# Tianjiao Li

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## RESEARCH INTERESTS

My research focuses on the design and analysis of novel first-order methods for *Nonlinear Optimization*, *Stochastic Optimization*, and *Dynamic Decision-Making*. I also actively pursue the practical value of these methods in relevant applications. I am particularly interested in

(i) Parameter-free methods for convex and nonconvex optimization
(ii) Stochastic optimization for statistical and machine learning
(iii) Policy optimization and policy evaluation in reinforcement learning
(iv) Applications, e.g., healthcare, E-commerce, finance

## EDUCATION

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|---|---|
| **Aug 2020 -** **Jun 2025** (expected) | **Georgia Institute of Technology**, Atlanta, GA, USA<br>Ph.D. in Operations Research<br>- Advisor: Guanghui (George) Lan<br>- Co-advisor: Ashwin Pananjady<br>- Minor: Machine Learning<br>- Department: H. Milton Stewart School of Industrial and Systems Engineering |
| **Aug 2019 -** **May 2021** | **Georgia Institute of Technology**, Atlanta, GA, USA<br>M.S. in Quantitative and Computational Finance |
| **Sep 2015 -** **Jun 2019** | **Fudan University**, Shanghai, China<br>B.S. in Information and Computational Science<br>- Department: School of Mathematical Sciences |

## PUBLICATIONS

($\alpha$-$\beta$ =alphabetical order)

- **A Simple Uniformly Optimal Method without Line Search for Convex Optimization**

  **Tianjiao Li**, Guanghui Lan
  Under second-round review, *Mathematical Programming Series A*. Initial version submitted in Oct 2023.
  *(Winner of Alice and John Jarvis Best Student Paper Award, 2024)*

- **Accelerated Stochastic Approximation with State-Dependent Noise**

  Sasila Ilandarideva, Anatoli Juditsky, Guanghui Lan, **Tianjiao Li ($\alpha$-$\beta$)**
  *Mathematical Programming Series A, 2024*

- **Stochastic First-Order Methods for Average-Reward Markov Decision Processes**

  **Tianjiao Li**, Feiyang Wu, Guanghui Lan
  *Mathematics of Operations Research, 2024*

- **Faster Algorithm and Sharper Analysis for Constrained Markov Decision Process**

  **Tianjiao Li**, Ziwei Guan, Shaofeng Zou, Tengyu Xu, Yingbin Liang, Guanghui Lan
  *Operations Research Letters, vol. 54, 107107, 2024*

- **Accelerated and Instance-Optimal Policy Evaluation with Linear Function Approximation**

  **Tianjiao Li**, Guanghui Lan, Ashwin Pananjady
  *SIAM Journal on Mathematics of Data Science, vol. 5, no. 1, pp. 174-200, 2023*

- **Simple and Optimal Methods for Stochastic Variational Inequalities, I: Operator Extrapolation**

  Georgios Kotsalis, Guanghui Lan, **Tianjiao Li** ($\alpha$-$\beta$)
  *SIAM Journal on Optimization, vol. 32, no. 3, pp. 2041-2073, 2022*

- **Simple and Optimal Methods for Stochastic Variational Inequalities, II: Markovian Noise and Policy Evaluation in Reinforcement Learning**

  Georgios Kotsalis, Guanghui Lan, **Tianjiao Li** ($\alpha$-$\beta$)
  *SIAM Journal on Optimization, vol. 32, no. 2, pp. 1120-1155, 2022*

## PREPRINTS AND WORKING PAPERS

- **Projected Gradient Methods for Nonconvex and Stochastic Optimization: New Complexities and Auto-Conditioned Stepsizes**

  Guanghui Lan, **Tianjiao Li**, Yangyang Xu ($\alpha$-$\beta$)
  Preprint at arXiv:2412.14291. Submitted to *Mathematical Programming Series A* in Dec 2024.

- **Auto-Conditioned Primal-Dual Hybrid Gradient Method and Alternating Direction Method of Multipliers**

  Guanghui Lan, **Tianjiao Li** ($\alpha$-$\beta$)
  Preprint at arXiv:2410.01979. To be submitted to *SIAM Journal on Optimization*.

- **Novel Accuracy Certificates for Smooth Convex Optimization**

  Sasila Ilandarideva, Anatoli Juditsky, Guanghui Lan, **Tianjiao Li** ($\alpha$-$\beta$)
  In preparation. To be submitted to *SIAM Journal on Optimization*.

- **Multiscale Replay: A Robust Algorithm for Stochastic Variational Inequalities with a Markovian Buffer**

  Milind Nakul, **Tianjiao Li**, Ashwin Pananjady
  In preparation. To be submitted to *Mathematics of Operations Research*.

## AWARDS AND HONORS

- **Alice and John Jarvis Best Student Paper Award, 2024**
  - Awarded annually to one Ph.D. student in ISyE across all disciplines
- **Second Place, Poster Competition, YinzOR Student Conference 2024**
- **Shabbir Ahmed PhD Fellowship for Excellence in Research, 2023**
  - Awarded annually to one Ph.D. student in ISyE for research in optimization
- **First Place, Best Poster Award, Georgia Statistics Day 2023**
- **Fudan University School of Mathematical Sciences Academic Scholarship**

## TEACHING AND STUDENT MENTORING

- **Course Instructor, Summer 2024, Georgia Tech**
  **Statistics and Applications (ISyE 3770)**
  - Description: one-semester probability and statistics course for engineering students
  - Class size: **64** (26 on campus + 38 online)
  - Overall teaching evaluation: **4.8/5.0** (response rate: 56%)
    * Respect for students: **4.8/5.0**
    * Inclusiveness: **4.9/5.0**
    * Communicated how to succeed: **4.7/5.0**
    * Availability: **4.9/5.0**
    * Stimulates interest: **4.6/5.0**
    * Clarity: **4.5/5.0**
    * Feedback helpfulness: **4.8/5.0**

- **Guest Lecturer, Fall 2024, Georgia Tech**
  **Computational Data Analysis / Machine Learning (ISyE 6740)**

  - Description: general machine learning course for master and Ph.D. students
  - Instructor: Guanghui (George) Lan
  - Responsibility: 2 Lectures in machine learning and data science

- **Guest Lecturer, Spring 2024, Georgia Tech**
  **Optimization Methods for Reinforcement Learning (ISyE 8803)**

  - Description: advanced topic in optimization for RL for ISyE Ph.D. students
  - Instructor: Guanghui (George) Lan
  - Responsibility: 8 Lectures in policy evaluation and average-reward MDPs

- **Student Mentoring:**

  - Milind Nakul, ISyE PhD Student, Georgia Tech
    Research project: Experience replay for policy evaluation in reinforcement learning

  - Feiyang Wu, CS Master Student, Georgia Tech
    Research project: Stochastic first-order methods for average-reward MDPs

  - ISyE PhD mentoring program, Georgia Tech

## VISITING EXPERIENCE

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|---|---|
| **Apr 2024 -** | **Laboratoire Jean Kuntzmann, University Grenoble Alpes**, Grenoble, France |
| **May 2024** | Visiting Graduate Student |
| | - Host: Anatoli Juditsky |
| | - Project: Stochastic Optimization Algorithms for Machine Learning Applications |
| **Oct 2021 -** | **Simons Institute for the Theory of Computing, UC Berkeley**, Berkeley, CA |
| **Nov 2021** | Visiting Graduate Student |
| | - Host: Ashwin Pananjady |
| | - Program: Computational Complexity of Statistical Inference |

## RESEARCH COLLABORATION

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|---|---|
| **Nov 2023 -** | **University of Louisville Health and Hospital** |
| **Present** | Project: reinforcement learning method for clinical decision making within surgical operations |
| | - Realtime intra- and post-operative clinical recommendation for prevention and mitigation of cardiac surgery-associated acute kidney injury (CSA-AKI) |
| | - Realtime intra-operative treatment recommendation for management of hypotension during surgeries |
| **Oct 2022 -** | **AI Institute for Advances in Optimization (AI4OPT)** |
| **May 2023** | Project: AI4OPT collaboration with Intel Corporation |
| | - Implemented the factorial model and random forest to detect significant factors in a process control problem (targeting at reducing the variability of a time series) with limited and highly skewed data |

## INDUSTRIAL EXPERIENCE

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|---|---|
| **May 2023 -** | **Amazon**, Seattle, WA, USA |
| **Aug 2023** | Position: Applied Scientist Intern |
| | - Developed an automated seasonality detection and seasonal-trend decomposition module for Amazon Payment anomaly detection platform |
| | - The internal paper was accepted by 2023 Amazon Machine Learning Conference (AMLC) |

# SERVICES

- **Journal Reviewing:**

  - SIAM Journal on Optimization
  - Mathematical Programming
  - Annuals of Statistics
  - Computational Optimization and Applications
  - Optimization Letters

- **Conference Reviewing:**

  - Conference on Learning Theory (COLT) 2022-2024

- **Session Organization:**

  - **INFORMS Annual Meeting 2024**, Seattle, WA, Oct 2024
    Session: Advances in Continuous Optimization Algorithms
    Session: Advances in Non-Smooth Optimization
  - **International Symposium on Mathematical Programming (ISMP 2024)**, Montreal, Canada, Jul 2024
    Session: Advances in First-Order Methods for Stochastic and Continuous Optimization

# TALKS AND PRESENTATIONS

- **IMS Young Mathematical Scientists Forum - Applied Mathematics**, Singapore, Jan 2025

  - Title: Universal Parameter-Free Methods for Convex and Nonconvex Optimization

- **INFORMS Annual Meeting**, Seattle, WA, Oct 2024

  - Session: First-Order Methods in Continuous and Stochastic Optimization
  - Title: A Simple Uniformly Optimal Method without Line Search for Convex Optimization

- **Cornell ORIE Young Researchers Workshop**, Ithaca, NY, Oct 2024

  - Session: Optimization I
  - Title: A Simple Uniformly Optimal Method without Line Search for Convex Optimization

- **YinzOR Student Conference, CMU Tepper School of Business**, Pittsburg, PA, Aug 2024

  - Poster presentation: Accelerated Stochastic Approximation with State-Dependent Noise
  - Won the Second Place in the poster competition

- **International Symposium on Mathematical Programming (ISMP 2024)**, Montreal, Canada, Jul 2024

  - Session: Advances in Stochastic First-Order Methods
  - Title: A Simple Uniformly Optimal Method without Line Search for Convex Optimization

- **DAO Team Seminar at Laboratoire Jean Kuntzmann**, Grenoble, France, May 2024

  - Title: A Simple Uniformly Optimal Method without Line Search for Convex Optimization

- **INFORMS Optimization Society Conference**, Houston, TX, Mar 2024

  - Session: Advances in Continuous Optimization Algorithms
  - Title: A Simple Uniformly Optimal Method without Line Search for Convex Optimization

- **INFORMS Annual Meeting**, Phoenix, AZ, Oct 2023

  - Session: Recent Advances in Policy Optimization and Reinforcement Learning
  - Title: Accelerated and Instance-Optimal Policy Evaluation with Linear Function Approximation

- **Georgia Statistics Day**, Atlanta, GA, Oct 2023

  - Poster presentation: Accelerated and Instance-Optimal Policy Evaluation with Linear Function Approximation
  - Won the First Place in the poster competition

- **SIAM Conference on Optimization**, Seattle, WA, May 2023

  - Session: New Sparse Optimization
  - Title: Accelerated Stochastic Approximation with State-Dependent Noise

- **INFORMS Annual Meeting**, Indianapolis, IN, Oct 2022

  - Session: Reinforcement Learning Theory

- Title: Stochastic First-Order Methods for Average-Reward Markov Decision Processes
- **ISyE Ph.D. Student Seminar**, Atlanta, GA, Sep 2022
  - Title: Stochastic First-Order Methods for Average-Reward Markov Decision Processes
- **Asilomar Conference on Signals, Systems, and Computers**, Online, Nov 2021
  - Session: Theory of Reinforcement Learning
  - Title: Faster Algorithm and Sharper Analysis for Constrained Markov Decision Process
- **INFORMS Annual Meeting**, Online, Oct 2021
  - Session: Stochastic Optimization in Machine Learning
  - Title: Simple and Optimal Methods for Stochastic Variational Inequalities

## REFERENCES

- **Guanghui (George) Lan (Professor)**

  H. Milton Stewart School of Industrial and Systems Engineering, Georgia Tech
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  & School of Electrical and Computer Engineering, Georgia Tech
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- **Arkadi Nemirovski (Professor)**

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