Yangyang Xu

Department of Mathematical Sciences
Rensselaer Polytechnic Institute Amos Eaton 310
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Education

Rice University, Houston, TX, USA.
Ph.D. in Computational and Applied Mathematics — 2014
Thesis: "Block coordinate update method in tensor optimization"
Advisor: Professor Wotao Yin

Chinese Academy of Sciences, Beijing, China.
M.S. in Operations Research — 2010

Nanjing University, Nanjing, China.
B.S. in Computational Mathematics — 2007

Employment

Rensselaer Polytechnic Institute
Assistant Professor — 2017.08 –

University of Alabama, Tuscaloosa
Assistant Professor — 2016.08 – 2017.08

University of Minnesota, Twin Cities
Postdoctoral Associate — 2015.09 – 2016.08
Mentor: Professor Shuzhong Zhang

University of Waterloo
Postdoctoral fellow — 2014.08 – 2015.08
Advisors: Professors Stephen Vavasis and Henry Wolkowicz

Siemens Corporate Research
Intern. Mentors: Drs. Ioannis Akrotirianakis and Amit Chakraborty — Summer 2012
Developed fast algorithms for binary and multi-class Support Vector Machines with applications to microarray and texture classifications.

Research Interests

Optimization:	nonlinear programming, tensor optimization, stochastic programming
Methods:	block update methods, stochastic approximation, first-order methods
Computing:	parallel computing
Applications:	compressed sensing, machine learning, signal processing, data mining

Publication list

Published or accepted

40. Z. Li and **Y. Xu**. Augmented Lagrangian based first-order methods for convex-constrained programs with weakly-convex objective. Accepted in INFORMS Journal on Optimization.

39. Yibo Xu and **Yangyang Xu**. Katyusha Acceleration for Convex Finite-Sum Compositional Optimization. Accepted in INFORMS Journal on Optimization.
38. Y. Ouyang and **Y. Xu**. Lower complexity bounds of first-order methods for convex-concave bilinear saddle-point problems. *Mathematical Programming, Series A*, 185, 1–35, 2021.
37. **Y. Xu**. Iteration complexity of inexact augmented Lagrangian methods for constrained convex programming. *Mathematical Programming, Series A*, 185, 199–244, 2021.
36. (Conference) Z. Li, P. Chen, S. Liu, S. Lu, **Y. Xu**. Rate-improved Inexact Augmented Lagrangian Method for Constrained Nonconvex Optimization. AISTATS, 130, 2170–2178, 2021.
35. **Y. Xu**. First-order methods for constrained convex programming based on linearized augmented Lagrangian function. INFORMS Journal on Optimization, 30(1), 89–117, 2021.
34. **Y. Xu**. Primal-dual stochastic gradient method for convex programs with many functional constraints. *SIAM Journal on Optimization*, 30(2), 1664–1692, 2020.
33. (Conference) C. Wu and **Y. Xu**. Greedy coordinate descent method on non-negative quadratic programming. *2020 IEEE 11th Sensor Array and Multichannel Signal Processing Workshop (SAM)*, pp. 1–5, 2020.
32. N. Zhou, B. Chen, T. Jiang, Y. Du and **Y. Xu**. Maximum Correntropy Criterion based Robust Semi-supervised Concept Factorization for Image Representation. *IEEE Transactions on Neural Networks and Learning Systems*, 31(10), 3877–3891, 2020.
31. T. Sun, Y. Sun, **Y. Xu** and W. Yin. Markov Chain Block coordinate descent. *Computational Optimization and Applications*, 75(1), 35–61, 2020.
30. X. Gao, **Y. Xu** and S. Zhang. Randomized primal-dual proximal block coordinate updates, *Journal of the Operations Research Society of China*, 7(2), pp. 205–250, 2019.
29. **Y. Xu**. Asynchronous parallel primal-dual block coordinate update methods for affinely constrained convex programs, *Computational Optimization and Applications*, 72(1), pp. 87–113, 2019.
28. N. Zhou, **Y. Xu**, H. Cheng, Z. Yuan and B. Chen. Maximum Correntropy Criterion based Sparse Subspace Learning for Unsupervised Feature Selection. *IEEE Transactions on Circuits and Systems for Video Technology*, 29(2), pp. 404–417, 2019.
27. Z. Peng, **Y. Xu**, M. Yan and W. Yin. On the convergence of asynchronous parallel iteration with unbounded delays. Special issue on *Journal of the Operations Research Society of China*, 7(1), pp. 5–42, 2019.
26. **Y. Xu**. Hybrid Jacobian and Gauss-Seidel proximal block coordinate update methods for linearly constrained convex programming. *SIAM Journal on Optimization*, 28(1), pp. 646–670, 2018.
25. D. Oliveira, H. Wolkowicz and **Y. Xu**. ADMM for the SDP relaxation of the QAP. *Mathematical Programming Computation*, 10(4), pp. 631–658, 2018.
24. Y. Chen, J. Zhang and **Y. Xu**. Adaptive lasso for accelerated hazards models. *Journal of Statistical Computation and Simulation*, 88(15), pp. 2948–2960, 2018.
23. (Conference) B. Liu, T. Xie, **Y. Xu**, M. Ghavamzadeh, Y. Chow, D. Lyu and D. Yoon. A Block Coordinate Ascent Algorithm for Mean-Variance Optimization, NeurIPS, pp. 1073–1083, 2018.
22. (Conference) X. Li, J. Ren, S. Rambhatla, **Y. Xu** and J. Haupt. Robust PCA via dictionary based outlier pursuit, ICASSP, pp. 4699–4703, 2018.
21. **Y. Xu** and S. Zhang. Accelerated Primal-Dual Proximal Block Coordinate Updating Methods for Constrained Convex Optimization. *Computational Optimization and Applications*, 70(1), 91–128, 2018.
20. **Y. Xu**. On the convergence of higher-order orthogonality iteration. *Linear and Multilinear Algebra*, 66(11), pp. 2247–2265, 2018.

19. **Y. Xu**. Accelerated first-order primal-dual proximal methods for linearly constrained composite convex programming. *SIAM Journal on Optimization*, 27(3), 1459–1484, 2017.
18. **Y. Xu** and W. Yin. A globally convergent algorithm for nonconvex optimization based on block coordinate update. *Journal of Scientific Computing*, 72(2), 700–734, 2017.
17. F. Wen and **Y. Xu**. HOSVD Based Multidimensional Parameter Estimation for Massive MIMO System from Incomplete Channel Measurements. *Multidimensional Systems and Signal Processing*, 29(4), pp. 1255–1267, 2018.
16. **Y. Xu**. Fast algorithms for higher-order singular value decomposition from incomplete data. *Journal of Computational Mathematics, Special Issues on Optimization and Structured Solution*, 35(4), 395–420, 2017.
15. Z. Peng, **Y. Xu**, M. Yan and W. Yin. ARock: an algorithmic framework for asynchronous parallel coordinate updates. *SIAM Journal on Scientific Computing*, 38(5), pp. A2851–A2879, 2016.
14. Z. Peng, T. Wu, **Y. Xu**, M. Yan and W. Yin. Coordinate Friendly Structures, Algorithms and applications. *Annals of Mathematical Sciences and Applications*, 1(1), 57–119, 2016.
13. N. Zhou, **Y. Xu**, H. Cheng, J. Fang and W. Pedrycz. Global and local structure preserving sparse subspace learning: an iterative approach to unsupervised feature selection. *Pattern Recognition*, 53, pp. 87–101, 2016.
12. **Y. Xu** and W. Yin. A fast patch-dictionary method for whole image recovery, *Inverse Problems and Imaging*, 10(2), 563–583, 2016.
11. **Y. Xu**, I. Akrotirianakis and A. Chakraborty. Proximal gradient method for Huberized support vector machine, *Pattern Analysis and Applications*, 19(4), 989–1005, 2016.
10. **Y. Xu** and W. Yin. Block stochastic gradient iteration for convex and nonconvex optimization, *SIAM Journal on Optimization*, 25(3), 1686–1716, 2015.
9. **Y. Xu**, R. Hao, W. Yin and Z. Su. Parallel matrix factorization for low-rank tensor completion, *Inverse Problems and Imaging*, 9(2), 601–624, 2015.
8. **Y. Xu**. Alternating proximal gradient method for sparse nonnegative Tucker decomposition. *Mathematical Programming Computation*, 7(1), 39–70, 2015.
7. **Y. Xu**, I. Akrotirianakis and A. Chakraborty. Alternating direction method of multiplier for regularized multiclass support vector machines. *Lecture Note in Computer Science*, 2015.
6. **Y. Xu**, W. Yin and S. Osher. Learning circulant sensing kernels. *Inverse Problems and Imaging*, 8(3), 901–923, 2014.
5. **Y. Xu** and W. Yin. A block coordinate descent method for multi-convex optimization with applications to nonnegative tensor factorization and completion. *SIAM Journal on Imaging Sciences*, 6(3), 1758–1789, 2013.
4. M. Lai, **Y. Xu** and W. Yin. Improved iteratively reweighted least squares for unconstrained smoothed ℓ_q minimization. *SIAM Journal on Numerical Analysis*, 51(2), pp. 927–957, 2013.
3. (Conference) Q. Ling, **Y. Xu**, W. Yin and Z. Wen. Decentralized low-rank matrix completion, *IEEE International Conference on Acoustics, Speech and Signal Processing* (ICASSP), pp. 2925–2928, 2012.
2. **Y. Xu** and J. Cui. Multi-task n-vehicle exploration problem: complexity and algorithms. *Journal of Systems Science and Complexity*, pp. 1080–1092, 2012.
1. **Y. Xu**, W. Yin, Z. Wen and Y. Zhang. An alternating direction algorithm for matrix completion with nonnegative factors. *Journal of Frontiers of Mathematics in China, Special Issues on Computational Mathematics (Springer)*, 2011, pp. 365–384.

Under review

7. **Yangyang Xu**, Yibo Xu, Y. Yan, and J. Chen. Distributed stochastic inertial methods with delayed derivatives.
6. G. Mancino-Ball, **Y. Xu**, J. Chen. A Decentralized Primal-Dual Framework for Non-convex Smooth Consensus Optimization.
5. **Yangyang Xu**, Yibo Xu, Y. Yan, C. Sutcher-Shepard, L. Grinberg and J. Chen. Parallel and distributed asynchronous adaptive stochastic gradient methods.
4. Y. Yan and **Y. Xu**. Adaptive Primal-Dual Stochastic Gradient Method for Expectation-constrained Convex Stochastic Programs.
3. Y. Xu. First-order methods for problems with $O(1)$ functional constraints can have almost the same convergence rate as for unconstrained problems.
2. Y. Xu. Momentum-based variance-reduced proximal stochastic gradient method for composite non-convex stochastic optimization.
1. Q. Lin, R. Ma and **Y. Xu**. Inexact Proximal-Point Penalty Methods for Non-Convex Optimization with Non-Convex Constraints.

Grants

NSF, Division of Mathematical Sciences

– Sole PI: Information-Based Complexity Analysis and Optimal Methods for Saddle-Point Structured Optimization, 2021.06–2024.05 (total \$249,972, CDS&E-MSS).

– Sole PI: Novel numerical approaches for structured optimization problems, 2017.08–2020.07 (total \$96,000, computational math).

IBM, AI Horizons Network

– PI: Large-Scale Distributed Optimization for Deep Learning and Reinforcement Learning, 2021.01–2021.12 (total \$200,000, co-PI: Tianyi Chen, my part \$100,000)

– PI: Asynchronous and adaptive stochastic approximation methods for accelerating deep learning, 2019.08–2020.12 (total \$150,000)

Patents

US Patent App. 10/332,025, 2019. **Y. Xu**, I. Akrotirianakis and A. Chakraborty. Proximal gradient method for huberized support vector machine.

Teaching Experience

Rensselaer Polytechnic Institute

MATP 6960: Stochastic Optimization and Reinforcement Learning	Fall 2021
MATP 4820/6610: Computational Optimization	Spring 2021
MATP 6960: Stochastic Optimization and Reinforcement Learning	Fall 2020
MATP 4820/6610: Computational Optimization	Spring 2020
MATP 6960: Stochastic Optimization Methods	Fall 2019
MATP 4820/6610: Computational Optimization	Spring 2019
MATP 6600 / ISYE 6780: Introduction to Optimization	Fall 2018
MATH 6490: Topics in Optimization	Spring 2018
MATP 6600 / ISYE 6780: Introduction to Optimization	Fall 2017

University of Alabama

Math 237: Introduction to Linear Algebra	Summer 2017
Math 410/510: Numerical Linear Algebra	Spring 2017
Math 227: Calculus III	Spring 2017
Math 126: Calculus II	Fall 2016

University of Waterloo

Math 137: Calculus I	Summer 2016

Invited talks

- Asynchronous Parallel Adaptive Stochastic Gradient Methods.

  SIAM Conference on Computational Science and Engineering, virtual, March 04, 2021.
- Near-optimal first-order methods for nonlinear programs with $O(1)$ functional constraints.

  Peking University Workshop on Optimization Theory and Methods, virtual, Jan. 30, 2021.
- Low-rank tensor approximation and completion.

  SIAM Conference on Imaging Sciences, Virtual, July 13, 2020
- Adaptive primal-dual stochastic gradient methods.

  INFORMS Annual Meeting, Virtual, Nov. 13, 2020;
  Conference on Computational Mathematics and Applications, Las Vegas, Oct. 26, 2019;
  INFORMS Annual Meeting, Seattle, Oct. 20, 2019.
- First-order methods for convex and nonconvex functional constrained problems.

  AI and Tensor Factorizations for Physical, Chemical, and Biological Systems Conference, Sep. 18, 2019;
  CUHK-Shenzhen Workshop on Optimization Theory and Applications, August 02, 2019.
- Lower complexity bounds of first-order methods for convex-concave bilinear saddle-point problems.

  INFORMS Annual Meeting, Seattle, Oct. 21, 2019;
  ICCOPT, Berlin, August 06, 2019;
  SUST Math Colloquium, May 08, 2019;
  UCLA Applied Math Colloquium. Nov. 06, 2018.
- Primal-dual block coordinate update methods for multiblock structured affinely constrained problems.

  Data and Computer Science, Sun Yat-Sen University, Guangzhou, May 10, 2019;
  SIAM Conference on Computational Science and Engineering, Spokane, WA, Feb. 25, 2019;
  Math seminar, Nanjing Normal University, Nanjing, June 21, 2018.

– Iteration complexity of inexact augmented Lagrangian method for nonlinearly constrained convex optimization problems.

  INFORMS Annual Meeting, Phoenix, Nov. 05, 2018;
  INFORMS International Meeting, Taiwan, June 18, 2018.

– First-order methods for convex programs with functional constraints.

  SCUT, Math Colloquium, Guangzhou, May 09, 2019;
  Analysis and Data Science Seminar, SUNY Albany, Oct. 08, 2018;
  Renmin University, Math Colloquium, Beijing, June 28, 2018;
  SPOC, Nanjing University, June 23, 2018;
  INFORMS Optimization Society Conference, Denver, March 24, 2018.
  Applied Math Colloquium, UCLA , Feb. 07, 2018.

– Optimal first-order methods for constrained convex programs.

  Chinese Academy of Sciences, Computational Math seminar, Beijing, June 26, 2018.

– Block coordinate update methods.

  ICCM First Annual Meeting, Guangzhou, Dec. 27, 2017.

– Asynchronous parallel primal-dual block update method.

  MOPTA, Lehigh University, Aug. 16–18, 2017.

– Accelerated primal-dual methods for linearly constrained convex problems.

  SIAM Conference on Optimization. Vancouver, Canada, May 22–25, 2017.

– Orthogonal Candecomp/Parafac Tensor Decomposition.

  SIAM Conference on CSE. Atlanta, GA, Feb. 27 – March 03, 2017.
  SIAM Conference on Applied Linear Algebra. Hong Kong, May 04, 2018.

– Primal-dual methods for affinely constrained problems.

  Seminar of Mathematical Sciences, Clemson University, Oct. 20, 2016.
  Colloquium of Math, University of Alabama Bermingham, March 10, 2017.
  Seminar of Computational Math, Louisiana State University, Sep. 26, 2017.

– Randomized primal-dual block coordinate updates.

  SIAM Conference on Imaging Sciences. Albuquerque, NM, May 23–26, 2016.

– Block stochastic gradient update method.

  INFORMS Annual Meeting. Philadelphia, PA, Nov. 1–4, 2015.

– On the convergence of higher-order orthogonality iteration and its extension.

  SIAM Conference on Applied Linear Algebra, Atlanta, GA, Oct. 26–30, 2015.

– Compressed higher-order singular value decomposition.

  AMMCS-CAIMS Congress. Wilfrid Laurier University, Waterloo, Cananda, June 7–12, 2015

– Low-rank tensor recovery via matrix factorization.

  SIAM Conference on CSE. Salt Lake City, March 14–18, 2015.

– Large-scale Optimization via Block Coordinate Update.

  Colloquium of Math, University of Central Florida, Orlando, Feb. 03, 2015.
  Colloquium of Statistics and Operations Research, University of North Carolina, Chapel Hill. Feb. 11, 2015.

– Parallel matrix factorization for low-rank tensor completion.

  SIAM Conference on Optimization. San Diego, CA, May 19–22, 2014.

- Block coordinate descent in tensor optimization.
  Colloquium of Math Department, National University of Singapore, Feb. 10, 2014.
- Block coordinate descent for multi-convex optimization.
  14th International Conference on Approximation Theory. San Antonio, TX, April 7–10, 2013.
- Decentralized low-rank matrix completion.
  CAAM Graduate Seminar, Rice University, Nov. 2, 2011.
- Matrix completion with nonnegative factors.
  Colloquium of Math Department, Shanghai Jiaotong University, Aug. 17, 2011.

Professional activities

Session Organizer

INFORMS Annual Meeting, Virtual, Nov. 07 – 13, 2020
INFORMS Annual Meeting, Seattle, Oct. 19 – 23, 2019
Sixth International Conference on Continuous Optimization (ICCOPT), Berlin, Aug. 05 – 08, 2019
INFORMS International Meeting, Taiwan, June 17 – 20, 2018
SIAM Conference on Applied Linear Algebra, Hong Kong, May 04 – 08, 2018
SIAM Conference on CSE, Atlanta, GA, Feb. 27 – March 03, 2017
SIAM Conference on Optimization, San Diego, CA, May 19 – 22, 2014
INFORMS Optimization Society Conference, Houston, TX, March 6 – 8, 2014

Journal Referee

Applied Mathematics and Computation
Computational Optimization and Applications
IEEE Signal Processing
IEEE Neural Network and Learning System
IEEE Transactions on Pattern Analysis and Machine Intelligence
IMA Journal of Numerical Analysis
INFORMS Journal on Optimization
Journal of Computational Mathematics
Journal of Global Optimization
Journal of Machine Learning Research
Journal of Mathematical Imaging and Vision
Journal of Operations Research Society of China
Journal of Optimization Theory and Application
Journal of Scientific Computing
Mathematics of Operations Research
Mathematical Programming
Optimization
Pattern Recognition
SIAM Journal on Imaging Sciences
SIAM Journal on Optimization
SIAM Journal on Scientific Computing

Honors and Awards

Gold paper award, International Consortium of Chinese Mathematicians	2017
Alan Weiser Memorial Travel Award, Rice University	2014