Jiajia Yu

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Research interests

Overall — applied and computational math, mathematics of data science/machine learning.

Current focus — mean-field games/control and optimal transport.

Employment

Aug. 2023 – July 2026 — **Duke University** – Durham, NC
Phillip Griffiths Assistant Research Professor
Mentors: Prof. Xiuyuan Cheng, Prof. Jian-Guo Liu and Prof. Hongkai Zhao

Sept. 2018 – May 2023 — **Rensselaer Polytechnic Institute** – Troy, NY
Research Assistant and Teaching Assistant

Education

2018 – 2023 — **Rensselaer Polytechnic Institute** – Troy, NY
Ph.D. in Mathematics. *GPA: 4/4.* Mentor: Prof. Rongjie Lai

2013 – 2017 — **Beijing Normal University** – Beijing, China
B.S. in Mathematics and Applied Mathematics. *Major GPA: 96/100*

Publications

Journal Articles

[4] **Jiajia Yu**, Quan Xiao, Tianyi Chen, Rongjie Lai, *A Bilevel Optimization Approach for Inverse Mean-Field Games*, Inverse Problems, **40** (2024) 105016 https://doi.org/10.1088/1361-6420/ad75b0

[3] **Jiajia Yu**, Rongjie Lai, Wuchen Li, Stanley Osher, *A Fast Proximal Gradient Method and Convergence Analysis for Dynamic Mean Field Planning*, Mathematics of Computation, 93 (2024), 603-642. https://doi.org/10.1090/mcom/3879

[2] Han Huang, **Jiajia Yu**, Jie Chen, Rongjie Lai, *Bridging Mean-Field Games and Normalizing Flows with Trajectory Regularization*, Journal of Computational Physics, Vol. 487, 112155, 2023. https://doi.org/10.1016/j.jcp.2023.112155

[1] **Jiajia Yu**, Rongjie Lai, Wuchen Li, Stanley Osher, *Computational Mean-field Games on Manifolds*, Journal of Computational Physics, Vol. 484, 112070, 2023. https://doi.org/10.1016/j.jcp.2023.112070

Preprints

[6] **Jiajia Yu**, Junghwan Lee, Yao Xie, Xiuyuan Cheng, *High-dimensional Mean-Field Games by Particle-based Flow Matching*, (Short version **accepted** by Neurips Workshop: Dynamics at the Frontiers of Optimization, Sampling, and Games. Long version submitted)

[5] Han Huang, **Jiajia Yu**, Tianyi Chen, Rongjie Lai, *Joint Inference of Trajectory and Obstacle in Mean-Field Games via Bilevel Optimization*, arXiv:2507.19344, 2025. (Submitted)

[4] **Jiajia Yu**, Jian-Guo Liu, Hongkai Zhao, *Equilibrium Correction Iteration for A Class of Mean-Field Game Inverse Problem*, arXiv:2506.23018, 2025. **(In revision)**

[3] **Jiajia Yu**, Xiuyuan Cheng, Jian-Guo Liu, Hongkai Zhao, *Convergence Analysis and Acceleration of Fictitious Play for General Mean-Field Games via Best Response*, arXiv:2411.07989, 2024. (Submitted)

[2] Yu Liu, Weibin Peng, Tianyu Wang, **Jiajia Yu**, *Zeroth-order Stochastic Cubic Newton Method Revisited*, arXiv:2410.22357, 2024. (Submitted)

[1] Tianyu Wang, Zicheng Wang, **Jiajia Yu**, *Zeroth-order Low-rank Hessian Estimation via Matrix Recovery*, arXiv:2402.05385, 2024. (Submitted)

Awards

2024 **SIAM Early Career Travel Award**, MDS24, SIAM

2023 **Karen and Lester Gerhardt Prize**, School of Science, RPI

2023 **Joaquin B. Diaz Memorial Prize**, Department of Mathematical Sciences, RPI

2022 **AWM Travel Grant**, AWM

Teaching

Instructor, Duke University, Durham, NC

2025F Math221&721 Linear Algebra

2024S, 2025S Math466&766 Mathematics of Machine Learning

2023F, 2024F Math465&765/COMPSCI445/STA465 Introduction to High-Dimensional Data Analysis (2023F co-teach with Prof. Xiuyuan Cheng)

Teaching Assistant, Rensselaer Polytechnic Institute, Troy, NY

2019F MATH 4400 ODE and Dynamical Systems, Instructor: Prof. Gregor Kovačič

2019F MATH 4200 Mathematical Analysis I, Instructor: Prof. Bruce Piper

2019S MATH 4020 Introduction to Number Theory, Instructor: Prof. Bruce Piper

2018F MATH 4200 Mathematical Analysis I, Instructor: Prof. Fengyan Li

2018F MATH 4040 Introduction to Topology, Instructor: Prof. Bruce Piper

Mentoring

May 2025 – July 2025 **Math+ Program (Undergraduate Research Project)**
Project: Translation-invariant optimal transport distance.
Students: Peilin He, Zakk Heile, Jayson Tran, Alice Wang. (All are rising juniors at Duke.)
A paper accepted by the Neurips2025 workshop with an extended version submitted to ICLR2026.

Presentations

Invited Seminar Talks

Nov. 2025 — Learning and inference in mean-field games
Applied and Analysis Seminar, Duke University, Durham, NC.

Oct. 2025 (Virtual) — Learning and inference in mean-field games
PSU-Purdue-UMD Joint Seminar on Mathematical Data Science.

Oct. 2023 — Computational mean-field games: from conventional methods to deep generative models
IMA Data Science Seminar, University of Minnesota, Minneapolis, MN.

Oct. 2023 — A bilevel optimization approach for inverse mean-field games
RTG Seminar, University of South Carolina, Columbia, SC.

July 2023 (Virtual) — Computational mean-field games: from conventional methods to deep generative models
Summer School on Mathematical Foundation of Data Science, University of South Carolina.

June 2022 (Virtual) — Computational mean-field games on manifolds
Optimal Transport and Mean-Field Games Seminar, University of South Carolina.

March 2021 (Virtual) — An efficient and flexible algorithm for dynamic mean-field planning and convergence analysis
Optimal Transport and Mean-Field Games Seminar, University of South Carolina.

Invited Workshop/Workshop Talks

July 2025 — Learning and inference in mean-field games
Sampling, Inference, and Data-Driven Physical Modeling in Scientific Machine Learning, IPAM, Los Angeles, CA.

Aug. 2024 — Computational methods for the mean-field game and its inverse game
Theory and Applications for Optimal Control and Generative Models, Purdue University, West Lafayette, IN.

July 2024 — *Empowering a Diverse Computational Mathematics Research Community,* ICERM, Providence, RI.

May. 2023 — *AMS MRC Conference: Ricci Curvatures of Graphs and Applications to Data Science,* Beaver Hollow Conference Center, Java Center, NY.

Conference Talks

Mar. 2025 — Convergence Analysis and Acceleration of Fictitious Play for General Mean-Field Games via the Best Response
AMS 2025 Spring Central Sectional Meeting, University of Kansas, Lawrence, KS.

Jan. 2025 — Bridging mean-field games and normalizing flows with trajectory regularization
JMM 2025, Seattle, WA.

Oct. 2024 — Computational methods for inverse mean-field games
SIAM MDS24, Atlanta, GA.

May. 2024 — A bilevel optimization approach for inverse mean-field games
SIAM IS24, Atlanta, GA.

Oct. 2023 — Computational mean-field games on manifolds
SIAM NYNJPA 1st Annual Meeting, New Jersey Institute of Technology, Newark, NJ.

Aug. 2023 A bilevel optimization approach for inverse mean-field games
MOPTA, Lehigh University, Bethlehem, PA.

Posters

May 2025 Convergence Analysis and Acceleration of Fictitious Play for General Mean-Field Games via the Best Response
NSF CompMath Meeting 2025, University of Utah, Salt Lake City, UT.

Mar. 2025 Convergence Analysis and Acceleration of Fictitious Play for General Mean-Field Games via the Best Response
Statistics and Optimal Transport Workshop, Columbia University, New York City, NY.

Nov. 2023 A bilevel optimization approach for inverse mean-field games
Triangle Computational and Applied Mathematics Symposium, Duke University, Durham, NC.

June 2022 Computational mean-field games on Euclidean space and manifolds
The 2022 AWM Research Symposium Poster Session, University of Minnesota, Minneapolis, MN.

Professional Services

Conference Organization

Oct. 2024 Mini-symposium at SIAM MDS24, Atlanta, GA.
Incorporating Optimal Transport in Machine Learning, co-organize with Alex Cloninger (UCSD).

Oct. 2023 Mini-symposium at SIAM NYNJPA 1st Annual Meeting, NJIT, Newark, NJ.
Optimal Transport: Computation, Applications, and Extensions, co-organize with Rongjie Lai (Purdue).

Journal/Book/Conference Reviewer

Journal of Computational Physics (JCP), Multiscale Modeling and Simulation (MMS), SIAM Imaging Science (SIIMS), SIAM Applied Mathematics (SIAP), Journal of Scientific Computing (JSC).

Advances in Data Science.

Neurips Workshop.

Outreach

2024 Judge for Triangle Competition in Mathematical Modeling (TriCoMM)

2022 – 2023 Vice President of AWM Student Chapter at RPI

Recommenders

Ph.D. Advisor Rongjie Lai, lairj@purdue.edu
Professor, Purdue University, Department of Mathematics.

Teaching Clark Bray, cbray@duke.edu
Associate Professor of the Practice of Mathematics, Duke University, Department of Mathematics.

Research Xiuyuan Cheng, xiuyuan.cheng@duke.edu
Professor, Duke University, Department of Mathematics.

Research Alexander Cloninger, acloninger@ucsd.edu
Professor, University of California, San Diego, Department of Mathematics and Halicioğlu Data Science Institute (HDSI).

Research Jian-Guo Liu, jian-guo.liu@duke.edu
Professor, Duke University, Department of Mathematics and Department of Physics.

Research Hongkai Zhao, hongkai.zhao@duke.edu
Professor, Duke University, Department of Mathematics.