

RESEARCH INTERESTS

High-Dimensional Statistics, Convex Optimization (Especially the Sum-of-Squares SDP Hierarchy), Theory of Machine Learning and Computational Aspects of Statistical Inference

EDUCATION

Swiss Federal Institute of Technology (ETH), Zürich 2021 - present
Master of Science in Computer Science
Thesis Advisor: [Prof. David Steurer](#)

Indian Institute of Technology Gandhinagar 2016 - 2020
Bachelor of Technology with Honours in Computer Science and Engineering
Research Advisors: [Prof. Nipun Batra](#), [Prof. Anirban Dasgupta](#)

WORK EXPERIENCE

Microsoft Research India 2020 - 2021
Research Fellow in Machine Learning and AI Group
Advisors: [Dr. Prateek Jain](#), [Dr. Purushottam Kar](#) and [Dr. Sundararajan Sellamanickam](#)

California Institute of Technology 2019
Summer Undergraduate Research Fellow
Advisor: [Prof. K. Mani Chandy](#)

PUBLICATIONS

- IGLU: Efficient GCN Training via Lazy Updates**
S Deepak Narayanan*, Aditya Sinha*, Prateek Jain, Purushottam Kar, Sundararajan Sellamanickam
International Conference on Learning Representations (ICLR), 2022
- Poster Abstract: A toolkit for spatial interpolation and sensor placement**
S Deepak Narayanan*, Zeel Patel*, Apoorv Agnihotri, Nipun Batra
Conference on Embedded Networked Sensor Systems (SenSys), 2020
- Active learning for air quality station deployment**
S Deepak Narayanan, Apoorv Agnihotri, Nipun Batra
*Workshop on Real World Experiment Design and Active Learning
International Conference on Machine Learning (ICML), 2020*
- Reproducibility Report - One ticket to win them all: generalizing lottery ticket initializations across datasets and optimizers.**
Varun Gohil*, S Deepak Narayanan*, Atishay Jain*
ReScience C 6, 2, #4.

RESEARCH PROJECTS

Robust Linear Regression – Assumptions, Algorithms and Lower Bounds Present
Advisor: Prof. David Steurer, ETH Zürich

- Researched and surveyed algorithms for the Robust Regression problem.
- Found an open research problem in the semi-random contamination model where there are no known matching lower bounds for state-of-the-art algorithms.
- Working towards resolving this problem and designing faster algorithms with near-optimal guarantees, while exploiting tools from statistics, information theory and optimization.

On Stochastic linear optimization and generalization on general data

Advisor: Prof. Fanny Yang, *Guarantees for Machine Learning Course*, ETH Zürich 2023

- Expanding on the recent work [1]¹, provided connections between regularized solutions, early stopped solutions and reference solutions. Rewrote proofs in a more approachable manner and demonstrated failure cases of the techniques presented in [1].

¹[1] Telgarsky, Matus. "Stochastic linear optimization never overfits with quadratically-bounded losses on general data." Conference on Learning Theory. PMLR, 2022.

Bandit Optimization using Graph Neural Networks for Accelerated Drug Discovery

Advisors: Prof. Ilija Bogunovic, Prof. Andreas Krause, ETH Zürich

2021-22

- Researched Graph Neural Network based bandits for accelerating drug discovery.
- Demonstrated the superiority of GNN-based methods over standard neural network based approaches, leveraging permutation invariance on both synthetic and benchmark datasets. Contribution was acknowledged in [2]².

Fast Training for Graph Convolutional Networks

Advisors: Dr. Prateek Jain, Dr. Purushottam Kar, Dr. Sundararajan Sellamanickam, Microsoft Research India

2020-21

- Researched fast training strategies for Graph Convolutional Networks.
- Proposed and implemented IGLU - a novel lazy update based optimization method, that offers up to 8× speedup, while maintaining competitive accuracy – outperforming the state-of-the-art by up to 1.2%.
- Work resulted in publication at ICLR 2022.

Graph Based Neural Architectures for Ranking

Advisors: Dr. Sundararajan Sellamanickam, Microsoft Research India

2020-21

- Proposed neural architectures for the learning to rank problem.
- By creating document-document graphs on the fly, proposed graph-based architecture surpassed performance of other neural rankers and rivalled Gradient Boosted Decision Trees.
- Explored knowledge transfer which resulted in performance improvements of 1% on benchmark datasets.

Sensor Placement and Active Learning for Air Quality Monitoring

Advisor: Prof. Nipun Batra, IIT Gandhinagar

2018-20

- Modeled air quality using Gaussian Processes with custom kernels and outperformed existing methods by reducing prediction errors by up to 8%.
- Developed an active learning strategy to place air quality sensors using uncertainty sampling, improving data accuracy.
- Paper presented at RealML Workshop, ICML 2020.

Deterministic Data Summarization for Fast Clustering

Advisor: Prof. Anirban Dasgupta, IIT Gandhinagar

2019-20

- Developed data summarization techniques for efficient k -means clustering.
- Introduced deterministic variants of sampling algorithms and demonstrated their competitiveness and reduced relative error compared to popular coresets constructions.

Analyzing streams of data: Applications in Acoustics

Advisor: Prof. Mani Chandy, Caltech

2019-20

- Developed novel signal processing algorithms and streamlined asynchronous audio streams, successfully recreating renowned effects like the Shimmer Acoustic Effect.
- Achieved comparable audio quality to expensive guitar pedals on a Raspberry Pi, demonstrating affordable alternatives.

AWARDS AND HONORS

- Award for the best performance in the core courses of Physics, Chemistry and Life Sciences among all students of the graduating batch of B.Tech. at IIT Gandhinagar. 2020
- Winner of Microsoft AI for Earth Azure Grant worth USD 30,000. Co-wrote the grant with Prof. Nipun Batra. 2019
- Winner of NeurIPS Reproducibility Challenge. 2019
- Recipient of Caltech's Summer Undergraduate Research Fellowship to conduct research. 2019
- Recipient of Indian Academy of Sciences Summer Research Fellowship to conduct research. 2018
- Featured in IIT Gandhinagar's Dean's List for the first six semesters. 2016 - 19
- Selected for the prestigious Kishore Vaigyanik Protsahan Yojana Fellowship by the Government of India. 2016
- Recipient of the prestigious National Talent Search Exam Scholarship from the Government of India. 2014

TEACHING

- **Algorithmic Foundations of Data Science, ETH Zürich** Prof. David Steurer, Spring 2023
Conducted exercise sessions, held office hours, corrected exercise sheets, and provided feedback on the graded homeworks and final exam.

²[2] P. Kassraie, A. Krause, and I. Bogunovic. "Graph neural network bandits." Advances in Neural Information Processing Systems, 2022

- **Computational Intelligence Lab, ETH Zürich**

Prof. Thomas Hofmann, Spring 2023

Designed exercise sheets, conducted exercise sessions and graded student projects.

- **Deep Learning, ETH Zürich**

Prof. Thomas Hofmann, Fall 2023

Designed exercise sheets, conducted exercise sessions and graded student projects.