EP3260: Machine Learning Over Networks
Computer Assignment 1-2
Instructors: Hossein S. Ghadikolaei, José Mairton B. da Silva Jr.
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Computer Assignment 1 - Closed-form solution vs iterative approaches

Let us consider

$$\mathbf{w}^\star = \underset{\mathbf{w}\in\mathbb{R}^d}{\text{minimize}} \frac{1}{N}\sum_{i\in[N]} \|\mathbf{w}^T\mathbf{x}_i - \mathbf{y}_i\|^2 + \lambda\|\mathbf{w}\|_2^2,$$

for a dataset $\{(\mathbf{x}_i, \mathbf{y}_i)\}$.

Then, address the following:

(a) Find a closed-form solution for this problem;

(b) Consider "Individual household electric power consumption" dataset ($N = 2075259$, $d = 9$) and find the optimal linear regressor from the closed-form expression;

(c) Repeat 2) for "Greenhouse gas observing network" dataset ($N = 2921$, $d = 5232$) and observe the scalability issue of the closed-form expression;

(d) How would you address even bigger datasets?

Computer Assignment 2 - Deterministic/stochastic algorithms in practice

Let us consider the logistic ridge regression

$$f(\mathbf{w}) = \frac{1}{N}\sum_{i\in[N]} f_i(\mathbf{w}) + \lambda\|\mathbf{w}\|_2^2,$$

where $f_i(\mathbf{w}) = \log\left(1 + \exp\{-y_i\mathbf{w}^T\mathbf{x}_i\}\right)$ for the "Greenhouse gas observing network" dataset.

Then, address the following:

1) Solve the optimization problem using GD, stochastic GD, SVRG, and SAG;

2) Tune a bit the hyper-parameters (including λ);

3) Compare these solvers in terms of complexity the hyper-parameter tunning, convergence time, convergence rate (in terms of # outer-loop iterations), and memory requirement.