DEPARTMENT OF
Industrial and
Systems Engineering

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LEHIGH
UNIVERSITY

INDUSTRIAL AND SYSTEMS ENGINEERING SEMINAR

TITLE:

Semi-Stochastic Gradient Descent Methods

SPEAKER:

Jakub Konečný, University of Edinburgh

TIME & LOCATION:

Wednesday, December 3, 4:00-5:00pm, Mohler Lab, #453

Abstract

In this talk I describe the problem of minimizing the average of a large number (n) of smooth convex loss functions. We propose a new method, S2GD (Semi-StochasticGradient Descent), which runs for one or several epochs in each of which a single full gradient and a random number of stochastic gradients is computed, following a geometric law. The total work needed for the method to output an ε-accurate solution in expectation, measured in the number of passes over data, or equivalently, in units equivalent to the computation of a single gradient of the loss, is $\mathcal{O}(\log(1/\varepsilon))$. This is achieved by running the method for $\mathcal{O}(\log(1/\varepsilon))$ epochs, with a single gradient evaluation and $\mathcal{O}(\kappa)$ stochastic gradient evaluations in each, where κ is condition number of the problem. To illustrate our theoretical results, S2GD only needs the workload equivalent to about 2.1 full gradient evaluations to find an 10^{-6}-accurate solution for a problem with $n = 10^9$ and $\kappa = 10^3$.

In the second part of the talk, I will try to explain "what machine learners actually want". In other words, I will provide insight into why the best optimization algorithm does not necessarily have to be the best learning algorithm (if we work in large scale setting), and how good is S2GD as a learning algorithm.

Bio sketch

Jakub is a PhD student at the University of Edinburgh, under supervision of Peter Richtárik. His main interest is large-scale optimization methods for machine learning. He is recipient of the prestigious Google Europe Doctoral Fellowship in Optimization Algorithms. Jakub has a paper published in Journal of Machine Learning Research, and two papers to appear in SIAM Journal on Optimization. Prior to PhD study, Jakub obtained bachelor's degree in Mathematics of Economy and Finance from Comenius University in Bratislava.