Yuchen Liang

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RESEARCH INTERESTS

Diffusion models, Generative models, Anomaly detection, Bayesian analysis, Statistical signal processing

EDUCATION

University of Illinois at Urbana-Champaign – Champaign, IL

Ph.D., Electrical and Computer Engineering, Aug 2019 – Aug 2023

- Advisor: Venugopal V. Veeravalli
- Dissertation: *Quickest Change Detection under Post-change Non-stationarity and Uncertainty*

University of Illinois at Urbana-Champaign – Champaign, IL

B.S., Computer Engineering, Aug 2015 – May 2019

RESEARCH EXPERIENCE

Postdoctoral Scholar

The Ohio State University – Columbus, OH | Sep 2023 – Present

Focused on statistical convergence analysis and algorithm design for generative models, particularly diffusion-based models for both continuous and discrete data, with emphasis on sampling acceleration and model mismatch.

Research on Discrete Diffusion Models

- Developed the first finite-time convergence and error bounds for discrete diffusion models using absorbing rate matrices.
- Introduced surrogate initialization and novel bounding techniques, including Jensen-type arguments and score control near initialization.
- Proposed a unifying analytical framework for multiple discrete samplers (tau-leaping, Euler, and Tweedie tau-leaping) that avoids restrictive Girsanov assumptions and achieves linear convergence in vocabulary size.

- Our theoretical insights aligned with empirical observations showing improved generation quality under absorbing than under uniform rate matrices.

Research on Continuous Diffusion Models

- Analyzed theoretical convergence and sampling properties of state-of-the-art diffusion generative models (e.g., DDPMs).
- Proposed an accelerated diffusion sampler using novel Bayesian tilting techniques.
- Developed BO-DDNM, an improved zero-shot conditional sampling method that minimizes distributional mismatch.
- Validated theoretical findings with comprehensive numerical simulations.
- Both projects are funded under the NSF AI-EDGE center.

Graduate Researcher

Coordinated Science Laboratory, UIUC – Champaign, IL | Aug 2019 – Aug 2023

Explored online anomaly detection under non-stationary observations and model uncertainty, targeting distributional mismatch and joint estimation-detection.

- Developed a suite of quickest change detection algorithms robust to (non-parametric) model uncertainty and data non-stationarity.
- Proved optimality guarantees for the proposed methods under vanishing false-alarm rate.
- Pioneered a leave-one-out and a window-limited-adaptive density estimation technique for joint estimation-detection under non-parametric models.
- Compared Bayesian and frequentist two-sample tests, demonstrating the efficacy of uncertainty-aware Bayesian formulations.
- Research advised by Prof. Venugopal V. Veeravalli and funded under IoBT.

PUBLICATIONS

1. **Y. Liang***, R. Huang*, L. Lai, N. Shroff, Y. Liang, “Absorb and Converge: Provable Convergence Guarantee for Absorbing Discrete Diffusion Models,” submitted to *NeurIPS 2025*. (*Equal Contribution)
2. **Y. Liang**, Y. Liang, L. Lai, N. Shroff, “Discrete Diffusion Models: Novel Analysis and New Sampler Guarantees,” submitted to *NeurIPS 2025*.
3. **Y. Liang**, P. Ju, Y. Liang, N. Shroff, “Theory on Score-Mismatched Diffusion Models and Zero-Shot Conditional Samplers,” *ICLR 2025*.

4. **Y. Liang**, P. Ju, Y. Liang, N. Shroff, "Broadening Target Distributions for Accelerated Diffusion Models via a Novel Analysis Approach," *ICLR 2025*.
5. J. Z. Hare*, **Y. Liang***, L. Kaplan, V. V. Veeravalli, "Bayesian Two-Sample Hypothesis Testing using the Uncertain Likelihood Ratio," *IEEE Trans. Signal Processing*, 2025. (*Equal Contribution)
6. **Y. Liang**, V. V. Veeravalli, "Quickest Change Detection with Post-Change Density Estimation," *IEEE Trans. Information Theory*, 2024.
7. L. Xie*, **Y. Liang***, V. V. Veeravalli, "Distributionally Robust Quickest Change Detection," *AISTATS 2024*. (*Equal Contribution)
8. **Y. Liang**, V. V. Veeravalli, "Quickest Change Detection with Leave-one-out Density Estimation," *ICASSP 2023*.
9. **Y. Liang**, A. G. Tartakovsky, V. V. Veeravalli, "Quickest Change Detection with Non-Stationary Post-Change Observations," *IEEE Trans. Information Theory*, 2023.
10. **Y. Liang**, V. V. Veeravalli, "Non-Parametric Quickest Mean-Change Detection," *IEEE Trans. Information Theory*, 2022.
11. **Y. Liang**, V. V. Veeravalli, "Quickest Detection of Composite and Non-Stationary Changes," *ICASSP 2022*.
12. **Y. Liang**, V. V. Veeravalli, "Non-Parametric Quickest Detection of a Change in the Mean," *CISS 2021*.

PRESENTATIONS

- "Non-Asymptotic Convergence of Discrete-time Diffusion Models: New Approach and Improved Rate," *INFORMS Annual Meeting*, Seattle, Oct 2024.
- "Theory on Score-Mismatched Diffusion Models and Zero-Shot Conditional Samplers," *AI-EDGE SPARKS Seminar*, Ohio State University, Oct 2024.

TEACHING & MENTORING

- Mentor to 10 undergraduates in NSF REU program (Summer 2024, 2025)
- Instructor, Deep Generative Models for REU students (Summer 2024, 2025)
- Advisor, *Faith Works* undergraduate organization, OSU (Sep 2024 – Present)
- TA, *ECE 365: Data Science and Engineering*, UIUC (Aug 2020 – Dec 2022)

REVIEW SERVICE

- Annual Conference on Neural Information Processing Systems (NeurIPS)

- IEEE Transactions on Information Theory
- IEEE Transactions on Signal Processing
- IEEE Transactions on Signal and Information Processing over Networks
- Sequential Analysis
- IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)
- IEEE Information Theory Workshop (ITW)
- IEEE International Symposium on Information Theory (ISIT)
- Communications in Statistics - Theory and Methods
- Journal of Statistical Planning and Inference (JSPI)

PROFESSIONAL SERVICE

- Executive Organizing Committee Member, NSF REU Program, Summer 2025.
- Chair, AI-EDGE SPARKS Seminar Series, 2025.