

IAS Distinguished Lecture Series
Frontiers in Operations Research/Operations Management

Recent Algorithmic Developments for the Markov Decision/Game Process

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Date : 4 January 2018 (Thursday)

Time : 4:00pm - 5:30pm (*Light refreshments will be served from 3:30pm to 4:00pm*)

Venue : Benjamin Kwok Lecture Theatre (LT-16), Purple Zone, 4/F,
Yeung Kin Man Academic Building, City University of Hong Kong



Discussants:

Professor Chuangyin Dang, Acting Head and Professor, Department of Systems Engineering and Engineering Management, City University of Hong Kong

Professor Anthony Man-Cho So, Associate Professor, Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong

Abstract

We present recent developments related to distributed algorithms for the Markov decision and turn-based game process, or linear programming at large.

1. We prove that the classical policy-iteration method (Howard 1960), including the simple policy-iteration (or simplex method, Dantzig 1947) with the most-negative-reduced-cost pivoting rule, is a strongly polynomial-time algorithm for solving discounted Markov decision processes (MDP) of any fixed discount factor. The result is surprising since almost all complexity results on the simplex and policy-iteration methods are negative, while in practice they are widely used for solving MDPs and stochastic games.
2. We develop new results on solving MDP approximately by a careful modification of approximate value iteration. We show how to combine classic approximate value-iteration analysis with new techniques in variance reduction. The result is one of few instances in using sampling to obtain a linearly convergent algorithm and we hope that the analysis may be useful more broadly.
3. We show that the direct extension of ADMM of three-block for linear programming is not necessarily convergent, although its convergence proof was established 40 years ago with one and two-block. We also propose possibly simple and efficient variants, which could be applied to solving very large-scale linear programs.

Biography

Yinyu Ye is currently the K.T. Li Chair Professor of Engineering at Department of Management Science and Engineering and Institute of Computational and Mathematical Engineering, Stanford University. He is also the Director of the MS&E Industrial Affiliates Program. He received the B.S. degree in System Engineering from the Huazhong University of Science and Technology, China, and the M.S. and Ph.D. degrees in Engineering-Economic Systems and Operations Research from Stanford University. His current research interests include Continuous and Discrete Optimization, Data Science and Application, Algorithm Design and Analysis, Computational Game/Market Equilibrium, Metric Distance Geometry, Dynamic Resource Allocation, and Stochastic and Robust Decision Making, etc. He is an INFORMS (The Institute for Operations Research and The Management Science) Fellow since 2012, and has received several academic awards including: the 2009 **John von Neumann Theory Prize** for fundamental sustained contributions to theory in Operations Research and the Management Sciences, the 2015 **SPS Signal Processing Magazine Best Paper Award**, the winner of the 2014 **SIAM Optimization Prize** awarded (every three years), the inaugural 2012 **ISMP Tseng Lectureship Prize** for outstanding contribution to continuous optimization (every three years), the inaugural 2006 **Farkas Prize** on Optimization, the 2009 IBM Faculty Award, etc.. He has supervised numerous doctoral students at Stanford who received the 2015 and 2013 Second Prize of INFORMS **Nicholson Student Paper Competition**, the 2013 **INFORMS Computing Society Prize**, the 2008 First **Nicholson Prize**, and the 2006 and 2010 **INFORMS Optimization Prizes** for Young Researchers. He is the Chairman of technical advisory board of **MOSEK**, one of the major commercial international optimization software companies. His text book written with David Luenberger, "Linear and Nonlinear Programming," has been popularly used in academic education. In the past, Ye has led and managed a group of researchers on a broader range of government and industrial projects including Boeing, American Express, Oracle, AOL, IBM, 49ers, Huawei, EPRI, China EPRI, Ai-Force, NSF, DOE, etc.; focusing on business analytics, sensor network, big data, risk management, electronic commerce, Internet economics, etc. He has been the Director of the Stanford Management Science and Engineering Department Industrial Affiliates Program since 2002, where his role is to establish direct links between members of the faculty and industrial affiliates.

