

# Guan-Horng Liu

[ghliu.github.io](https://ghliu.github.io)

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## 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<sup>†</sup>, M. Tao<sup>‡</sup>,  
*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] I<sup>2</sup>SB: Image-to-Image Schrödinger Bridge,  
**G.-H. Liu**, A. Vahdat, D.-A. Huang, E. Theodorou, W. Nie<sup>†</sup>, A. Anandkumar<sup>‡</sup>,  
*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<sup>‡</sup>, **G.-H. Liu**<sup>‡</sup>, V. Mikuni<sup>‡</sup>, B. Nachman<sup>‡</sup>, W. Nie<sup>‡</sup>,  
*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

Sony AI	04/2024
National Taiwan University (Host: Prof. Shao-Hua Sun)	04/2024
Appier Group Inc.	01/2024
School of Industrial and Systems Engineering, Georgia Tech (Host: Prof. 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: Prof. 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)