Yibo Xu

Contact Information

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Research Interests

My interests are in all fields of optimization, with particular emphases in continuous optimization, mixed-discrete and continuous nonconvex programming. My objectives are to develop new mathematical tools and algorithms for solving various decision problems that arise in engineering contexts. My current focus is on large-scale optimization methods for machine learning. I have additional training, and long-term interests, in such areas as convex analysis, large-scale decomposition, networks, computational algebraic geometry, cryptography, algebra and statistics.

Education

Clemson University, Clemson, South Carolina, USA

Ph.D., Mathematical Sciences **May, 2018**

- Dissertation entitled, "Convex Hulls, Relaxations, and Approximations of General Monomials and Multilinear Functions."
- Advisor: Warren Adams
- GPA: 4.00/4.00

University of Nevada, Reno, Reno, Nevada, USA

M.S., Applied Mathematics **December, 2013**

- GPA: 4.00/4.00

Class in honor of Shiing-Shen Chern, Nankai University, Tianjin, China

B.S., Mathematics and Applied Mathematics **June, 2010**

- Thesis entitled, "Convexity and Optimization in Linear Spaces," scored 95%.

Publications

Xu, Yangyang, **Xu, Yibo**, Yan, Y., Chen, J., "Distributed stochastic inertial methods with delayed derivatives," submitted.

Xu, Yangyang, **Xu, Yibo**, Yan, Y., Sutcher-Shepard, C., Grinberg, L., Chen, J., "Parallel and distributed asynchronous adaptive stochastic gradient methods," submitted.

Xu, Yibo, Xu, Yangyang, "Katyusha Acceleration for Convex Finite-Sum Compositional Optimization," *INFORMS Journal on Optimization,* accepted, 2021.

Xu, Y., "Convex Hull Derivation for a Symmetric Multilinear Polynomial and a Symmetric Polytope," submitted.

Xu, Y., Adams, W., Gupte, A., "Convex Hulls of Symmetric Multilinear Polynomials over Box Constraints," submitted.

Adams, W., Gupte, A., **Xu, Y.**, "Error bounds for monomial convexification in polynomial optimization," *Mathematical Programming Series A,* Vol. 175, No. 1-2, pp. 355-393, 2019.

Papers in preparation

Xu, Y., Adams, W., Gupte, A., "Error Analysis of Multilinear Terms using Linear Functions."

Conference Presentations

Xu, Y., "Deriving the Convex Hull Form of a Symmetric Multilinear Polynomial," INFORMS Annual Meeting, Houston, TX, USA, October 2017.

Xu, Y., Adams, W., Gupte, A., "Deriving Convex Hull Forms of Special Symmetric Multilinear Polynomials," SIAM Conference on Applied Algebraic Geometry, Atlanta, GA, USA, August 2017.

Xu, Y., Adams, W., Gupte, A., "On the Strength of Linear Approximations for Multilinear Monomials," INFORMS Annual Meeting, Nashville, TN, USA, November 2016.

Xu, Y., Adams, W., Gupte, A., "Error Bounds from Monomial Convexification in Polynomial Optimization," INFORMS Annual Meeting, Nashville, TN, USA, November 2016.

Seminar Presentations

Xu, Y., "Solving Strongly Convex Stochastic Composition Optimization," Dynamical Systems/RTG Seminar, Rensselaer Polytechnic Institute, Troy, NY, USA, February 2019.

Xu, Y., "Deriving the Convex Hull Form of a Symmetric Multilinear Polynomial," Operations Research Seminar, Clemson University, Clemson, SC, USA, October 2017.

Poster Presentation

Xu, Y., Adams, W., Gupte, A., "Deriving Convex Hull Forms of Special Symmetric Multilinear Polynomials," Mixed Integer Programming workshop, Montreal, Canada, June 2017.

Reviewer

IEEE Access, Journal of Global Optimization, AISTATS.

Large Scale Optimization in Supply Chains and Smart Manufacturing: Theory and Applications, Springer Optimization and Its Applications, 2019.

Recent Advances in Optimization and Modeling of Contemporary Problems, Tutorials in Optimizations Research, October 2018.

Academic Experience

Clemson University, Clemson, South Carolina, USA

Post Doctoral Fellow **August, 2021 - Present**

- Conduct collaborative and independent research on operations research.
- Teach two courses per semester.
- Math 1020 Business Calculus I, Fall 2021. 2 sections, 76 students.

Rensselaer Polytechnic Institute, Troy, New York, USA

Postdoctoral Research Associate **August, 2018 - July, 2021**

- Conduct research on continuous optimization.
- Design algorithms which improve state-of-the-art computational complexities or achieve nearly-linear asynchronous parallelization speed-up.
- Present recent research advances of the field, report research progresses, innovate, discuss and convey ideas within the research group.
- Perform preliminary computational experiments to verify theoretical advances.
- Draft notes which integrate said progresses and result in research papers.

Clemson University, Clemson, South Carolina, USA

Graduate Teacher of Record **August, 2015 - May, 2018**

- Math 1020 Business Calculus I, Fall 2017. 2 sections, 37 students.
- Math 2070 Business Calculus II, Fall 2016. 2 sections, 34 students.
- Math 2070 Multivariable Calculus, Spring 2016. 1 section, 32 students.
- Math 1020 Introduction to Mathematical Analysis, Fall 2015. 2 sections, 36 students.

Graduate Teaching Assistant **August, 2014 - May, 2018**

- Intro to Combinatorics, Spring 2018.
- Calculus of One Variable II, Spring 2017.
- Calculus of One Variable I, Spring 2015.
- Calculus of One Variable I, Fall 2014.

University of Nevada, Reno, Reno, Nevada, USA

Instructor **January - May, 2014**

- Math 126R Pre-calculus I, Spring 2014. 1 big section, 148 students.
- Math 126R Pre-calculus I, Spring 2014. 2 sections, 26 students.
- Math 126R Pre-calculus I, Summer 2013. 1 section, 24 students.

Teaching Assistant **January, 2012 - December, 2013**

- Calculus I, Fall 2013.
- Calculus I, Spring 2013.
- Pre-calculus I, Fall 2012.
- Calculus II, Spring 2012.

Graduate Honors and Awards

Mixed Integer Programming Workshop Travel Award	2017
Outstanding MS Student, Department of Mathematical Sciences, Clemson University	2016
Institute for Mathematics and its Applications Workshop Financial Support	2016

Selected Courses

Institute for Mathematics and its Applications, New Directions Short Course: Mathematical Optimization, Minneapolis, MN, USA, August 1-12, 2016.

Clemson University:

- ❑ Nonlinear Optimization Algorithms for Big Data Analysis
- ❑ Advanced Linear Programming
- ❑ Network Flow Programming
- ❑ Discrete Optimization
- ❑ Probability Theory I
- ❑ Statistical Inference
- ❑ Computational Algebraic Geometry
- ❑ Cryptography
- ❑ Matrix Analysis
- ❑ Linear Analysis
- ❑ Partial Differential Equations
- ❑ Finite Element Method

University of Nevada, Reno:

- ❑ Operations Research I & II
- ❑ Graph Theory & Combinatorics
- ❑ Game Theory
- ❑ Cooperative Game Theory
- ❑ Independent Study in Non-cooperative Game Theory
- ❑ Complex Function Theory
- ❑ Topology I
- ❑ Abstract Real Analysis I & II
- ❑ Modern Algebra I & II
- ❑ Numerical Analysis & Approximation I
- ❑ Methods in Applied Mathematics II

Undergraduate Honors and Awards

Third place, Siguo Wargame Elimination Game of Nankai University	2009
Basic Sciences Scholarship	2007
Outstanding Freshman Scholarship (Grade 2)	2006

Undergraduate and Earlier Publications (in Chinese)

Xu, Y., "Mathematical 'Besieged Fortress?' — Thoughts Drawn from a Math Problem," Beauty of Mathematics (internal journal in Nankai University), no. 4, 2008.

Xu, Y., "Another Solution to a Problem in National Mathematical Olympiad of Senior High School,"

High-School Mathematics, no. 8, pp 19-21, 2007.

Xu, Y. and Yu, S., "Proof to a Series of Inequalities," Bulletin of Mathematics, no. 18, pp 46-47, 2004.

Several papers, relative to findings and principles in Siguo Wargame in Nankai Bulletin Board System during 2009 and 2010.

Undergraduate Activities

Siguo Wargame Association, Nankai University, Tianjin, China

- A club for players of the Siguo Wargame, a four-player abstract strategy board game with imperfect information, which bears similarities to Stratego.

Chairman **September, 2009 - June, 2010**

- Enlarged and strengthened the Association by scheduling weekly meetings, organizing inter- and intra-university competitions, and preparing members for tournaments.

Member **September, 2008 - June, 2010**

Nankai Bulletin Board System, Nankai University, Tianjin, China

Moderator of Board "Mathematics" & Board "Siguo Wargame" **September, 2008 - June, 2010**

- Responsibilities consisted of holding discussions, maintaining board discussion, and answering questions.

Xutuan Middle School, Xutuan Town, Mengcheng County, Anhui Province, China

Volunteer Math Teacher **June, 2007 - July, 2007**

- Introduced rational number line, absolute value, etc., and inspired a class of thirty students in a one-month volunteer program in Xutuan, a poor town in Anhui Province.

Computer Skills

- Language: C++, PHP. Operating System: Windows.
- Experienced in LaTeX, MATLAB, CVX, PORTA.
- Some experience with AMPL, Maple, Mathematica.