Yuchen Liang

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RESEARCH INTERESTS

Diffusion Generative Models, Controlled Generative Models, Trustworthy AI, Anomaly Detection

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*

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

- Bronze Tablets University Honors: top 3% of the graduating class

PROFESSIONAL EXPERIENCE

The Ohio State University Columbus, OH

Postdoctoral Researcher, NSF AI Institute for Future Edge Networks and Distributed Intelligence (AI-EDGE), Sep 2023 – Present

- Co-supervisors: Yingbin Liang and Ness B. Shroff
- Primary research focus: Diffusion generative models

RESEARCH ACHIEVEMENTS

Summary: My research spans multiple disciplines—including machine learning, statistical signal processing, and information theory—with a focus on generative models and anomaly detection, centered on the following key directions:

- **Theories on Diffusion Models**: The goal is to develop fundamental theories and improved algorithms for diffusion models, focusing on their convergence properties and sampling mechanisms, with an emphasis on enhancing sampling

speed and quality. We have developed the *first* theory for masked diffusion models and the *first* analysis that is applicable to samplers used in practice, such as the Euler method.

- **Controlled Generative Models**: The goal is to develop theoretically informed fine-tuning algorithms that steer the outputs of pre-trained generative models, particularly diffusion models, toward desired conditions, typically by defining a reward function and applying reinforcement learning (RL) methods. We have developed the *first* theory for zero-shot conditional diffusion models.

- **Anomaly Detection for Trustworthy AI**: The goal is to develop robust data-driven anomaly detection methods for time-sequential data under distributional uncertainty and dynamic environments, enabling reliable detection in safety-critical AI systems. We have developed a family of quickest change detection (QCD) algorithms with optimality guarantees even when the anomalous distribution is unknown or time-varying.

PUBLICATIONS

Journals

[J1] J. Z. Hare*, **Y. Liang***, L. Kaplan, V. V. Veeravalli. Bayesian Two-Sample Hypothesis Testing using the Uncertain Likelihood Ratio. In *IEEE Transactions on Signal Processing*, 2025. (*Equal Contribution)

[J2] **Y. Liang**, V. V. Veeravalli. Quickest Change Detection with Post-Change Density Estimation. In *IEEE Transactions on Information Theory*, 2024.

[J3] **Y. Liang**, A. G. Tartakovsky, V. V. Veeravalli. Quickest Change Detection with Non-Stationary Post-Change Observations. In *IEEE Transactions on Information Theory,* 2023.

[J4] **Y. Liang**, V. V. Veeravalli. Non-Parametric Quickest Mean-Change Detection. In *IEEE Transactions on Information Theory*, 2022.

Conferences

[C1] **Y. Liang**, R. Huang, L. Lai, N. Shroff, Y. Liang. Absorb and Converge: Provable Convergence Guarantee for Absorbing Discrete Diffusion Models. In *The Thirty-ninth Annual Conference on Neural Information Processing Systems (NeurIPS),* 2025. **(Acceptance rate: 24.52%)**

[C2] **Y. Liang**, Y. Liang, L. Lai, N. Shroff. Discrete Diffusion Models: Novel Analysis and New Sampler Guarantees. In *The Thirty-ninth Annual Conference on Neural Information Processing Systems (NeurIPS),* 2025. **(Acceptance rate: 24.52%)**

[C3] **Y. Liang**, P. Ju, Y. Liang, N. Shroff. Theory on Score-Mismatched Diffusion Models and Zero-Shot Conditional Samplers. In *The Thirteenth International Conference on Learning Representations (ICLR),* 2025. **(Acceptance rate: 31.75%)**

[C4] **Y. Liang**, P. Ju, Y. Liang, N. Shroff, Broadening Target Distributions for Accelerated Diffusion Models via a Novel Analysis Approach. In *The Thirteenth International Conference on Learning Representations (ICLR),* 2025. **(Acceptance rate: 31.75%)**

[C5] J. Z. Hare, **Y. Liang**, L. Kaplan, V. V. Veeravalli. On Network Quickest Change Detection with Uncertain Models: An Experimental Study. In *27th International Conference on Information Fusion (FUSION)*, 2024.

[C6] L. Xie*, **Y. Liang***, V. V. Veeravalli. Distributionally Robust Quickest Change Detection. In *The Twenty-seventh International Conference on Artificial Intelligence and Statistics (AISTATS),* 2024. (*Equal Contribution) **(Acceptance rate: 27.6%)**

[C7] **Y. Liang**, V. V. Veeravalli. Quickest Change Detection with Leave-one-out Density Estimation. In *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP),* 2023. **(Acceptance rate: 45.1%)**

[C8] **Y. Liang**, V. V. Veeravalli. Quickest Detection of Composite and Non-Stationary Changes with Application to Pandemic Monitoring. In *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP),* 2022. **(Acceptance rate: 45.0%)**

[C9] **Y. Liang**, V. V. Veeravalli. Non-Parametric Quickest Detection of a Change in the Mean. In *55th Annual Conference on Information Sciences and Systems (CISS),* 2021.

INVITED TALKS

- "Toward a Theory of Discrete Diffusion Models: Beyond Euclidean Domains," at UC Davis, Nov 2025.
- "Absorb and Converge: Provable Convergence Guarantee for Absorbing Discrete Diffusion Models" (oral presentation), *DeepMath Conference*, Ann Arbor, Nov 2025.
- "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.

RESEARCH COLLABORATORS

- AI-EDGE faculties and postdoctoral researchers on joint research initiatives.
- Researchers from the Army Research Lab as part of the Internet of Battlefield Things (IoBT) program.
- Prof. Lifeng Lai (UC Davis) and Prof. Shaofeng Zou (Arizona State University) on works of diffusion models and RL.

- Prof. Liyan Xie (University of Minnesota) on works of non-parametric statistics, anomaly detection and sequential analysis.

TEACHING EXPERIENCE

The Ohio State University Columbus, OH

Instructor, NSF REU program, Summers 2024 and 2025

- Developed an 8-week course on *AI and Networking* for undergraduate participants in the NSF REU program.
- Taught lectures on *Deep Generative Models*, covering major paradigms including autoregressive models, GANs, and diffusion models.
- Contributed to course materials and online resources: reu-ai-edge-osu.github.io.

University of Illinois Urbana-Champaign Champaign, IL

Teaching Assistant, *ECE 365: Data Science and Engineering*, UIUC, Aug 2020 – Dec 2022

- Provided theoretical guidance and coding assistance in an undergraduate *Data Science* course covering supervised and unsupervised machine learning methods.
- Designed weekly Jupyter Notebook assignments with interactive visualizations and deployed Gradescope auto-graders.
- Developed and maintained the course website and online resources.

MENTORING EXPERIENCE

- Mentor, to 4 first-year Ph.D. students on diffusion model research (Jan 2025 – Present)
- Mentor, to 10 undergraduates in NSF REU program on diffusion model projects (Summer 2024, 2025)
- Advisor, *FaithWorks* undergraduate organization, OSU (Sep 2024 – Present)

PROFESSIONAL SERVICE

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

REVIEWER

- IEEE Transactions on Information Theory

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