

Reading Report: Distributed Sparse Linear Regression

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This paper proposes new algorithms to estimate the coefficients of linear regression problems via Lasso when the training data are distributed across different agents. As we all know, the Lasso, is a regularization technique capable of performing joint estimation and continuous variable selection, especially well-suited for sparse and possibly under-determined optimization problems. However, in the situation that communicating with a central processing unit is prohibited, the centralized algorithms for classic linear regression problems are not able to be applied to.

The authors firstly transform a common Lasso estimator in a distributed fashion to the distributed minimization problem with consensus constraints. Under the assumption of connected graph, it can be ensured that the reformulated problem is equal to the original but in a separable form. Moreover, adding auxiliary local variables and associating Lagrange multipliers to it can transform to the quadratically augmented function which is highly decomposable and can be minimized parallelly by the alternating-direction method of multipliers. Initializing these multipliers to zero makes ADMM reduce to the local updates which comprise the distributed quadratic programming Lasso (DQP-Lasso). In order to reduce the cost of communication and the complexity of computation further, the authors also provide the coordinate descent version of Distributed Lasso. In the DCD-Lasso, they simplify the local minimization of the iterates by updating the scalar coordinate cyclically instead of the whole target vector. Based on the above algorithms, they provide a new framework where each agent estimates updates using simple soft-thresholding operations. Different from DCD-Lasso, D-Lasso allows to update all coordinates of iterates in parallel, potentially leading to a faster convergency rate.