Guan-Horng Liu

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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.

RESEARCH EXPERIENCE

FAIR, Meta AI — New York, NY
Research Scientist — 09/2024 - present
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

EDUCATION

Georgia Institute of Technology — Atlanta, GA
Ph.D. in Machine Learning (GPA: 4.0/4.0) — 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) — 06/2014
- 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) — 06/2013
- Advisor: Pei-Chun Lin
- Graduated Cum Laude; Best Paper Award in 2013 IEEE/SICE ISS

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] I^2SB: 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 (×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

(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)