Sharut Gupta

Indian Institute of Technology Delhi

+91 9877205405 • sharut.gupta.mt617@maths.iitd.ac.in

https://www.cse.iitd.ac.in/~sharut/

Education

Bachelor's and Master's (Dual Degree) in Mathematics and Computing **2017 - 2022**

Indian Institute of Technology, Delhi (IIT Delhi) *GPA 9.636/10 (8 semesters)*

Publications

Google Scholar

- **Gupta, S.**, Singh, P.,... Kalpathy-Cramer, J., "The unreasonable effectiveness of Batch-Norm statistics in addressing catastrophic forgetting across medical institutions", *NeurIPS: Machine Learning for Health, 2020,* **Spotlight Presentation**.
- **Gupta, S.**, Singh, P.,...Kalpathy-Cramer, J., "Addressing catastrophic forgetting for medical domain expansion", Under Review at Nature Biomedical Engineering
- Sangare, M., **Gupta, S**., Bouzefrane, S., Banerjee, S., Muhlethaler, P., "Exploring the Forecasting Approach for Road Accidents: Analytical measures with Hybrid Machine Learning", *Expert systems with Applications, Elsevier, August 2020*
- Tom F.*, **Gupta S.***, Gupta M.D., "Scalable Capsule Networks", *MLADS-Synapse 2020.* **Best paper award** & **Oral ppt.**

Internships and Research Experience

Invariant Federated Learning **MILA, Imagia, IIT Delhi**

Master's Thesis Project, Advisors: Prof. Yoshua Bengio, Prof. Niladri Chatterjee *August 2021 - May 2021*

Tracker Data Analysis for Personalized Automated Lifestyle Suggestions **Google Research**

Software Engineer, Host: Dr. Sriram Lakshminarasimhan *May 2021 - July 2021*

- Wearables and trackers can measure several combinations of physiological markers like Heart Rate, SpO2, Stress levels, sleep durations, physical activity, etc, with varying levels of accuracy and often at different sampling frequencies.
- The aim of the study is to be able to learn to coach the users towards healthier lifestyle choices through smartphones
- Proposed algorithms and architectures that leverage the inter-correlations among different physiological markers for time series imputation, generation, outlier and signature detection and is robust to aperiodic and erroneous data.
- Improved the learnability of both deep learning and statistical algorithms to model highly stochastic time series data.

Addressing catastrophic forgetting across medical institutions **QTIM, MIT-Harvard**

Research Scholar, Advisor: Prof. Jayashree Kalpathy-Cramer *January 2020 - May 2021*

- Model brittleness is a primary concern when deploying deep learning models in medical settings. A model performing extremely well in one institution may plummet on another due to inter and intra institution variations
- Investigated the trade-off between model refinement and retention of previously learned knowledge and subsequently addressed catastrophic forgetting (CF) for the assessment of mammographic breast density in two data settings
- Analysed the influence of BatchNorm layer, highlighting its importance and need while fine-tuning on new domains

Distributed deep learning networks among institutions for medical imaging **QTIM, MIT-Harvard**

Research Scholar, Advisor: Prof. Jayashree Kalpathy-Cramer *January 2020 - May 2021*

- When medical data samples are limited, collaboration amongst multiple institutions becomes necessary to achieve high performance. However, sharing patient data often poses limitations due to technical, legal, and ethical concerns
- Proposed novel techniques for distributing deep learning models as an attractive alternative to sharing patient data
- Compared various model architectures and training heuristics like federated averaging, federated fine-tuning, local training, centrally hosted training etc. while simulating the distribution of deep learning models across 4 institutions

Scalable Capsule Networks **Microsoft R&D**

Data Scientist, Manager: Prof. Mithun Das Gupta *May 2020 - July 2020*

- Capsule network is a neural network whose parameter count scales quadratically with the number of capsules per layer due to the vote computation step wherein vote is computed between every capsule of the current and next layer
- Proposed a technique to alleviate the parameter intensive nature of capsules and make them scalable to large datasets
- Compared with baselines and SOTA techniques to test generalizability of proposed method across multiple datasets

Vehicular Networks And Accident Forecasting using Machine Learning **Inria Paris**

Research Scholar, Advisor: Prof. Paul Muhlethaler *May 2019 - August 2019*

- Despite considerable research efforts, it has not been possible to provide the most deterministic and computationally intelligent model to predict the exact context of road accidents due to unbalanced data instances at various levels
- Investigated the accident-prone areas of cities and the effect of external factors like traffic volume, the driver's age etc.
- Amalgamated the descriptive strength of Gaussian Mixture Model (statistical modeling) with high-performance classification capabilities of Support Vector Classifiers (machine-learning modeling) to improve the overall accuracy

Weakly Supervised Breast Cancer Detection **IIT Delhi**

Researcher, Advisor: Prof. Chetan Arora *December' 18 - March' 20*

- Improving tumour detection techniques currently deployed at AIIMS, Delhi viz Computer Aided Detection (CAD)
- Used medical reports as weak descriptors to train a model for weakly supervised breast cancer detection, classification
- Investigated the use of this trained model for automatic medical report generation using unlabelled mammograms

Awards and Achievements

- Ranked **second** in the department of Mathematics and Computing Engineering, IIT Delhi - 2017 entry students
- Awarded for being in **top 2** academic performers in the department and in **top 7%** in the institute for four semesters
- Awarded first prize for the best ongoing **Research and Innovative Project, 2019** by IIT Delhi Alumni Association
- Awarded the **Quadeye Excellence Scholarship** 2021 for demonstrating strong academic background and aptitude
- Selected in Microsoft's coding community for women, **Microsoft - Codess** after clearing rigorous coding challenges
- Secured an All India Rank of **424** amongst 1.7 million candidates appearing in the Joint Entrance Examination 2017
- Awarded with the Kishore Vaigyanik Protsahan Yojana (**KVPY**) fellowship by IISc for exceptional aptitude in Science
- Amongst top 800 students who qualified for Indian National Mathematics Olympiad after bagging 34th rank in **RMO**

Key Academic Projects

CovidNet: Segmenting COVID-19 abnormalities **Deep Learning | Spring' 20**

- Developed a CT segmentation algorithm that estimates the extent of abnormality in chest CTs from COVID-19 patients
- Achieved a dice score of 0.71 on the test set with Intra-Class Correlation and Spearman coefficient as 0.99 and 0.98

Real Time Ping-Pong Game **Computer Vision | Autumn' 19**

- Found camera calibration matrix for web camera using multiple views of chessboard and Rendered a 3D AR Object
- Used video input from web-cam, two visual markers as paddles reflecting the ball off the plane using laws of reflection

My Exam Scribe **International Women's Hackathon | Spring' 19**

- 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

QnA System for Handling Customer Problems **Natural Language Processing | Winter' 18**

- Built a tool to automatically propose questions based on the conversation between a customer service representative
- Using the context information, created a question and answer repository for assistance in faster problem resolution

Technical Skills

- **Programming Languages:** C, C++, Python, Java, MATLAB, R, LaTeX, HTML, JavaScript
- **Frameworks and Libraries:** OpenCV, PyQt, TensorFlow, Keras, PyTorch, NLTK, Gate NLP
- **Softwares:** Octave, WEKA, ROS, RapidMiner, Adobe Photoshop, Adobe Illustrator, Autodesk Inventor, ngspice

Mentoring and Leadership

Session Chair, ACM SIGKDD **Aug' 21 - Aug' 21**

- Chaired the session on Responsible AI as a part 'Data Science in India', an ACM SIGKDD India Chapter event

IIT Delhi Strategy and Vision Document 2030 Implementation Committee **Nov' 20 - Present**

- Only student member of the Overall Vision Committee, IIT Delhi 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

Deputy General Secretary Mentorship, Board for Student Welfare **Jul' 20 - Jul' 21**

- Initialised an auxiliary program to tackle crucial issues of substance abuse, intellectual plagiarism and language issues
- Co-established the Office of Accessible Education (OAE) providing special assistance for the disabled community
- Founded research mentorship and journal club at IITD which is dedicated towards fostering student research

Teaching Assistantships **Jul '20 - Present**

Served as a Teaching Assistant for the following courses

- MTL106, Probability and Stochastic Processes, July 2020 - Dec, 2020
- MTL102, Differential Equations, Jan,2021 - May, 2021
- MTL342, Analysis and Design of algorithms, July 2021 - Dec 2021