

# Ajinkya K. Mulay

MACHINE LEARNING ENGINEER · PRIVACY RESEARCHER

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## Research Interests

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**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

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### Aug. 2018 - May 2023

PHD IN ELECTRICAL AND COMPUTER ENGINEERING

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

W. Lafayette, IN

Aug. 2018 - May 2023

### Aug. 2014 - May 2018

B.TECH (WITH HONORS) IN ELECTRICAL ENGINEERING

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

Hyderabad, India

Aug. 2014 - May 2018

## Honors & Awards

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

## Publications

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<b>Rakshit Naidu, Harshita Diddee, Ajinkya Mulay, Aleti Vardhan, Krithika Ramesh, Ahmed Zamzam, "Towards Quantifying the Carbon Emissions of Differentially Private Machine Learning"</b>	OpenMined
ICML 2021 SRML WORKSHOP	
<b>Ajinkya Mulay, Tushar Semwal, Ayush Agrawal, "FedPerf: A Practitioners' Guide to Performance of Federated Learning Algorithms"</b>	OpenMined
NEURIPS 2020 PRE-REGISTRATION EXPERIMENT WORKSHOP	
<b>Ajinkya Mulay, Anand Basawade, Bheemarjuna Tamma, Anthony Franklin, "DFC: Dynamic UL-DL Frame Configuration for Improving Channel Access in eLAA"</b>	NeWS Lab, IIT Hyderabad
IEEE NETWORKING LETTERS	
<b>Ajinkya Mulay, Hideya Ochiai, Hiroshi Esaki, "IoT WebSocket Connection Management Algorithm for Early Warning Earthquake Alert Applications"</b>	Esaki Lab, University of Tokyo
ACM/IEEE UCC, AUSTIN, TX, USA	
<b>Konkimalla Chandra Prakash, et. al., "A Novel Electric Network Frequency Classification Algorithm and an Electrical Power Signal Measurement Circuit"</b>	LFOVIA Group, IIT Hyderabad
IEEE SIGNAL PROCESSING CUP, 2016	

## Pre-Prints

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<b>Ajinkya Mulay, Sean Lane, Erin Hennes "PowerGraph: Using neural networks and principal components to multivariate statistical power trade-offs"</b>	SuperPower, Psychological Sciences, Purdue
ARXIV, 2022	

## Invited Talks

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- 2022 **How to promote open science under privacy**, Psychological Sciences Department, Purdue University
- 2022 **PowerGraph: Using neural networks and principal components to multivariate statistical power trade-offs**, IMPS
- 2021 **Graphing multivariate statistical power manifolds with Machine Learning**, MCP Colloquium, Purdue University
- 2020 **FedPerf: A Practitioners' Guide to Performance of Federated Learning Algorithms**, NeurIPS Pre-Registration Workshop

## Skills

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

## Experience

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### 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

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### MENTORING STUDENTS FOR ANVIL

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

Jan 2022 - May 2022

### GRADUATE TEACHING ASSISTANT FOR ECE 27000

Teaching assistant for *Introduction to Digital Design*

Aug 2019 - May 2020

### GRADUATE TEACHING ASSISTANT FOR ECE 20002

Teaching assistant for *Electrical Engineering Fundamentals II*

Aug 2018 - May 2019

## Other Services

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

## Extra-Curricular

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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