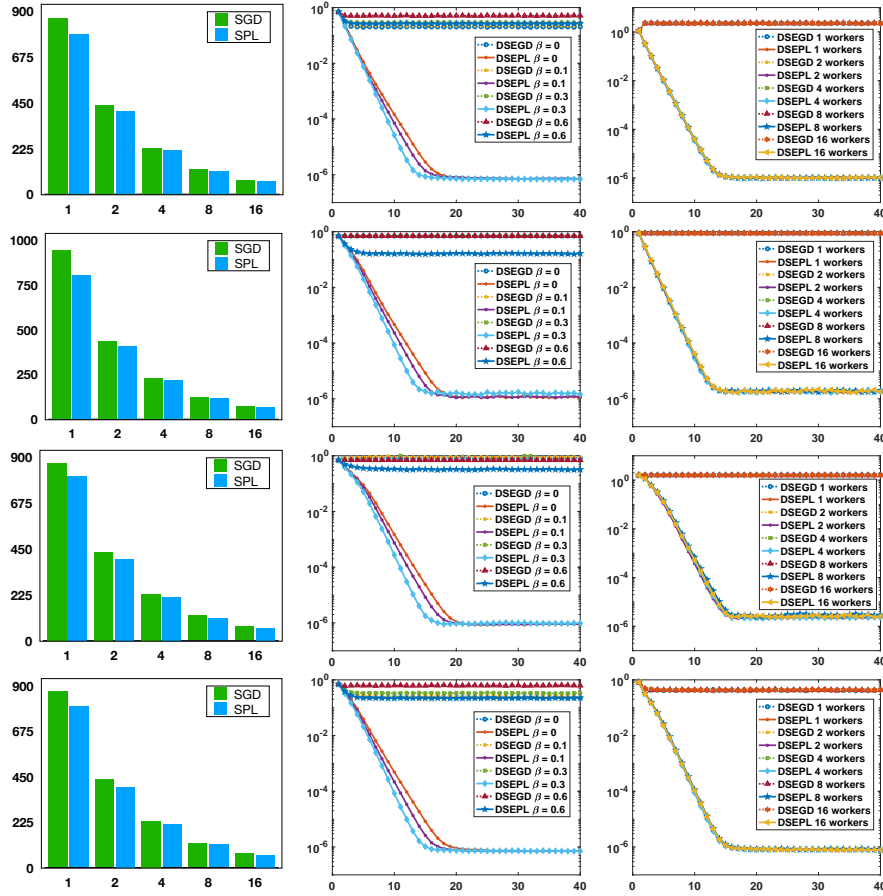


Figure 1. From the first row to the last: $f_1 = 2x + \cos x, f_2 = 10 + e^x, f_3 = x^3 + x^2, f_4 = x^2$. In each row, the first figure indicates speedup as the number of workers increases; the second plots $\|x^k - x^*\|$ for $\alpha = 0.5$ and different β ; the last plots $f(x^k) - f^*$ for $\alpha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

Simulated delay

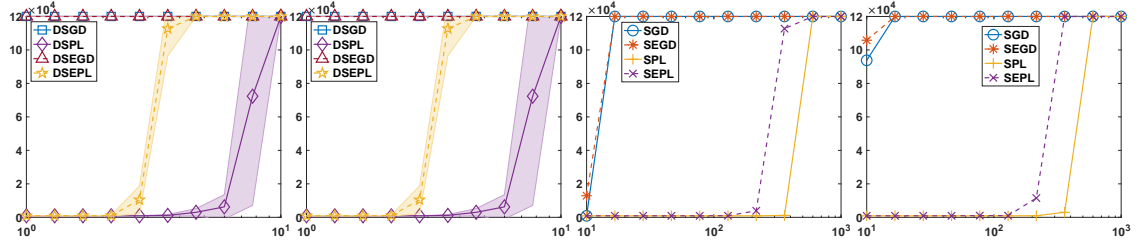


Table 1. Experiments of simulated delay for the robust nonlinear regression problem using $f_2 = 10 + e^x$, $\kappa = 10$, $p_{\text{fail}} = 0.2$. Two figures on the left: the number of iterations with different stepsize α and $\beta = 0.3$, $\tau \in \{216, 360\}$; Two figures on the right: the number of iterations with different $\tau \in [1, 1000]$ and $\beta = 0.3$, $\alpha \in \{3.60, 4.65\}$.