Sakshi Agarwal

Computer Science PhD Candidate

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Research Interests

Developing Inference Algorithms, My interests focus on developing (variational) inference algorithms, that leverage pre-trained Deep Generative Models (such as Diffusion Models) and Vision-Language Foundation Models (like CLIP, BLIP) to address real-world user queries involving both images and text. My goal is to adapt and align predictions of these foundational models to enhance their reliability and robustness in specific application contexts.

Education

2019–present **PhD, Computer Science**, University of California, Irvine, Advisor: Prof. *Erik Sudderth*.

2013–2017 : **B.Tech in Electrical and Computer Engineering**, Indian Institute of Technology, Kharagpur, Advisor: Prof. *Sudeshna Sarkar*.

Research Experience

University of California, Irvine

2024–Present **Producing Reliable Text Descriptions of complex real-world images**.
- Enhancing text descriptions produced by Vision-Language Models to accurately describe complex images.
- Exceptionally useful feature for AI tools assisting the Low-Vision and Blind.

2024–Present **Adapting Image Generation with Stable Diffusion**.
- Improving the relevance of images generated using Stable Diffusion to user text prompts and additional constraints like segmentation and object masks.

2023-2024 **Solving Image Inverse Problems using (Latent) Diffusion Models**.
- Developed a variational inference method using latent diffusion models to solve image inverse problems.
- *1.25x Faster* and *1.7x consistent* image recovery when compared with other contemporary works.
- Preferred inference method for complex user queries with *high* image degradation.

2022 **Image Inpainting with Pre-trained (Hierarchical) VAEs**.
- Developed a (non-amortized) variational inference algorithm using (Hierarchical) VAEs for image inpainting, showing 3x improved (more probable) image recovery than amortized inference methods.
- Identified suboptimal behaviour of amortized inference networks for out-of-distribution observations.

2021 **Neural Networks for Message-Passing Inference Algorithms**.
- Developed an approximate message-passing inference algorithm; using neural networks for human-defined graphical models with discrete variables.
- *5x Improved* inference performance (accuracy) while also being *2x faster* over original.

Amazon.com, Seattle

2020 **Theme Categorization**, *Applied Scientist Intern*.
- Categorized Q/A pairs on Amazon website into generic themes for improved user-experience.
- Proposed suitable metrics to evaluate themes.

Xerox Research Center, India

2017–2019 ***Hate Speech & Crime Detection***.
- Utilized an attention-based RNN network to detect "subtle" hate-speech in comments of an article.
- Time series prediction of crime occurrence in a low crime city based on its past crime events, and data available on other high crime cities.

Publications

In Conference Proceedings

2023 **Sakshi, Agarwal**, Gabriel Hope, Ali Younis, and Erik B. Sudderth. A decoder suffices for query-adaptive variational inference. In Robin J. Evans and Ilya Shpitser, editors, *Proceedings of the Thirty-Ninth Conference on Uncertainty in Artificial Intelligence*, volume 216 of *Proceedings of Machine Learning Research*, pages 33–44. PMLR, 31 Jul–04 Aug 2023.

2022 **Sakshi Agarwal**, Kalev Kask, Alexander Ihler, and Rina Dechter. NeuroBE: Escalating NN approximations of bucket elimination. In *The 38th Conference on Uncertainty in Artificial Intelligence*, 2022.

2021 Yasaman Razeghi, Kalev Kask, Yadong Lu, Pierre Baldi, **Sakshi, Agarwal**, and Rina Dechter. Deep bucket elimination. In Zhi-Hua Zhou, editor, *Proceedings of the Thirtieth International Joint Conference on Artificial Intelligence, IJCAI-21*, pages 4235–4242. International Joint Conferences on Artificial Intelligence Organization, 8 2021. Main Track.

In Workshops

2018 **Sakshi, Agarwal**, Krishnaprasad Narayanan, Manjira Sinha, Rohit Gupta, Sharanya Eswaran, and Tridib Mukherjee. Decision support framework for big data analytics. In *2018 IEEE World Congress on Services (SERVICES)*, pages 53–54, 2018.

2017 Mohit Yadav and **Sakshi, Agarwal**. Regularization and learning an ensemble of rnns by decorrelating representations. In *AAAI Workshops*, 2017.

Patents

2021 **Sakshi, Agarwal** and SS Mannarswamy. Neural network architecture for subtle hate speech detection, us patent 10,936,817, 2021.

2020 **Sakshi, Agarwal**, Poorvi Agarwal, Arun Rajkumar, and Sharanya Eswaran. Method and system for forecasting in sparse data streams via dense data streams, us patent app. 16/112,768, 2020.

2019 Sharanya Eswaran, **Sakshi, Agarwal**, Sitara Shah, Narayanan Krishnaprasad, Banerjee Shisagnee, Johnston Terry, Avantika Gupta, and Tridib Mukherjee. Operational recommendations based on multi-jurisdictional inputs, us patent app. 15/988,247, 2019.

Academic Achievements

2022 Reviewer at NeurIPS 2024, UAI 2024, AISTATS 2023

2013 Qualified in the Joint Entrance Examination (Advanced & Main), 2013 with a percentile of 98.3% and 99.7% respectively.

2011 Secured a rank of 648 in the 4th International Mathematics Olympiad (organized by SOF India) 2011.

Programming Languages

Python, PyTorch, TensorFlow, Theano, R, C, C++

Algorithms/Models

Variational Inference, Amortized Variational Inference, Diffusion Models, Variationnal Autoencoders, Deep Generative Models, Text-to-Image Generation, Out-of-distribution robustness

Teaching Assistantship

Winter, 2022 **CS175: Project In AI**, UC Irvine.

Spring, 2021 **CS171: Intro to Artificial Intelligence**, UC Irvine.

Winter, 2020 **CS265: Graph Algorithms**, UC Irvine.