

YUCHEN ZHU

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Education

Georgia Institute of Technology, Atlanta

PhD in Machine Learning

2023 - 2028

4.0/4.0 GPA

Yale University, New Haven

MA in Statistics & Data Science

2022 - 2023

4.0/4.0 GPA

New York University, New York & Shanghai

BS in Honors Mathematics (Summa Cum Laude)

2018 - 2022

3.96/4.0 GPA

Current Research

Discrete Diffusion and Diffusion Language Models

March 2024 – present

- [1]: RL Post-training of diffusion language model for reasoning
- [2]: Diffusion neural samplers training for discrete and continuous distributions with proximal gradient descent
- [3]: Search-enhanced RL post-training for biological sequences discrete diffusion models
- [4]: Published in **NeurIPS 2025**. RL techniques for training masked discrete diffusion models for sampling discrete distributions.
- [5]: Published in **NeurIPS 2025**. Fast high-order solver for accelerating discrete diffusion models inference.
- [6]: Plug-and-play guided generation for discrete masked model.

Multimodal learning and Vision-Language Models

July 2024 – present

- [7]: Published in **ICML 2025**. A framework named **Diffuse Everything** for unified diffusion models across multiple domains for generating multimodal data, such as vision-language and mixed-type tabular data.
- [8]: Benchmarking Multimodal In-context Learning capabilities of modern VLMs with reasoning.

Diffusion Generative Models with Applications in Sciences

Aug 2023 – present

- [9]: Published in **ICLR 2025**. A **multimodal diffusion model** called **Stem** for gene expression profiles prediction based on its associated histology images
- [10]: Published in **ICLR 2025**. A new methodology **Trivialized Diffusion Model** for generative modeling of data distribution on general Lie groups.
- [11]: A new methodology **Structure-Preserving Diffusion Model** for constrained generative modeling of data distribution of quantum density matrices, based on Mirror Diffusion.

Past Research

Deep Learning for Mean-field System

Sep 2021 – Aug 2023

- [12]: Published in **ICML 2025**. Studied **Mean field Optimal Stopping** as a proxy for multi-agent optimal stopping. Proved its dynamic programming principle on an extended state space. Proposed two numerical algorithms.
- [13]: Published in **CEMRACS 2022**. Introduced a new computational problem called **Mean field Optimal Transport**, and proposed three numerical approaches based on deep learning.

Mean-field Analysis of Neural Network and Reinforcement Learning Theory

Sep 2022 – Aug 2023

- [14]: Provided a mean-field analysis of neural networks for solving functional minimax optimization problems, such as non-parametric IV, asset pricing, policy evaluation in RL.

Publications

- [4] **Yuchen Zhu***, Wei Guo*, Jaemoo Choi, Guan-Horng Liu, Yongxin Chen, Molei Tao, “MDNS: Masked Diffusion Neural Sampler via Stochastic Optimal Control”. In: *Advances in Neural Information Processing Systems (NeurIPS)* (2025).
- [5] Yinuo Ren*, Haoxuan Chen*, **Yuchen Zhu***, Wei Guo*, Yongxin Chen, Grant M Rotskoff, Molei Tao, Lexing Ying, “Fast Solvers for Discrete Diffusion Models: Theory and Applications of High-Order Algorithms”. In: *Advances in Neural Information Processing Systems (NeurIPS)* (2025).
- [7] Kevin Rojas*, **Yuchen Zhu***, Sichen Zhu, Felix Ye, Molei Tao, “Diffuse Everything: Multimodal Diffusion Models on Arbitrary State Spaces”. In: *International Conference on Machine Learning (ICML)*. 2025.

- [8] Chengyue Huang*, **Yuchen Zhu***, Sichen Zhu*, Jingyun Xiao, Moises Andrade, Shivang Chopra, Zsolt Kira, “Mimicking or Reasoning: Rethinking Multi-Modal In-Context Learning in Vision-Language Models”. In: *ICCV 2025 MARS2 Workshop* (2025).
- [9] Sichen Zhu*, **Yuchen Zhu***, Molei Tao, Peng Qiu, “Diffusion Generative Modeling for Spatially Resolved Gene Expression Inference from Histology Images”. In: *International Conference on Learning Representations (ICLR)*. 2025.
- [10] **Yuchen Zhu***, Tianrong Chen*, Lingkai Kong, Evangelos Theodorou, Molei Tao, “Trivialized Momentum Facilitates Diffusion Generative Modeling on Lie Groups”. In: *International Conference on Learning Representations (ICLR)*. 2025.
- [12] **Yuchen Zhu***, Lorenzo Magnino*, Mathieu Laurière, “Learning to Stop: Deep Learning for Mean Field Optimal Stopping”. In: *International Conference on Machine Learning (ICML)*. 2025.
- [13] Sebastian Baudet†, Briec Frénais†, Mathieu Laurière†, Amal Machta†, **Yuchen Zhu†**, “Deep Learning for Mean Field Optimal Transport”. In: *CEMRACS 2022* (2023).

Preprints

- [1] **Yuchen Zhu***, Wei Guo*, Jaemoo Choi, Petr Molodyk, Bo Yuan, Molei Tao, Yongxin Chen, “Enhancing Reasoning for Diffusion LLMs via Distribution Matching Policy Optimization”. In: *arXiv preprint arXiv:2510.08233* (2025).
- [2] Wei Guo*, Jaemoo Choi*, **Yuchen Zhu**, Molei Tao, Yongxin Chen, “Proximal Diffusion Neural Sampler”. In: *arXiv preprint arXiv:2510.03824* (2025).
- [3] Sophia Tang*, **Yuchen Zhu***, Molei Tao, Pranam Chatterjee, “TR2-D2: Tree Search Guided Trajectory-Aware Fine-Tuning for Discrete Diffusion”. In: *arXiv preprint arXiv:2509.25171* (2025).
- [6] Wei Guo*, **Yuchen Zhu***, Molei Tao, Yongxin Chen, “Plug-and-Play Controllable Generation for Discrete Masked Models”. In: *arXiv preprint arXiv:2410.02143* (2024).
- [11] **Yuchen Zhu**, Tianrong Chen, Evangelos A Theodorou, Xie Chen, Molei Tao, “Quantum State Generation with Structure-Preserving Diffusion Model”. In: *arXiv preprint arXiv:2404.06336* (2024).
- [14] **Yuchen Zhu**, Yufeng Zhang, Zhaoran Wang, Zhuoran Yang, Xiaohong Chen, “A Mean-Field Analysis of Neural Gradient Descent-Ascent: Applications to Functional Conditional Moment Equations”. In: *arXiv preprint arXiv:2404.12312* (2024).

Talks

INFORMS Optimization Society Conference, Atlanta, March 2026

ML@GT Student Conference, Atlanta, Sep 2025

MolSS Seminar, Online, Aug 2025

Georgia Tech ML Student Seminar, Atlanta, Oct 2024

SIAM Mathematics on Data Science (MDS) 2024, Atlanta, Oct 2024

Southeast ACM Student Workshop 2024, Atlanta, Apr 2024

Work Experience

Georgia Tech

Aug 2023 – Present

Teaching Assistant

Atlanta

- Lead Studio sessions, Math Lab Hours. Homework, exams grading.

New York University

June 2023 – Aug 2023

Research Assistant

Remote

- Research on computational Mean field games and Mean field Optimal Stopping

Yale University

Jan 2023 – May 2023

Teaching Assistant

New Haven

- Lead review sessions, office hours and grading for S&DS 685 Theory of Reinforcement Learning

DigiFinex Global

May 2022 – Aug 2022

Quantitative Researcher Intern

Irvine

- Develop high-frequency statistical arbitrage strategies for crypto assets

Teaching

- MATH 3236 Statistical Theory: Spring 2025
- MATH 4581 Classical Mathematical Methods in Engineering: Spring 2025
- MATH 7244 Stochastic Calculus II: Fall 2024
- MATH 1712 Survey of Calculus: Fall 2023
- MATH 2551 Multivariable Calculus: Spring 2024
- MATH 2550 Intro to Multivariable Calculus: Summer 2024
- S&DS 685 Theory of Reinforcement Learning: Spring 2023

Honors and Awards

NeurIPS 2025 Scholar Award

ML@GT Student Conference Best Presentation (3rd place), Fall 2025

David L. Brown Fellowship Award, Spring 2025

Georgia Tech Thank a Teacher Teaching award, Spring 2024

NYU Shanghai Dean's Award in Art & Science (1/500)

NYU Major Honors in Honors Mathematics (1/30)

NYU Shanghai Recognition Award 2021

NYU Dean's Undergraduate Research Fund (DURF) 2020