

Kulin Shah

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EDUCATION

University of Texas at Austin

August 2021 -

Ph.D. in Computer Science

Advisor: [Prof. Adam Klivans](#)

International Institute of Information Technology, Hyderabad

August 2015 - July 2019

B. Tech (Honors) in Computer Science and Engineering

Advisor: [Prof. Naresh Manwani](#)

RESEARCH INTEREST

Various aspects (e.g., robustness, reasoning, privacy, efficiency) of Large Language Models and Diffusion Models.

RESEARCH EXPERIENCE

Graduate Research Assistant, University of Texas at Austin

Aug 2021 - Present

- Advisor: [Prof. Adam Klivans](#)
- Working on problems in understanding and improving the building blocks of modern generative models (diffusion models and autoregressive models).

Student Researcher, Google Research

June 2023 - March 2024

- Manager: [Dr. Rina Panigrahy](#)
- Worked on problems in language modeling to improve its reasoning capabilities and efficiency of the architecture.
- Finished two projects on understanding reasoning and efficiency of the language models (see papers [this](#) and [this](#)).
- The dataset created in our [reasoning NeurIPS'24](#) paper was used in BIG-Bench Extra Hard benchmark of language models and used to evaluate Gemma 3 models (Google's open language models).

Research Fellow, Microsoft Research, India

Aug 2019 - July 2021

- Mentor: [Dr. Navin Goyal](#) and [Dr. Amit Deshpande](#)
- Worked on problems in generative models, representation learning, theory of deep learning.

Research Intern, Microsoft Research, India

May 2019 - July 2019

- Mentor: [Dr. Amit Deshpande](#) and [Prof. Chiranjib Bhattacharyya](#)
- Worked on problems related to fairness in machine learning.

Research Intern, Indian Institute of Science (IISc), Bangalore

May 2018 - June 2018

- Mentor: [Prof. PS Sastry](#)
- Worked towards understanding architecture and training dynamics of Capsule Network.

SELECTED RESEARCH PROJECTS

• Robust training of diffusion models and its implication on memorization

- ◊ Proposed a diffusion-based framework to learn distributions using only highly corrupted samples, enabling generative modeling in scenarios without clean data and improving memorization ([Paper at NeurIPS'23](#)).
- ◊ Developed a principled approach to mitigate memorization in diffusion models by leveraging training using corrupted data at large noise scales, improving *image-generation quality (fidelity) and memorization both simultaneously* ([Paper under review](#)).

• Understanding and improving the reasoning capabilities of language models

- ◊ Investigated the reasoning and search capabilities of LMs to solve complex puzzles (e.g., Sudoku), demonstrating the logical token-generation order dramatically enhances reasoning abilities ([Paper at NeurIPS'24](#)).
- ◊ Analyzing the benefit of Masked Diffusion Models (MDMs) in any order generation/reasoning on solving complex puzzles (e.g., Sudoku) and showing that MDMs *without supervision* about the logical token-generation order outperform autoregressive models *with supervision* ([Paper under review](#)).

16. **Train for the Worst, Plan for the Best: Understanding Token Ordering in Masked Diffusions**
Jaeyeon Kim*, **Kulin Shah***, Vasilis Kontonis, Sham M. Kakade, Sitan Chen [\[paper\]](#)
Preprint
15. **Does Generation Require Memorization? Creative Diffusion Models using Ambient Diffusion**
Kulin Shah, Alkis Kalavasis, Giannis Daras, Adam Klivans [\[paper\]](#)
Preprint
14. **Causal Language Modeling Can Elicit Search and Reasoning Capabilities on Logic Puzzles**
Kulin Shah, Nishanth Dikkala, Xin Wang, Rina Panigrahy [\[paper\]](#)
Neural Information Processing Systems (NeurIPS), 2024
13. **Unrolled denoising networks provably learn optimal Bayesian inference** [\[paper\]](#)
Aayush Karan*, **Kulin Shah***, Sitan Chen, Yonina Eldar
Neural Information Processing Systems (NeurIPS), 2024
12. **Learning general Gaussian mixtures with efficient score matching** [\[paper\]](#)
($\alpha - \beta$) Sitan Chen, Vasilis Kontonis, **Kulin Shah**
Preprint
11. **Simple Mechanisms for Representing, Indexing and Manipulating Concepts** [\[paper\]](#)
($\alpha - \beta$) Yuanzhi Li, Raghu Meka, Rina Panigrahy, **Kulin Shah**
Preprint
10. **Learning Mixtures of Gaussians Using the DDPM Objective** [\[paper\]](#)
Kulin Shah, Sitan Chen, Adam Klivans
Neural Information Processing Systems (NeurIPS), 2023
9. **Ambient Diffusion: Learning Clean Distributions from Corrupted Data** [\[paper\]](#)
Giannis Daras, **Kulin Shah**, Yuval Dagan, Aravind Gollakota, Alexandros G. Dimakis, Adam Klivans
Neural Information Processing Systems (NeurIPS), 2023
8. **Debiased Dynamic Stochastic Gradient Aggregation for Learning with Multiple Objectives**
Mao Ye*, **Kulin Shah***, Qiang Liu
Preprint
7. **Learning and Generalization in Overparameterized Normalizing Flows** [\[paper\]](#)
Kulin Shah, Amit Deshpande, Navin Goyal
International Conference on Artificial Intelligence and Statistics (AISTATS), 2022.
Workshop on the Theory of Overparameterized Machine Learning (TOPML), 2021.
6. **RISAN: Robust Instance Specific Deep Abstention Network** [\[paper\]](#)
Bhavya Kalra, **Kulin Shah**, Naresh Manwani
Conference on Uncertainty in Artificial Intelligence (UAI), 2021 (Oral).
5. **Rawlsian Fair Adaptation of Deep Learning Classifiers** [\[paper\]](#)
Kulin Shah, Pooja Gupta, Amit Deshpande, Chiranjib Bhattacharyya
AAAI/ACM Conference on AI, Ethics, and Society (AIES), 2021.
4. **Online Active Learning for Reject Option Classifier** [\[paper\]](#)
Kulin Shah, Naresh Manwani
AAAI Conference on Artificial Intelligence (AAAI), 2020 (Oral).
3. **Sparse Reject Option Classifier using Successive Linear Programming** [\[paper\]](#)
Kulin Shah, Naresh Manwani
AAAI Conference on Artificial Intelligence (AAAI), 2019 (Oral) .
2. **PLUME: Polyhedral Learning Using Mixture of Experts** [\[paper\]](#)
Kulin Shah, PS Sastry, Naresh Manwani

1. Ingredients for Happiness: Modeling Constructs via Semi-supervised Content Driven Inductive Transfer [paper]

Bakhtiyar Syed, V. Indurthi, **Kulin Shah**, Manish Gupta and Vasudeva Varma

AAAI-19 Workshop on Affective Content Analysis, AFFCON-19 (**Runner-up** for CL-Aff shared task).

AWARDS AND ACHIEVEMENTS

- Awarded **Google** conference travel scholarship award in 2024.
- Awarded **NeurIPS** scholar award 2023.
- Awarded **Google, Microsoft Research** travel grant and **AAAI Student Scholarship** to attend **AAAI** 2019.
- Awarded **Research Award** for exceptional research work at IIIT Hyderabad.
- Awarded **Dean's List** award for excellent academic performance in 2016, 2017 and 2018.
- **34 rank** in India in online round of ACM ICPC programming contest, 2018 (Total 3000+ teams)
- **53 rank** in Amritapuri regional of ACM ICPC programming contest, 2017 (Total top 260 teams from India).

TALKS

- Presented our work on learning mixtures of Gaussians using diffusion models at a joint diffusion seminar between Harvard University, Caltech, and UT Austin. 2024
- Presented our work on learning mixtures of Gaussians using diffusion models at Apple Machine Learning Research. 2024
- Presented our work on learning in Normalizing Flows at a general meeting at Microsoft Research India. 2021
- Presented our work on reject option classifier in AAAI Conference on Artificial Intelligence. 2019

TECHNICAL SKILLS

Programming Languages	Python, Matlab, C, C++, Bash, Java
Libraries & Tools	PyTorch, TensorFlow, Jax, Huggingface, Keras, Scikit-learn, Git, Latex

RELEVANT COURSES

Generative Models & Multiobjective optimization	Reinforcement Learning
Topics in Machine Learning (Online Learning & Bandits)	Statistical Methods in AI
Optimization Methods	Autonomous Robots
Game Theory	Computer Vision
Adv. Probability (Concentration, Stein's Method, Mean-field theory)	Functional Analysis