Chieh-Hsin (Jesse) Lai

Research Scientist, Sony AI;
Visiting Assistant Professor, Department of Applied Mathematics, NYCU Taiwan;
PhD. Mathematics, University of Minnesota
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SUMMARY

- Multiple papers accepted at top AI conferences or workshops (ICML, AISTATS, ICLR, NeurIPS etc.).
- Strong mathematical background in theory of *Machine Learning*, *Optimization*, *Partial Differential Equations*, *Ordinary Differential Equations*, *Dynamical Systems*, *Signal Processing*, *Combinatorics*, and *Statistics*.
- Conducting advanced research in the theory and applications of *Robustness issues in deep Learning*, *Deep Generative Models (including GANs, Diffusion Models, Normalizing Flows, etc.)* and with solid knowledge to these fields.
- Sophisticating programming skills in Python, Matlab, Tensorflow, and Pytorch.
- Developing sophisticated communication and presentation skills as a teaching assistant for six years.

WORKING EXPERIENCE

Visiting Assistant Professor, Department of Applied Mathematics at National Yang Ming Chiao Tung University, Taiwan *August 2024 – present*

- Supervising students to conduct research on AI for Science (Partial Differential Equations)

Research Scientist, Sony AI, Japan *May 2022 – present*

- Research Directions: deep generative modeling and robustness

Senior Research Engineer, Sony USA *October 2021 – May 2022*

- Research Directions: deep generative modeling and robustness

EDUCATION

Ph.D. of Mathematics, University of Minnesota – Twin Cities (UMN) *August 2016 – May 2021*

- Advisor: Gilad Lerman
- Research Interests: Theory and applications of Machine Learning, Deep Learning, Anomaly Detection, Generative Tasks, Data Analysis

Master of Mathematics, UMN *June 2017 – April 2018*

- Advisor: Wei-Ming Ni
- Research Directions: Biological Partial Differential Equations
- Modeled and studied the long-time behavior of the population of some species in a region via systems of nonlinear partial differential equations and dynamical system.

Bachelor of Mathematics, National Tsinghua University (NTHU), Taiwan *August 2012 – June 2015*

- Undergraduate Research: Harmonic Analysis and its applications to Boltzmann Equation.

PUBLICATIONS (SELECTED) *: EQUAL CONTRIBUTION

[1] D Kim*, **CH Lai***, WH Liao, N Murata, Y Takida, T Uesaka, Y He, Y Mitsufuji, S Ermon, *PaGoDA: Progressive Growing of a One-Step Generator from a Low-Resolution Diffusion Teacher*, NeurIPS 2024

[2] Seo, Junyoung, Kazumi Fukuda, Takashi Shibuya, Takuya Narihira, Naoki Murata, Shoukang Hu, **Chieh-Hsin Lai**, Seungryong Kim, and Yuki Mitsufuji, *GenWarp: Single Image to Novel Views with Semantic-Preserving Generative Warping*, NeurIPS 2024

[3] D Kim*, **CH Lai***, WH Liao, N Murata, Y Takida, T Uesaka, Y He, Y Mitsufuji, S Ermon, *Consistency Trajectory Models: Learning Probability Flow ODE Trajectory of Diffusion*, ICML 2024

[4] K Saito, D Kim, T Shibuya, **CH Lai**, Z Zhong, Y Takida, Y Mitsufuji, *SoundCTM: Uniting Score-based and Consistency Models for Text-to-Sound Generation*, Preprint 2024

[5] J Seo, K Fukuda, T Shibuya, T Narihira, N Murata, S Hu, **CH Lai**, S Kim, Y Mitsufuji, *GenWarp: Single Image to Novel Views with Semantic-Preserving Generative Warping*, Preprint 2024

[6] D Kim*, **CH Lai***, WH Liao, N Murata, Y Takida, T Uesaka, Y He, Y Mitsufuji, S Ermon, *Consistency Trajectory Models: Learning Probability Flow ODE Trajectory of Diffusion*, ICML 2024

[7] Y He*, N Murata*, **CH Lai**, Y Takida, T Uesaka, D Kim, WH Liao, Y Mitsufuji, JZ Kolter, R Salakhutdinov and S Ermon, *Manifold preserving guided diffusion*, ICML 2024

[8] Y Takida, M Imaizumi, T Shibuya, **CH Lai**, T Uesaka, N. Murata and Y Mitsufuji, *SAN: Inducing Metrizability of GAN with Discriminative Normalized Linear Layer*, ICML 2024

[9] **CH Lai**, Y Takida, N Murata, T Uesaka, Y Mitsufuji, S Ermon, FP-Diffusion: Improving Score-based Diffusion Models by Enforcing the Underlying Score Fokker-Planck Equation, ICML 2023

[10] **CH Lai**, Y Takida, T Uesaka, N Murata, Y Mitsufuji, S Ermon, *On the Equivalence of Consistency-Type Models: Consistency Models, Consistent Diffusion Models, and Fokker-Planck Regularization*, ICML SPIGM workshop 2023.

[11] K Saito, N Murata, T Uesaka, **CH Lai**, Y Takida, T Fukui, Y Mitsufuji, *Unsupervised vocal dereverberation with diffusion-based generative models*, ICASSP 2023.

[12] **CH Lai***, D Zou*, G Lerman, *Robust Variational Autoencoding with Wasserstein Penalty for Novelty Detection*, AISTATS 2023.

[13] N Murata, K Saito, **CH Lai**, Y Takida, T Uesaka, Y Mitsufuji, S Ermon, *Gibbsddrm: A partially collapsed gibbs sampler for solving blind inverse problems with denoising diffusion restoration*, ICML 2023 (Oral).

[14] G Fabbro, S Uhlich, **CH Lai**, W Choi, M Martinez-Ramirez, W Liao, I Gadelha, G Ramos, E Hsu, H Rodrigues, FR Stoeter, A Defossez, Y Luo, J Yu, D Chakraborty, S Mohanty, R Solovyev, A Stempkovskiy, T Habruseva, N Goswami, T Harada, M Kim, JH Lee, Y Dong, X Zhang, J Liu, Y Mitsufuji, *The sound demixing challenge 2023–music demixing track*, Preprint 2023.

[15] Y Takida, WH Liao, **CH Lai**, T Uesaka, S Takahashi, Y Mitsufuji, *Preventing oversmoothing in VAE via generalized variance parameterization*, Neurocomputing 509, 137-156.

[16] Y Takida, M Imaizumi, T Shibuya, **CH Lai**, N Murata, T Uesaka, Y Mitsufuji, S Ermon, *SAN: Inducing Metrizability of GAN with Discriminative Normalized Linear Layer*, Preprint 2023

[17] Y Takida, T Shibuya, WH Liao, **CH Lai**, J Ohmura, T Uesaka, N Murata, S Takahashi, T Kumakura, Y Mitsufuji, SQ-VAE: Variational Bayes on Discrete Representation with Self-annealed Stochastic Quantization, ICML 2022.
[18] R Manekar, K Tayal, Z Zhuang, **CH Lai**, V Kumar, J Sun, Breaking Symmetries in Data-Driven Phase Retrieval, Computational Optical Sensing and Imaging, CTh4A. 4
[19] K Tayal, **CH Lai**, R Manekar, Z Zhuang, V Kumar, J Sun, Unlocking Inverse Problems Using Deep Learning: Breaking Symmetries in Phase Retrieval, NeurIPS 2020 Workshop on Deep Learning and Inverse Problems.
[20] K Tayal, **CH Lai**, V Kumar, J Sun, Inverse Problems, Deep Learning, and Symmetry Breaking, 2020, ICML workshop on ML Interpretability for Scientific Discovery, 2020
[21] **CH Lai***, D Zou*, G Lerman, Robust Subspace Recovery Layer for Unsupervised Anomaly Detection, ICLR 2020.

SKILLS

Programming: Python, Matlab, Tensorflow, and Pytorch.
Mathematics: Theory of Probability, Statistics, Optimization, Machine Learning, Harmonic Analysis, Wavelets Analysis, Graph Theory, and Partial Differential Equations.
Languages: Mandarin (native speaker), English (fluent), Japanese (intermediate)

RESEARCH EXPERIENCE

Research Assistant, UMN *Aug 2016 to 2021*

- Developing new algorithms using autoencoder, variational autoencoder and Generative Adversarial Networks with Robust Subspace Recovery technique to deal with anomaly detection tasks.
- Developing robust generation algorithms for image or natural language datasets.
- Collaborate with scientists from Computer Science to conduct research on theory and methodology for Inverse Problems (e.g. Fourier Phase Retrieval) by using Deep Learning.

Research Assistant, Institute of Mathematics, Academia Sinica, Taiwan *Sep 2015 to Jul 2016*

- Researched topics in Harmonic Analysis and its applications to Signal Processing and Complex Differential Geometry, which is crucial to Quantum Mechanics.

EVENTS/INVITED TALKS

Organizing Tutorial on Diffusion Models at ICASSP 2025 *TBD 2025*
Organizing Expo Workshop at NeurIPS 2024, *Dec. 10 2024*

- Efficient Content Creation and Editing through Deep Generative Models

Organizing Tutorial on Diffusion Models at ISMIR 2024 *Nov. 11 2024*

- Project Page: https://sites.google.com/view/diffusion-tutorial-ismir24/home

Invited talk at NVIDIA Taiwan, *Feb. 21 2024*
Invited talk at Department of EE, National Taiwan University, *Feb. 21 2024*
Invited talk at Robotic Search Lab, National Central University, *Feb. 22 2024*
Invited talk at Department of Math, National Central University, *Feb. 22 2024*
Invited talk at Appier Taiwan, *Feb. 23 2024*
Invited talk at Department of Math, National Tsinghua University, *Feb. 27 2024*
Guest lecture at Duke Kushan University, *Feb. 29 2024*
Organizing Expo Workshop at NeurIPS 2023, *Dec. 10 2023*

- Media Content Restoration and Editing with Deep Generative Models and Beyond

Presented Poster in 2019 NSF ATD and AMPS workshop, Washington D.C *Oct 21 - 23 2019*

TEACHING EXPERIENCE

Teaching Assistant, Department of Mathematic, UMN *Aug 2016 to 2021*

- Lead discussion sections and serve as TA for several undergraduate-level math courses as well as some honors math program courses.
- Develop leadership and ability to explain difficult concepts in an easily understandable fashion from running recitation class.

Teaching Assistant, Mathematics, NTHU, Taiwan *Sep 2013 to Jun 2015*

- TA and discussion leader for undergraduate- and graduate- level courses since junior.
- Developed communication as well as presentation skills from offering office hour for students and leading discussion group daily.

HONORS AND AWARDS

Academic Achievement Award, NTHU *2015, 2014, 2013*
College of Science Elite Student Award, NTHU *2013*
Chow Hung-Ching Scholarship Award, Institute of Mathematics, Academia Sinica *2013*