DIVYANSH JHUNJHUNWALA

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EDUCATION

Carnegie Mellon University, Pittsburgh, USA *August 2020 - Present*
Ph.D. Candidate **GPA: 3.97/4.0**
Department of Electrical and Computer Engineering
Advisor: Dr. Gauri Joshi

Indian Institute of Technology Kharagpur, India *July 2016 - July 2020*
Bachelor of Technology(Honors) **CGPA: 9.74/10**
Department of Electronics and Electrical Communication Engineering
Minor in Computer Science
Institute Silver Medal for highest CGPA in department

La Martiniere for Boys, Kolkata, India *April 2001 - April 2016*
Indian School Certificate Examination(2016) **98.5 %**
Secured 6^{th} highest aggregate marks all over India

RESEARCH INTERESTS

Distributed Optimization, Machine Learning, Federated Learning

SELECTED AWARDS AND HONORS

- Selected as finalist for **Qualcomm Innovation Fellowship 2022** for research proposal on "*Incentivized Federated Learning for Data-Heterogeneous and Resource-Constrained Clients*".
- **David H. Barakat and LaVerne Owen-Barakat College of Engineering Dean's Fellowship** for pursuing doctoral studies at CMU for the academic year 2021-2022 and 2022-2023.
- **Carnegie Institute of Technology Dean's Fellowship** for pursuing doctoral studies at CMU for the academic year 2020-2021.
- **Swapan Kumar Saha Memorial Prize, IIT Kharagpur** for graduating with the highest CGPA among all B.Tech students in E&ECE department.
- **Goralal Syngal Scholarship, IIT Kharagpur** for being among the top ten academic performers in the institute in the academic year 2018-2019.
- **Govt. of India INSPIRE Scholarship** for being one of the top 1% performers in the Indian School Certificate exams 2016.

PUBLICATIONS

C4. **FedExP: Speeding up Federated Averaging via Extrapolation**
Divyansh Jhunjhunwala, Shiqiang Wang, Gauri Joshi
International Conference on Learning Representations (ICLR) 2023
Selected for spotlight presentation, top 25% of accepted papers.

- Proposed an algorithm to adaptively determine the server step size in Federated Averaging based on dynamically varying client updates throughout the federated learning process.

C3. **FedVARP:Tackling the Variance Due to Partial Client Participation in Federated Learning**
Divyansh Jhunjhunwala, Pranay Sharma, Aushim Nagarkatti, Gauri Joshi
Uncertainty in Artificial Intelligence (UAI) 2022

- Proposed a novel variance reduction algorithm applied at the server to eliminate error due to partial client participation in federated learning.

C2. **Leveraging Spatial and Temporal Correlations in Sparsified Mean Estimation**
Divyansh Jhunjhunwala, Ankur Mallick, Advait Gadhikar, Swanand Kadhe, Gauri Joshi
Neural Information Processing Systems (NeurIPS) 2021

- Designed estimators that utilize correlation in data across clients (spatial) and across time (temporal) to improve mean estimation at server when clients send sparsified updates.

C1. **Adaptive Quantization of Model Updates for Communication-Efficient Federated Learning**
Divyansh Jhunjhunwala, Advait Gadhikar, Gauri Joshi, Yonina C. Eldar
International Conference on Acoustics, Speech, and Signal Processing (ICASSP) 2021

- Proposed `AdaQuantFL`, an adaptive quantization strategy to compress model updates from client to server to reduce communication cost and achieve a low training error floor in federated learning.

PREPRINTS

P3. **Towards a Theoretical and Practical Understanding of One-Shot Federated Learning with Fisher Information**
Divyansh Jhunjhunwala, Shiqiang Wang, Gauri Joshi
A preliminary version appeared at FL@ICML workshop 2023

- Proposed an algorithm for learning a global model for federated learning in just one round with first-of-its kind theoretical guarantees for a two-layer neural network.

P2. **Erasure Coding of Neural Networks for Fast and Efficient Multi-Model Inference**
Divyansh Jhunjhunwala*, Neharika Jali*, Shiqiang Wang, Gauri Joshi
Under submission

- We develop `COIN`, a model-fusion framework to approximate the sum of outputs of multiple neural networks with a single neural network for handling demand uncertainty in multi-model inference.

P1. **To Federate or Not To Federate: Incentivizing Client Participation in Federated Learning**
Yae Jee Cho, **Divyansh Jhunjhunwala**, Tian Li, Virginia Smith, Gauri Joshi
Neural Information Processing Systems (NeurIPS) 2022 Workshop on Federated Learning
Selected for oral presentation

- We propose the `IncFL` framework, wherein server actively incentivizes clients to participate in federated learning training by dynamically adjusting the global aggregation procedure.

(* denotes equal contribution)

INTERNSHIPS

IBM Research, Yorktown Heights *May 2023- August 2023*
Mentors: Dr. Shiqiang Wang, Maroun Touma

- Developed a Deep Q-Learning based controller to optimally allocate GPU resources between fine-tuning and inference jobs at the edge.
- Investigated various machine unlearning algorithms for practical application at IBM and led a joint team effort to develop solutions for the NeurIPS 23 Unlearning Challenge.

IBM Research, Yorktown Heights *May 2022- August 2022*
Mentor: Dr. Shiqiang Wang

- Investigated properties of over-parameterized neural networks for combating heterogeneity, promoting few-shot learning and tuning server step size in federated learning.

- Paper on tuning server step sizes was published as a spotlight presentation at ICLR 2023. Paper on one-shot federated learning is in submission.

Carnegie Mellon University, ECE Department *May 2019-July 2019*
Mentors: Prof. Gauri Joshi, Prof. Osman Yagan

- Formulated and experimentally verified a novel algorithm for learning population-level statistics while maintaining privacy of individual user samples.

RELEVANT COURSES

CMU	Advanced Introduction to Machine Learning, Convex Optimization, Intermediate Statistics, Algorithms for Big Data, Probabilistic Graphical Models, Algorithms for Large-scale Distributed Machine Learning and Optimization, Advanced Machine Learning, Foundations of Reinforcement Learning
IIT Kharagpur	Matrix Algebra, Probability and Stochastic Processes, Deep Learning Analog Communication, Digital Communication, Signals and Systems, Network Theory, Control Systems, Digital Image Processing, Artificial Intelligence, Network Optimization, Algorithms

SKILLS

Languages	C, C++, Python, MATLAB
ML Frameworks	OpenCV, TensorFlow, Keras, PyTorch, Ray

SERVICE

Journal Reviewer	IEEE Transactions on Communication, IEEE Transactions on Signal Processing, IEEE Transactions on Networking
Conference Reviewer	ICLR 2024, ICML 2023, ICML 2022, NeurIPS 2022
Workshop Reviewer	NeurIPS 23 Workshop on Federated Learning in the Age of Foundation Models, NeurIPS 22 International Workshop on Federated Learning: Recent Advances and New Challenges

TEACHING

Graduate Teaching Assistant, Carnegie Mellon University

- 18-661: Intro to Machine Learning for Engineers *Fall 2022*