Sharut Gupta

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Education

Massachusetts Institute of Technology (MIT) — **2022 - Present**
Ph.D. candidate in Electrical Engineering and Computer Science (EECS) — *GPA 5.0/5.0*
Advisor: Prof. Stefanie Jegelka

Indian Institute of Technology, Delhi (IIT Delhi) — **2017 - 2022**
Bachelor's and Master's (Dual Degree) in Mathematics and Computing — *GPA 9.68/10*
Advisor: Prof. Yoshua Bengio and Prof. Niladri Chatterjee

Internships and Research Experience

Google DeepMind, Research Intern — **Cambridge, US**
Manager: Dilip Krishnan — *June 2024 - Aug 2024*
- As a part of the Gemini Team, developed an alternative approach to the traditional chain-of-thought-based reasoning, enhancing the reasoning capabilities of large language models(*Patent Application in Process*)

Meta AI (FAIR), Research Intern — **Paris, France**
Managers: David Lopez Paz and Kartik Ahuja — *June 2023 - Aug 2023*
- Proposed In-Context Risk Minimization (ICRM) algorithm for training robust and generalizable models with significant out-of-distribution performance improvements (*accepted at ICLR 2024*)

Mila - Quebec AI Institute, Research Intern — **Remote**
Host: Prof. Yoshua Bengio — *Sept 2021 - May 2022*
- Proposed FL Games, a game-theoretic framework that learns causal features invariant across clients/end-users, for addressing the challenge of data distribution heterogeneity across clients in Federated Learning (*accepted at NeurIPS-FL*).

Google Research, Software Engineering Intern — **Bangalore, India**
Manager: Dr. Sriram Lakshminarasimhan and Narayan Hegde — *May 2021 - July 2021*
- Proposed algorithms for modeling highly stochastic and noisy time series data from wearable tracker data for forecasting (generation), imputation, anomaly, and signature (*in production with Google FitBit*)

Quantitative Translational Imaging in Medicine (QTIM), Research Intern — **Boston, US**
Host: Prof. Jayashree Kalpathy Cramer — *Jan 2020 - May 2021*
- Developed a novel pairwise learning framework designed to output a measure of pulmonary disease severity on chest X-rays (CXRs) for COVID patients (*deployed at Massachusetts General Hospital*).
- Proposed an algorithm based on Batch Normalization layer statistics to address the challenge of catastrophic forgetting in transfer learning for the assessment of mammographic breast density (*accepted at NeurIPS ML4H*)

Microsoft Research and Development, Research Intern — **Hyderabad, India**
Manager: Dr. Mithun Das Gupta — *May 2020 - July 2020*
- Proposed Scalable (Bilinear) Capsule Networks, whose parameters scale linearly, thus alleviating the parameter-intensive nature of capsule layers in capsule networks (*Best paper award and Spotlight presentation at MLADS Synapse 2020*).

INRIA, Research Intern · Paris, France
Host: Prof. Paul Muhlethaler · *May 2019 - July 2019*
- Proposed an algorithm by combining the descriptive strength of Gaussian Mixture Model (statistical modeling) with high-performance classification capabilities of Support Vector Classifiers (machine-learning modeling) to improve traffic accident forecasting in autonomous vehicles (*accepted in Expert Systems with Applications, Elsevier*)

Honors and Awards

- Jane Street Graduate Fellowship—Finalist — *2024*
- NeurIPS 2024 Top Reviewer Award — *2024*
- MIT Presidential Graduate Fellowship Award — *2022*
- NeurIPS Volunteer Award — *2022*
- Suman Upma Gupta Memorial Award, *highest GPA female student among graduating students* — *2022*
- Suyash Chandra Memorial Award, *best undergraduate project among all graduating students* — *2022*
- Quadeye Excellence Fellowship — *2021*
- Top 7% Academic Award, *for five semesters* — *2017-2021*
- IIT JEE, *All India Rank of 424 amongst 1.7 millon students* — *2017*
- Kishore Vaigyanik Protsahan Yojana (KVPY) fellowship — *2016*
- Regional Mathematics Olympiad (RMO) — *2016*

Featured Publications (* denotes equal contribution)   Google Scholar

Publications

12. **An Information Criterion for Controlled Disentanglement of Multimodal Data** [Paper]
    Chenyu Wang*, **Sharut Gupta***, Xinyi Zhang, Sana Tonekaboni, Stefanie Jegelka, Tommi Jaakkola, Caroline Uhler
    Under Review at the International Conference on Learning Representations (ICLR) 2025
    Oral Presentation and Honorable Mention Award at the UniReps Workshop, NeurIPS 2024

11. **In-Context Symmetries: Self-Supervised Learning through Contextual World Models** [Paper]
    Sharut Gupta*, Chenyu Wang*, Yifei Wang*, Tommi Jaakkola, Stefanie Jegelka
    Conference on Neural Information Processing Systems (NeurIPS) 2024
    Oral Presentation (Top 4) at the SSL Workshop, NeurIPS 2024

10. **Understanding the Role of Equivariance in Self-supervised Learning** [Paper]
    Yifei Wang, Kaiwen Hu, **Sharut Gupta**, Ziyu Ye, Yisen Wang, Stefanie Jegelka
    Conference on Neural Information Processing Systems (NeurIPS) 2024

9. **Context is Environment** [Paper]
   Sharut Gupta, Stefanie Jegelka, David Lopez-Paz and Kartik Ahuja
   International Conference on Learning Representations (ICLR) 2024

8. **Structuring Representation Geometry with Rotationally Equivariant Contrastive Learning** [Paper]
   Sharut Gupta*, Joshua Robinson*, Derek Lim, Soledad Villar, Stefanie Jegelka
   International Conference on Learning Representations (ICLR) 2024

7. **Removing Biases from Molecular Representations via Information Maximization** [Paper]
   Chenyu Wang, **Sharut Gupta**, Caroline Uhler, Tommi S. Jaakkola
   International Conference on Learning Representations (ICLR) 2024

6. **Collaborative privacy-preserving approaches for distributed deep learning using multi-institutional data** [Paper]
   Sharut Gupta, Sourav Kumar, Ken Chang, Charles Lu, Praveer Singh, Jayashree Kalpathy-Cramer
   RadioGraphics, Radiological Society of North America (RSNA) 2023

5. **Minimizing Client Drift in Federated Learning via Adaptive Bias Estimation** [Paper]
   Farshid Varno, Laya Rafiee, **Sharut Gupta**, Stan Matwin, Mohammad Havaei
   European Conference on Computer Vision (ECCV) 2022

4. **Multi-population generalizability of a chest radiograph severity score for COVID-19** [Paper]
Matthew D Li, Nishanth T Arun, **Sharut Gupta**, Mehak Aggarwal et al
Medicine 2022

3. **Assessing the trustworthiness of saliency maps for localizing abnormalities in medical imaging** [Paper]
Nishanth Arun, Nathan Gaw, Praveer Singh, Ken Chang, Mehak Aggarwal, Bryan Chen, Katharina Hoebel, **Sharut Gupta**, Jay Patel, Mishka Gidwani, Julius Adebayo, Matthew D Li, Jayashree Kalpathy-Cramer
Radiology Artificial Intelligence 2021

2. **Exploring the forecasting approach for road accidents** [Paper]
Mamoudou Sangare, **Sharut Gupta**, Samia Bouzefrane, Soumya Banerjee, Paul Muhlethaler
Expert Systems with Applications, Elsevier 2021

1. **Federated Learning for Breast Density Classification: A Real-World Implementation** [Paper]
Holger R Roth, Ken Chang, Praveer Singh, Nir Neumark, Wenqi Li, Vikash Gupta, **Sharut Gupta**, Liangqiong Qu et al.
MICCAI Domain Adaptation and Representation Transfer, and Distributed and Collaborative Learning 2020

Preprints

4. **Optimal Algorithms for Group Distributionally Robust Optimization and Beyond**
Tasuku Soma, Khashayar Gatmiry, **Sharut Gupta**, Stefanie Jegelka
Under review

3. **FL Games: A federated learning framework for distribution shifts** [Paper]
Sharut Gupta, Kartik Ahuja, Mohammad Havaei, Niladri Chatterjee, Yoshua Bengio
NeurIPS 2022 International Workshop on Federated Learning: Recent Advances and New Challenges,
Oral Presentation

2. **Addressing catastrophic forgetting for medical domain expansion** [Paper]
Sharut Gupta, Praveer Singh, Ken Chang, Liangqiong Qu et al.
NeurIPS Machine Learning for Health 2021, Spotlight Presentation

1. **Scalable Capsule Networks**
Francis Tom*, **Sharut Gupta***, Mithun Das Gupta
MLADS Synapse 2020, Best Paper Award and Spotlight Presentation

Key Academic Projects

Weakly Supervised Breast Cancer Detection   **AIIMS Delhi, IIT Delhi**
Advisor: Prof. Chetan Arora   *2019-2020*
- Used medical reports as weak descriptors of mammogram images to train a model for weakly supervised breast cancer detection.

CovidNet: Segmenting COVID-19 abnormalities   **QTIM, Boston**
Advisor: Prof. Jayashree Kalpathy Cramer   *2020-202*
- Developed a CT segmentation algorithm that estimates the extent of abnormality or disease severity in chest CTs from COVID-19 patients.

Real Time Ping-Pong Game   **IIT Delhi**
Advisor: Prof. Chetan Arora   *2019-2019*
- Found camera calibration matrix for web camera using multiple views of chessboard and rendered a 3D AR Object. Further used video input from web-cam, two visual markers as paddles and designed a ping-pong game, reflecting the ball off the plane of visual markers using laws of reflection.

My Exam Scribe   **International Women's Hackathon**
Mentor: Akashdeep Nain   *2019-2019*
- Built a mobile application on top of the Google Assistant using Dialogflow, Webhook and Firebase Cloud Database. Enabled visually impaired to write exams without the use of human scribes by reading questions and storing answers

Leadership and Research Outreach

- Board for Student Welfare (BSW) IIT Delhi, Deputy General Secretary Mentorship — 2020 - 2021
    - Initialised an auxiliary program to tackle crucial issues of intellectual plagiarism and language
    - Co-established the Office of Accessible Education (OAE) providing special assistance for the disabled
    - Founded research mentorship and journal club at IIT Delhi, dedicated towards fostering student research

- IIT Delhi Strategy and Vision Document 2030 Implementation Committee, Core Member, — 2020 - 2022
    - Only student member of the Overall Vision Committee, responsible for identification of core areas and overseeing their progress in 5 key domains which would lead the institute to become a global leader by 2030

- WiDS Cambridge Datathon, Organizer — 2023 - Present
    - Organize the WiDS Cambridge Datathon Workshop that through the WiDS Datathon Challenge, aims to provide mentorship and training to women with a strong interest in data science.

- Responsible AI as a part of Data Science in India, ACM SIGKDD, Session Chair — 2021
- MIT Graduate Application Assistance Program (GAAP), Executive Team Member — 2024 - Present
- The Gradient Substack Newsletter, Editor — 2023 - Present
- MIT ML Tea Seminar, Organizer — 2023 - Present
- MIT Graduate Application Assistance Program (GAAP), Mentor — 2022 - Present
- MIT Thriving Stars EECS Buddy Program, Mentor — 2022 - Present
- Initiative for Gender Equity and Sensitisation (IGES) IIT Delhi, Core Team Member — 2020 - 2021
- BSW Department Academic Mentorship Program at IIT Delhi, Academic Mentor — 2018 - 2019

Teaching

- Teaching Assistant for the course 6.7960 Deep Learning, MIT — 2024
- MIT Educational Studies Program (ESP) Splash, Instructor — 2023
- Teaching Assistant for the course Analysis and Design of Algorithm, IIT Delhi — 2021
- Teaching Assistant for the course Differential Equations, IIT Delhi — 2021
- Teaching Assistant for the course Probability and Stochastic Processes, IIT Delhi — 2020

Reviewing Service

Conferences

- Neural Information Processing Systems (NeurIPS) — 2024
- The International Conference on Learning Representations (ICLR) — 2024
- Machine Learning for Health (ML4H) Symposium — 2024

Workshops

- Symmetry and Geometry in Neural Representations (NeurReps), NeurIPS — 2024
- Geometry-grounded Representation Learning and Generative Modeling (GRaM), ICML — 2024
- Workshop on In-Context Learning (ICL), ICML — 2024
- Theoretical Foundations of Foundation Models (TF2M), ICML — 2024
- Robustness of Few-shot and Zero-shot Learning in Large Foundation Models (R0-FoMo), NeurIPS — 2023

Talks and Presentations

- *Redefining Context for Powerful Test-Time Adaptation using Unlabelled Data*
    - MIT Embodied Intelligence (EI) Seminar — November, 2024

- *Context is Environment*
    - TAG-DS, *The Pacific Northwest Seminar on Topology, Algebra, and Geometry in Data Science* — March, 2024
    - MIT Machine Learning (ML) Tea Seminar series — February, 2024
    - The Quantitative Translational Imaging in Medicine (QTIM) Lab — January, 2024

- *Structuring Representation Geometry with Rotationally Equivariant Contrastive Learning*
  - MIT LIDS and STATS Tea Talks   March, 2024

- *FL Games: A federated learning framework for distribution shifts*
  - NeurIPS Workshop on Federated Learning: Recent Advances and New Challenges   December, 2022
  - The Quantitative Translational Imaging in Medicine (QTIM) Lab   July, 2023