

# MANAN MEHTA

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## EDUCATION

### University of Illinois Urbana-Champaign

Ph.D., Mechanical Engineering

Graduate Minor, Statistics

Aug 2020 - Dec 2023 (expected)

GPA: **3.91**

Ph.D. Thesis: Data-Efficient Machine Learning for Smart Manufacturing and Industrial Internet of Things

### Birla Institute of Technology and Science, Pilani

B.E. (Hons.), Mechanical Engineering

Aug 2015 - May 2019

GPA: **3.91**

## RESEARCH EXPERIENCE

### Incentive Mechanisms for Distributed Deep Learning in Manufacturing

Jan 2022 - Present

- Exploring avenues for incentive design for companies to participate in collaborative deep learning
- Leading an effort across three research teams to formulate fair incentive mechanisms for practical federated training

### Agglomerative Client Clustering for Federated Learning with Non-IID Data

Jan 2022 - Nov 2022

- Formulated a clustering algorithm to deal with client-level statistical heterogeneity in federated learning (FL)
- Developed the first algorithm capable of automatic cluster identification while seamlessly handling client fractions
- Outperformed state-of-the-art clustered FL algorithms by an average of 26% over four types of non-IID distributions
- Enabled the implementation of privacy-preserving FL in real-world applications with diverging client distributions

### Federated Learning-Based Semantic Segmentation for Defect Detection

Aug 2021 - Dec 2021

- Conceived and demonstrated one of the first applications of federated deep learning in additive manufacturing
- Formulated an FL-based computer vision algorithm for highly precise defect detection using image segmentation
- Combined the U-Net architecture with federated averaging to enable distributed and data-efficient model training
- Achieved test accuracy within 5% of centralized learning without compromising data privacy of participating clients

### Multi-Task Learning using Multi-Resolution Data in Manufacturing

Feb 2021 - July 2021

- Developed an end-to-end methodology for multi-task learning of Gaussian processes with input-dependent noise
- Derived an expectation-maximization algorithm for a hierarchical Bayesian framework with intrinsic uncertainty
- Enabled highly efficient, flexible, and accurate modeling in critical manufacturing applications involving regression

### Adaptive Sampling Design for Multi-Task Learning using Gaussian Processes

Aug 2020 - Jan 2021

- Formulated a novel framework to combine active learning and multi-task learning for Gaussian process regression
- Derived a variance measure for optimal sequential sampling across similar-but-not-identical learning tasks
- Reduced RMSE by 60% and increased sampling efficiency by 40% compared to existing methods

## INDUSTRY EXPERIENCE

### Data Analyst Intern, Lam Research

May 2020 - July 2020

- Formulated and programmed a physics-informed system-level heat transfer solver on Python
- Performed statistical analysis of machine age data to draw useful inferences for remaining useful life prediction
- Automated the detection of Fluorine deposition depth from images to reduce manual testing from 20 min to 10 sec

## TECHNICAL SKILLS

Python (numpy, scipy, matplotlib, scikit-learn, PyTorch, TensorFlow), R, C++, SQL, MATLAB,  $\text{\LaTeX}$ , MS Office Suite

## TEACHING EXPERIENCE

### MATH 231E, Calculus II

Aug 2020 - Dec 2020

- Led a team of 6 teaching assistants and conducted weekly teaching sessions for sophomores
- Included in the 'List of Teachers Ranked as Excellent' by the Center for Innovation in Teaching and Learning

### ME 170, Computer-Aided Design

Aug 2019 - May 2020

- Led laboratory sessions, guided students on design projects, and graded in-class assignments
- Included in the 'List of Teachers Ranked as Excellent' by the Center for Innovation in Teaching and Learning

## PUBLICATIONS

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- [5] **Mehta, M.**, Yang, Y., and Shao, C., 2023. Multi-task learning with multi-resolution data in manufacturing. *In preparation*.
- [4] **Mehta, M.**, Chen, S., Tang, H., and Shao, C., 2023. A federated learning approach to mixed fault diagnosis in rotating machinery. *Accepted, Journal of Manufacturing Systems*.
- [3] **Mehta, M.** and Shao, C., 2023. A greedy agglomerative framework for clustered federated learning. *IEEE Transactions on Industrial Informatics*.
- [2] **Mehta, M.** and Shao, C., 2022. Federated learning-based semantic segmentation for pixel-wise defect detection in additive manufacturing. *Journal of Manufacturing Systems*, 64, pp.197-210.
- [1] **Mehta, M.** and Shao, C., 2021. Adaptive sampling design for multi-task learning of Gaussian processes in manufacturing. *Journal of Manufacturing Systems*, 61, pp.326-337.

## INVITED PRESENTATIONS

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- “Federated learning in manufacturing and beyond: opportunities and challenges,” AI Institute for Food Systems, UC Davis, Sep. 2022.
- “An introduction to Gaussian process regression and filtered kriging for surface interpolation,” nanoHUB, Purdue University, July 2022.
- “Active learning for multi-task learning of Gaussian processes,” UIUC – Cyprus Institute Joint Talk Series, Oct. 2021.

## HONORS AND AWARDS

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- Awarded the NSF Travel Award for the 51<sup>st</sup> North American Manufacturing Research Conference 2023
- Awarded the Swati and Mukul Chawla Scholarship for graduate studies, UIUC 2022
- Awarded the K. C. Mahindra Fellowship for graduate studies 2019
- Ranked 3<sup>rd</sup> out of 120 undergraduates in Mechanical Engineering, BITS Pilani 2019
- Awarded the Institute Merit Scholarship, BITS Pilani 2015 - 2019
- Awarded the DAAD-WISE Scholarship for research exchange in Germany 2018
- Awarded the Dhirubhai Ambani Scholarship for excellence in mathematics 2016

## SELECTED COURSEWORK

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Computer Science :	Machine Learning, Deep Learning, Computer Vision, Data Science and Analytics, Big Data Foundations, Data Structures and Algorithms
Mathematics/Statistics :	Advanced Regression Analysis, Statistical Learning, Random Processes, Optimization, Mathematical Statistics, Probability Theory