

Guan-Horng Liu

ghliu.github.io

Mailing Address:

MK Bldg. 405, Georgia Tech,
Atlanta, GA 30332

Email and Phone:

ghliu@gatech.edu
(412) 609-2396

RESEARCH INTERESTS

deep generative models, Schrödinger bridge, dynamic optimal transport, stochastic optimal control, scalable higher-order optimization, Hamilton-Jacobi Bellman principle, forward-backward stochastic differential equations.

EDUCATION

Georgia Institute of Technology

Atlanta, GA

Ph.D. in Machine Learning (GPA: 4.0/4.0)

expected 07/2024

- Advisor: Evangelos A. Theodorou
- Thesis: Large-Scale Optimization for DNN Architecture: A Dynamical System Theory
- Received ICLR'21 Spotlight, ICML'21 Oral, NeurIPS'21 Spotlight, and NeurIPS'22 Oral

Carnegie Mellon University

Pittsburgh, PA

M.S. in Robotics (GPA: 4.0/4.0)

05/2017

- Advisor: George Kantor
- Thesis: High-dimensional planning and learning for off-road driving

Tokyo Institute of Technology

Tokyo, Japan

Research Exchange Program (GPA: 4.0/4.0)

06/2015

- Advisor: Edwardo F. Fukushima
- Technical report: Autonomous navigation of the unmanned surface vehicle

National Taiwan University

Taipei, Taiwan

B.S. in Mechanical Engineering (GPA: 3.99/4.0)

06/2014

- Advisor: Pei-Chun Lin
- Graduated Cum Laude; Best Paper Award in 2013 IEEE/SICE ISS

RESEARCH EXPERIENCE

FAIR, Meta AI

New York, NY

Research Scientist

incoming 09/2024

Research Scientist Intern (Mentor: Ricky T. Q. Chen)

Summer 2023

NVIDIA Research

Santa Clara, CA

Research Intern (Mentors: Weili Nie, Arash Vahdat, Anima Anandkumar)

Summer 2022

Uber Advanced Technology Group

Pittsburgh, PA

Robotics Research Engineer (Manager: Tony Stentz)

09/2017 – 12/2018

Aptiv Mobility Group

Pittsburgh, PA

Research Intern (Mentor: Wenda Xu)

Summer 2016

PUBLICATIONS

(*Equal contribution †Equal advising ‡Alphabetical order)

Preprints

- [P1] React-OT: Optimal Transport for Generating Transition State in Chemical Reactions,
C. Duan*, **G.-H. Liu***, Y. Du*, T. Chen, Q. Zhao, H. Jia, C. P. Gomes, E. Theodorou, H. J. Kulik,
2024.
- [P2] Augmented Bridge Matching,
V. D. Bortoli, **G.-H. Liu**, T. Chen, E. Theodorou, W. Nie,
2023.

Conference Papers

- [C1] Generalized Schrödinger Bridge Matching,
G.-H. Liu, Y. Lipman, M. Nickel, B. Karrer, E. Theodorou, Ricky T. Q. Chen,
International Conference on Learning Representations (ICLR), 2024.
- [C2] A Robust Differential Neural ODE Optimizer,
P. Theodoropoulos, **G.-H. Liu**, T. Chen, A. D. Saravanos, E. Theodorou,
International Conference on Learning Representations (ICLR), 2024.
- [C3] Mirror Diffusion Models for Constrained and Watermarked Generation,
G.-H. Liu, T. Chen, E. Theodorou[†], M. Tao[‡],
Advances in Neural Information Processing Systems (NeurIPS), 2023.
- [C4] Deep Momentum Multi-Marginal Schrödinger Bridge,
T. Chen, **G.-H. Liu**, M. Tao, E. Theodorou,
Advances in Neural Information Processing Systems (NeurIPS), 2023.
- [C5] I²SB: Image-to-Image Schrödinger Bridge,
G.-H. Liu, A. Vahdat, D.-A. Huang, E. Theodorou, W. Nie[†], A. Anandkumar[‡],
International Conference on Machine Learning (ICML), 2023.
- [C6] Deep Generalized Schrödinger Bridge, [Oral, 1.9%]
G.-H. Liu, T. Chen*, O. So*, E. Theodorou,
Advances in Neural Information Processing Systems (NeurIPS), 2022.
- [C7] Likelihood Training of Schrödinger Bridge using Forward-Backward SDEs Theory,
T. Chen*, **G.-H. Liu***, E. Theodorou,
International Conference on Learning Representations (ICLR), 2022.
- [C8] Second-Order Neural ODE Optimizer, [Spotlight, 3.0%]
G.-H. Liu, T. Chen, E. Theodorou,
Advances in Neural Information Processing Systems (NeurIPS), 2021.
- [C9] Dynamic Game Theoretic Neural Optimizer, [Long talk, 3.0%]
G.-H. Liu, T. Chen, E. Theodorou,
International Conference on Machine Learning (ICML), 2021.
- [C10] Differential Dynamic Programming Neural Optimizer, [Spotlight, 3.8%]
G.-H. Liu, T. Chen, E. Theodorou,
International Conference on Learning Representations (ICLR), 2021.
- [C11] Variational Inference MPC using Tsallis Divergence,
Z. Wang*, O. So*, J. Gibson, B. Vlahov, M. S. Gandhi, **G.-H. Liu**, E. Theodorou,
Robotics: Science and Systems (RSS), 2021.

- [C12] Learning End-to-end Multimodal Sensor Policies for Autonomous Navigation,
G.-H. Liu, A. Siravuru, S. Prabhakar, M. Veloso, G. Kantor,
Conference on Robot Learning (CoRL), 2017.
- [C13] Autonomous Control of the WAM-V Catamaran Type USV: Propulsion System Design,
G.-H. Liu, A. Y. Yasutomi, A. Holgado, E. F. Fukushima,
Annual Conference of the Robotics Society of Japan, 2014.
- [C14] Design of a Kangaroo Robot with Dynamic Jogging Locomotion, [Best Paper Award, 0.8%]
G.-H. Liu, H.-Y. Lin, H.-Y. Lin, S.-T. Chen, P.-C. Lin,
IEEE/SICE International Symposium on System Integration (ISS), 2013.

Journal Papers

- [J1] Improving Generative Model-based Unfolding with Schrödinger Bridges,
S. Diefenbacher[‡], **G.-H. Liu**[‡], V. Mikuni[‡], B. Nachman[‡], W. Nie[‡],
Physical Review D, 2024.
- [J2] A Bio-Inspired Hopping Kangaroo Robot with an Active Tail,
G.-H. Liu, H.-Y. Lin, H.-Y. Lin, S.-T. Chen, P.-C. Lin,
Journal of Bionic Engineering (JBE), 2014.

Workshop Papers & Technical Reports

- [O1] Improved Sampling via Learned Diffusions,
L. Richter*, J. Berner*, **G.-H. Liu**,
ICML Workshop on New Frontiers in Learning, Control, Dynamical Systems, 2023.
- [O2] Spatio-Temporal Differential Dynamic Programming for Control of Fields,
E. N. Evans, O. So, A. P. Kendall, **G.-H. Liu**, E. Theodorou,
Preprint, 2021.
- [O3] Deep Learning Theory Review: An Optimal Control and Dynamical Systems Perspective,
G.-H. Liu, E. Theodorou,
Preprint, 2019.
- [O4] High Dimensional Planning and Learning for Off-Road Driving,
G.-H. Liu,
CMU Robotics Institute Master Thesis, 2017.

HONORS & AWARDS

Fellowships & Scholarships

AE Graduate Research Fellowship, Georgia Tech	2022 – 2023
Study Abroad Scholarship, Ministry of Education, Taiwan	2019 – 2021
Student Exchange Scholarship, JASSO, Japan	2013

Awards & Prizes

Best Paper Award, IEEE/SICE ISS	2013
Third Prize, Chuian-Yan Thesis Paper Competition, Taiwan	2013
Presidential Awards ($\times 4$), Top 5% in National Taiwan University	2009 – 2014

INVITED TALKS

Learning Scalable Diffusion Models using Optimality and Constraint Structures

AMLab, University of Amsterdam	05/2024
Sony AI	04/2024
National Taiwan University (Host: Shao-Hua Sun)	04/2024
Appier Group Inc.	01/2024
School of Industrial and Systems Engineering, Georgia Tech (Host: Yao Xie)	12/2023
FAIR, Meta AI	11/2023
Nvidia Research	10/2023

Mirror Diffusion Models

Learning on Graphs and Geometry Reading Group	10/2023
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(Generalized) Schrödinger Bridge

Learning on Graphs and Geometry Reading Group	02/2023
NeurIPS Workshop on Score-Based Methods	12/2022
Rough Path Interest Group, Alan Turing Institute	11/2022
IBM Research Seminar	11/2022
NeurIPS Workshop on Optimal Transport and Machine Learning	12/2021
School of Mathematics, Georgia Tech (Host: Molei Tao)	11/2021

Optimal Control Theoretic Neural Optimizer

AE4803 Robotic Systems and Autonomy (guest lecture)	10/2022
Rough Path Interest Group, Alan Turing Institute	12/2021
Georgia Tech Machine Learning PhD Seminar (contributed talk)	10/2021
NeurIPS Workshop on Optimization for Machine Learning (spotlight talk)	12/2020

ACADEMIC SERVICES

Co-organizer: ICML 2024 Workshop on [Structured Probabilistic Inference & Generative Modeling](#)

ICML 2023 Workshop on [New Frontiers in Learning, Control, and Dynamical Systems](#)

Area Chair: NeurIPS 2023 Workshop on AI for Science

Reviewer: ICLR (2023–2024), ICML (2023–2024), NeurIPS (2023–2024), L4DC (2023–2024), IJCAI (2024)