Prachi Badarayani

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Education

Cornell University *New York*
PhD in Computer Science *Aug 2025*
- Advisor: Prof. Volodymyr Kuleshov

Cornell University *New York*
MS in Computer Science *Aug 2022*
- Advisor: Prof. Volodymyr Kuleshov

Indian Institute of Technology, Bombay *Mumbai*
BTech with Honors in Computer Science *Aug 2018*
- Advisor: Prof. Sudarshan

Research Interests

My research interests span deep generative probabilistic models, uncertainty estimation and causal machine learning. I work on multimodal generative models for causal inference that incorporate unstructured information for the correction of confounding. I also work on improving the reliability of predictive uncertainties in the context of deep learning, causal inference and sequential decision-making.

Work Experience

Microsoft, Cambridge, USA — July 2025 - Present
Dr. Sadid Hasan
Selected for Microsoft's highly selective AI Development Acceleration Program (0.1% acceptance rate), a fixed-term rotational role for new PhDs designed to apply advanced research across multiple AI product teams.

Microsoft Research, Redmond, USA — May 2023 - Aug 2023
Dr. Swati Sharma, Dr. Angels de Luis Balaguer
We built deep generative causal models to power a conversational agent for the FarmBeats project, improving agricultural yields by providing farmers with actionable causal insights for decision-making.

Amazon Robotics, North Reading, USA — June 2022-Aug 2022
Dr. Chaitanya Mitash
We designed vision transformers for complex spatial reasoning in cluttered scenes, enhancing robotic scene understanding to enable the manipulation of previously unseen objects.

Nomura Structured Finance, Mumbai, India — June 2017-Aug 2017
Alok Kacchap
Architected and implemented a suite of C++ libraries for the bond futures and options market, engineered for robustness and accuracy against dynamic shifts in market conventions.

Swiss Federal Institute of Technology (EPFL), Switzerland — June 2016-Aug 2016
Prof. Bernard Moret
We inferred the evolutionary history of plant genomes using sequential genetic data using maximum likelihood estimation. We demonstrated significant reduction in the computational requirements of phylogenetic (evolutionary) tree reconstruction for plant species using improved representation of sequence data.

Publications

Probabilistic Conformal Prediction Improves Clinical Decision-Making.
Shachi Deshpande, Kamilė Stankevičiūtė, April Wei, Volodymyr Kuleshov. (In Preparation)

Calibrated Regression Against An Adversary Without Regret.
Shachi Deshpande, Charles Marx and Volodymyr Kuleshov
Uncertainty in Artificial Intelligence (UAI), 2025

Calibrated and Conformal Propensity Scores for Causal Effect Estimation.
Shachi Deshpande and Volodymyr Kuleshov.
Uncertainty in Artificial Intelligence (UAI), 2024
Also appeared at Spurious Correlations, Invariance and Stability (SCIS) Workshop, ICML 2023

Online Calibrated and Conformal Prediction Improves Bayesian Optimization.
Shachi Deshpande , Charles Marx and Volodymyr Kuleshov.
International Conference on Artificial Intelligence and Statistics (AISTATS) 2024

Deep Multi-Modal Structural Equations For Causal Effect Estimation With Unstructured Proxies.
Shachi Deshpande, Kaiwen Wang, Dhruv Sreenivas, Zheng Li and Volodymyr Kuleshov.
Advances in Neural Information Processing Systems (NeurIPS) 2022
Also appeared at Women in Machine Learning Workshop (WiML), NeurIPS 2022

Calibrated and Sharp Uncertainties in Deep Learning via Simple Density Estimation.
Volodymyr Kuleshov and **Shachi Deshpande**.
International Conference on Machine Learning (ICML) 2022. (Spotlight)
Also appeared at Distribution-Free Uncertainty Quantification (DFUQ) Workshop, ICML 2022.

New Genome Similarity Measures based on Conserved Gene Adjacencies.
Daniel Doerr, Luis Antonio B. Kowada, Eloi Araujo, **Shachi Deshpande**, Simone Dantas, Bernard M.E. Moret, and Jens Stoye. *Journal of Computational Biology 2017.*

Research

Probabilistic Conformal Prediction for Clinical Decision-Making

Prof. Volodymyr Kuleshov, Prof. April Wei | Cornell University
We design a unified framework to enforce probabilistic conformal and calibrated prediction of genetic risk to develop a disease. With reliable predictive PRS uncertainties for populations with distribution shifts, we demonstrate an improved ability to perform clinical decision-making on several semi-simulated and real datasets derived from the UK Biobank.

Calibration of Learned Propensity Score Models for Causal Machine Learning

Prof. Volodymyr Kuleshov | Cornell University
We propose probabilistic calibration to improve the effectiveness of propensity score models in causal effect estimation. Calibration reduces the variance and error bounds on causal effect estimates, thus allowing the use of simple propensity models that improve the computational throughput of Genome-Wide Association Studies by more than two-fold.

Deep Multimodal Structural Equations for Causal Inference

Prof. Volodymyr Kuleshov | Cornell University
We incorporate multi-modal, unstructured information in modern datasets within the framework of causal inference using deep generative models. We propose novel generative architectures and inference algorithms that scale to multi-modal setups with missing data. We create multimodal causal inference benchmarks for evaluation of causal effect estimation.

Calibrated and Conformal Prediction for Sequential Decision-Making Under Uncertainty

Prof. Volodymyr Kuleshov | Cornell University
We propose a simple algorithm to calibrate the uncertainty of posterior distributions over the objective function as part of the Bayesian optimization process. We show that by improving the uncertainty estimates of the posterior distribution with calibration, Bayesian optimization makes better decisions and arrives at the global optimum in fewer steps.

Online Query Optimization in Distributed Systems

Prof. S Sudarshan | Undergraduate Thesis, IIT Bombay
We proposed dynamic tuple routing policies to optimize join computation in streaming query application within a distributed computing environment. We designed parallel query execution policies and demonstrated reduction in latency of computation without compromising the application throughput in simulated star join datasets.

Derivative Clouds for compute-intensive applications

Prof. Umesh Bellur | R & D Project, IIT Bombay

We performed an empirical study of CPU and memory overcommitment on application performance over a range of derivative setups and virtualization frameworks. We determined efficient Virtual Machine cluster configurations corresponding to application requirements through empirical validation of our models.

Awards and Fellowships

2025 **Selected in the Microsoft AI Development Acceleration Program**, Microsoft
2022 **Doctoral Grant for Grace Hopper Celebration**, Cornell University
2022 **NeurIPS Travel Grant**, Women in ML
2018 **Cornell University Fellowship**, Cornell University
2013 **INSPIRE Scholarship**, Dept of Science and Technology, Govt of India
2013 **Dhirubhai Ambani Scholarship**, Reliance Foundation
2008 **National Talent Search Examination Scholarship**, NCERT, Govt of India

Seminars and Talks

Oct 2023 **Causality Discussion Group**, TU Darmstadt, Germany (Virtual)
Oct 2023 **Microsoft Research** , Cambridge, UK (Virtual)
Sept 2022 **Machine Learning Reading Group** , Cornell Tech, NY, USA
Aug 2022 **Amazon Robotics** , Boston, MA, USA

Teaching Experience

Spring 2021 **Deep Probabilistic and Generative Models**, Teaching Assistant
Fall 2020 **Applied Machine Learning**, Teaching Assistant
Summer 2020 **Introduction to Programming Using Python**, Teaching Assistant
Spring 2020 **Interactive Computer Graphics**, Teaching Assistant
Fall 2017, Spring 2018 **Computer Programming and Utilization**, Teaching Assistant

Key Coursework

Causal Machine Learning, Reinforcement Learning, Decision Theory, Topics in Machine Learning and Natural Language Processing (Seminars), Emerging Cloud Technologies, Model Checking, Computer Graphics, Information Retrieval, Probability Theory, Stochastic Processes

Outreach & Professional Development

Service and Outreach

2021-2022 **Computer Science Graduate Organization, Cornell Tech**, Vice-President
2021-2022 **Dept of Computer Science, Cornell**, Mentor for incoming Graduate students
2019-2020 **CS Graduate Admissions Committee, Cornell**, Reviewer
2017-2018 **Dept of Computer Science, IIT Bombay**, Academic mentor

Reviewer

NeurIPS 2021, 2022, 2023, 2024
AISTATS 2022, 2023
ICML 2023