Ajinkya K. **Mulay**

Machine Learning Engineer · Privacy Researcher

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Research Interests

Privacy, Federated Learning & AutoML: My primary focus is on learning, designing and building privacy-preserving federated systems and automated learning systems. My current research interests include privacy-preserving Machine Learning, Federated Learning and AutoML. Some of my past interests include Wireless Communications (3G and 4G) and IoT.

Education

Aug. 2018 - May 2023 — *W. Lafayette, IN*

PhD in Electrical and Computer Engineering — *Aug. 2018 - May 2023*

- Advised by *Prof. Xiaojun Lin*
- Major GPA: 3.6/4.0

Aug. 2014 - May 2018 — *Hyderabad, India*

B.Tech (with Honors) in Electrical Engineering — *Aug. 2014 - May 2018*

- Advised by *Prof. Bheemarjuna Reddy*
- Major GPA: 8.88/10

Honors & Awards

2020	**Invited Talk & Top 5% Paper**, NeurIPS Pre-Registration Workshop	*USA*
2020	**Graduate Research Assistantship**, SuperPower Group, Psychological Sciences, Purdue	*Indiana, USA*
2017	**Two-Year Graduate Teaching Assistantship**, Electrical and Computer Engineering Department, Purdue	*Indiana, U.S.A*
2018	**Winner and World Finalist for Emergensor Startup**, Microsoft Imagine Cup, Japan National Final	*Tokyo, Japan*
2018	**Winner**, Third Business Plan Competition, University of Tokyo	*Tokyo, Japan*
2017	**India-Japan Engineering Program Research Scholarship**, University of Tokyo	*Tokyo, Japan*
2016	**Undergraduate Teaching Assistantship**, IIT Hyderabad	*India*
2016	**Special Recognition & 8th Rank for Young Team**, IEEE Signal Processing Cup	*India*
2014	**Academic Excellence Award**, IIT Hyderabad	*India*
2010	**Recipient of the prestigious National Talent Search Examination (N.T.S.E)**, Govt. of India	*India*

Publications

Rakshit Naidu, Harshita Diddee, Ajinkya Mulay, Aleti Vardhan, Krithika Ramesh, Ahmed Zamzam, "Towards Quantifying the Carbon Emissions of Differentially Private Machine Learning" — *OpenMined*

ICML 2021 SRML Workshop

Ajinkya Mulay, Tushar Semwal, Ayush Agrawal, "FedPerf: A Practitioners' Guide to Performance of Federated Learning Algorithms" — *OpenMined*

NeurIPS 2020 Pre-Registration Experiment Workshop

Ajinkya Mulay, Anand Basawade, Bheemarjuna Tamma, Anthony Franklin, "DFC: Dynamic UL-DL Frame Configuration for Improving Channel Access in eLAA" — *NeWS Lab, IIT Hyderabad*

IEEE Networking Letters

Ajinkya Mulay, Hideya Ochiai, Hiroshi Esaki, "IoT WebSocket Connection Management Algorithm for Early Warning Earthquake Alert Applications" — *Esaki Lab, University of Tokyo*

ACM/IEEE UCC, Austin, TX, USA

Konkimalla Chandra Prakash, et. al., "A Novel Electric Network Frequency Classification Algorithm and an Electrical Power Signal Measurement Circuit" — *LFOVIA Group, IIT Hyderabad*

IEEE Signal Processing Cup, 2016

Pre-Prints

Ajinkya Mulay, Sean Lane, Erin Hennes "PowerGraph: Using neural networks and principal components to multivariate statistical power trade-offs" *SuperPower, Psychological Sciences, Purdue*

ARXIV, 2022

Skills

Focus Topics:	Differential Privacy, Federated Learning, Graph Algorithms, AutoML
Machine Learning	PyTorch, Tensorflow, Keras, Pytorch-Lightning, Scikit-Learn, PySyft
Data Analytics	Pandas, Numpy, Matplotlib
Programming	Python, Cpp, R, Go, MATLAB, LaTeX
Mobile	Swift, Dart, Flutter, XCode
DevOps	AWS, Azure, Docker
Languages	English (Proficient), Japanese (Basic), Hindi, Marathi

Experience

May 2021 - Aug 2021 *Menlo Park, CA*

SOFTWARE ENGINEERING INTERN *May 2021 - Aug 2021*

- Developed a fast and highly scalable differentially private machine learning algorithm which outperforms the state-of-the-art model's test performance by **15%**.
- Implemented additional visualizations to improve gradient flow and easily debug larger machine learning runs.
- **Technology Stack:** Python, PyTorch

Aug. 2020 - Present *West Lafayette, IN, USA*

MACHINE LEARNING TEAM LEAD *Aug. 2020 - Present*

- Designed algorithms to examine effects of parameter uncertainty on statistical power and identify regions of robustness/reactivity in specified parameter values over a high-dimensional parameter space
- Reduced inference, training time and resource usage to under 10% of the baseline with feature engineering while maintaining majority of the predictive capabilities
- **Technology Stack:** Python, PyTorch, Matplotlib, Pandas, Weights and Biases, R, Jupyter Notebooks, Git

Mar. 2020 - Present *Remote, USA*

RESEARCH SCIENTIST *Mar. 2020 - Present*

- Developing methods to characterize Private Federated Learning Systems and identify and track the performance of Federated Algorithms over varied environments with a single easy-to-use metric; proposal accepted at Pre-registration Workshop, NeurIPS 2020
- Demonstrated top 5 Federated Machine Learning algorithms on **100+** virtual mobile devices with an accuracy of over **99%** on *LEAF* datasets
- **Technology Stack:** PyTorch, Weights and Biases, PySyft, Matplotlib

Aug. 2018 - Mar. 2020 *West Lafayette, IN, USA*

GRADUATE TEACHING ASSISTANT *Aug. 2018 - Mar. 2020*

- Mentored 350+ undergraduate students and 15+ undergraduate teaching assistants to develop a strong fundamental understanding of electrical engineering concepts

Aug. 2017 - Apr. 2018 *Hyderabad, India*

UNDERGRADUATE STUDENT RESEARCHER *Aug. 2017 - Apr. 2018*

- Designed and developed an algorithm to reduce interference between eLAA-WiFi networks by 40% using Game Theory techniques
- **Technology Stack:** MATLAB, Python

Jul. 2017 - Dec. 2018 *Tokyo, Japan*

CHIEF SERVER ENGINEER *Jul. 2017 - Dec. 2018*

- Built and maintained the back-end for a mobile application used to notify people of local emergencies
- Reduced the map's refresh time by **60%** to improve user experience
- **Technology Stack:** Azure, Java, Google Maps API, Android Studio, Go, Python

May 2017 - Jul. 2017 *Tokyo, Japan*

RESEARCH INTERNSHIP *May 2017 - Jul. 2017*

- Slashed the packet drop rate over a 3G IoT-Cloud network by **99%** by designing a dynamic ping-pong connection management algorithm
- **Technology Stack:** Go, Arduino, C

May 2015 - Jul. 2016 *Hyderabad, India*

UNDERGRADUATE STUDENT RESEARCHER *May 2015 - Jul. 2016*

- Developed a novel Neural Network-based classification algorithm to predict location of an audio recording using the Electrical Network Frequency (ENF) signature embedded in the audio file; achieved an accuracy of over **85%**
- **Technology Stack:** MATLAB, Python

Teaching and Mentoring

Mentoring Students for Anvil *Jan 2022 - May 2022*

Mentoring Undergraduate Students for the Anvil's Co-Founder AI Matching Platform Development

Graduate Teaching Assistant for ECE 27000 *Aug 2019 - May 2020*

Teaching assistant for *Introduction to Digital Design*

Graduate Teaching Assistant for ECE 20002 *Aug 2018 - May 2019*

Teaching assistant for *Electrical Engineering Fundamentals II*

Other Services

2022 **Reviewer**, Conference on Health, Inference, and Learning (CHIL)

Extra-Curricular

2020-21 **Active Blogger**, Topics- Machine Learning, Differential Privacy, MS/PhD Applications
2018-21 **Active Member**, HKN (Eta Kappa Nau), Purdue University
2020-21 **Active Member**, Startup Purdue, Co-Founded Happyou, a mental health SaaS startup
2014-18 **Soccer Member, Varsity Team**, Inter & Intra-Collegiate Events, IIT Hyderabad
2015-17 **Head of Finance**, ELAN, IIT Hyderabad's Techno-Cultural Fest, managed budget in excess of $40K
2015-17 **Events and Workshop Manager**, Entrepreneurship Cell, IIT Hyderabad