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In-network Nonconvex Big Data Optimization

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Aula O1, Edificio Corpo O

About the speaker

Gesualdo Scutari (S05M06SM11) received the Electrical Engineering and Ph.D. degrees (both with honors) from the University of Rome La Sapienza, Rome, Italy, in 2001 and 2006, respectively. He is an Associate Professor with the Department of Industrial Engineering at Purdue University, and he is the Scientific Director for the area of Big-Data Analytics at the Cyber Center (Discovery Park) at Purdue Universit. He had previously held several research appointments, namely, at University of California at Berkeley, Berkeley, CA; Hong Kong University of Science and Technology, Hong Kong; University of Rome, La Sapienza, Rome, Italy; University of Illinois at Urbana-Champaign, Urbana, IL. His primary research interests focus on theoretical and algorithmic issues related to continuous (large-scale) optimization, Big-Data Analytics, equilibrium programming, and their applications to signal processing, communications and networking; medical imaging; and machine learning. Dr. Scutari is an Associate Editor of IEEE Transactions on Signal Processing, and he served as an Associate Editor of IEEE Signal Processing Letters. He served on the IEEE Signal Processing Society Technical Committee on Signal Processing for Communications (SPCOM). Dr. Scutari received the 2006 Best Student Paper Award at the International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2006, the 2013 NSF Faculty Early Career Development (CAREER) Award, the 2013 UB Young Investigator Award, the 2015 AnnaMaria Molteni Award for Mathematics and Physics from the Italian Scientists and Scholars in North America Foundation (ISSNAF), and the 2015 IEEE Signal Processing Society Young Author Best Paper Award.

Abstract

Nowadays, large-scale systems are ubiquitous. Some examples/applications include wireless communication networks; electricity grid, sensor, and cloud networks; and machine learning and signal processing applications, just to name a few. In many of the above systems, i) data are distributively stored in the network (e.g., clouds, computers, sensors, robots), and ii) it is often impossible to run analytics on central fusion centers, owing to the volume of data, energy constraints, and/or privacy issues. Thus, distributed in-network processing with parallelized multi-processors is preferred. Moreover, many applications of interest lead to large-scale optimization problems with nonconvex, nonseparable objective functions. All this makes the analysis and design of distributed/parallel algorithms over networks a challenging task. In this talk we will present our ongoing work in this area. More specifically, we consider a large-scale network composed of agents aiming to distributively minimize a (nonconvex) smooth sum-utility function plus a nonsmooth (nonseparable), convex one. The latter is usually employed to enforce some structure in the solution, e.g., sparsity. The agents have access only to their

local functions but not the whole objective, and the network is modeled as a directed, time-varying, B- strongly connected graph. We propose a distributed solution method for the above optimization wherein the agents in parallel minimize a convex surrogate of the original nonconvex objective while using a novel broadcast protocol to distribute the computations over the network. Convergence to stationary solutions is established. Numerical results show that our new algorithm compares favorably to current schemes on both convex and nonconvex problems.

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