

Ankush Kumar Mishra

PhD Student in Mechanical Engineering, Iowa State University

Research Scholar at [ComPM Lab](#) and [IDEA Lab](#)

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INTERESTS / RESEARCH AREAS

Machine Learning, Bayesian Optimization, Self-Driving Lab, 3D Printing, 3D Scene Reconstruction (Computer Vision), Computational Material Science, Reliability, Uncertainty Quantification

ACADEMIC DETAILS

Degree	Discipline	Institute	GPA
PhD. (2021- Dec' 25)	Mechanical Engineering Minor: Statistics	Iowa State University Ames, Iowa	3.97/4
M.S.(with Thesis) (2017-2020)	Aerospace Engineering	Indian Institute of Technology, Madras, India	9/10

SELECTED PUBLICATIONS [Full List](#)

- **A Mishra, et al.** "Real Time 3D Reconstruction for Enhanced Cybersecurity of Additive Manufacturing Processes", **Journal of Manufacturing Processes**, 2025 [DOI](#)
- **A Mishra, N Baishnab, et al.** "Identifying Representative Sub-domains in 3D Microstructures for Accelerated Structure-Property Mapping in Organic Photovoltaic", **Computational Materials Science**, 2024 [DOI](#)
- **A Mishra, et al.** "Interpretable Spectral Features Predict Conductivity in Self-Driving Doped Conjugated Polymer Labs" (Under Review)
- **A Mishra, X Liu**, "Reliability-informed End-of-use Decision Making for Product Sustainability using Two-stage Stochastic Optimization", **Applied Mathematical Modelling**, 2023.[DOI](#)
- **A Mishra, et al.** "Spec2Ham: Inverse design of Hamiltonian Parameters from Spectroscopy" (Under Preparation)
- J Mauthe, **A Mishra, et al.**, "AI-Guided High Throughput Investigation of Conjugated Polymer Doping Reveals Importance of Tuning Undoped Polymer Order" (**Accepted : Matter**)
- A Jignasu, K Marshall, **A Mishra, et al.** "Slice-100K: A Multimodal Dataset for Extrusion-based 3D Printing" **The Thirty-Eighth Annual Conference on Neural Information Processing Systems, NeurIPS 2024** [DOI](#)

SELECTED RESEARCH PROJECTS

- **Data-Driven Feature Selection for Property Prediction in Self-Driving Labs**
 - Developed a **genetic algorithm**-based framework to featurize optical spectra and identify key spectral regions from limited data.
 - Extracted **interpretable features** using ML to uncover structure–property relationships matching expert-level performance.
 - **Reduced experimental** turnaround time by **50%** via model-guided decision-making.
 - Facilitated active learning-driven experiment selection via a **shared portal** connecting experimental and computational teams across institutions.

Learnings: Feature engineering, small data ML, active learning, self-driving labs, collaboration with interdisciplinary groups

- **Real-Time Process Monitoring by Deploying 3D Scene Reconstruction for Early Intrusion Detection of a 3D Printing Process using Digital Twin**

- Developed a practical framework for **Industry 4.0** to improve **cyber security in 3D printing**, reducing risks from cyber attacks and financial losses.
- **Designed** and implemented an advanced physical configuration by **innovatively modifying a 3D printer to integrate multiple cameras**, for real-time process monitoring
- **Wrote code from scratch** to gather **2D/3D data** from various cameras, **pre-process data**, and execute 3D scene reconstruction using **point cloud registration** and comparison with a Digital Twin, within **timeframe of 30s**.

Learnings Design of experimental setup, 3D printing, efficient coding practices, usage of point-cloud data, 3D scene reconstruction, *SolidWorks*, *CloudCompare*, *Intel RealSense* depth camera, CAD design

• Identifying Representative Sub-domains in 3D Microstructures for Accelerated Structure-Property Mapping in Organic Photovoltaic

- Employed drift-diffusion and GRASPI for detailed OSC properties analysis and feature correlation with J_{sc} , requiring significant computation resources.
- Implemented **Bayesian optimization** for RVE identification for **accelerated analysis**, achieving a **400-fold reduction in computational cost** with negligible deviation in J_{sc} , maintaining **99% accuracy**.

Learnings: Graph-based algorithm, feature correlation, Bayesian Optimization, High-Performance Cluster Computing

WORK EXPERIENCE

• Amazon Robotics

Data and Applied Scientist Co-op

08/19/2024 - 01/10/2025

- Designed a data pipeline with **SQL and Pandas** to process, segregate and **group millions of packages** and its corresponding features for tote consolidation at **Amazon Robotics Fulfillment Center**
- Developed a **Transformer-based model** to classify totes for consolidation, achieving a **10% improvement** over the existing Gradient Boosting method.
- Conducted an **ablation study** to evaluate the impact of additional features on model performance.

Learnings: AWS, S3 Bucket, Deep Learning, SQL, Pytorch, Data Distributed Parallelism, Robotic Simulator Setup, Vision Language Action Model

• Oak Ridge National Lab

Graduate Research Intern

06/03/2024 - 08/16/2024

- Developed a **Bayesian-based inverse algorithm** combined with **zeroth-order local optimizers** to predict Hamiltonian parameters from spectroscopy
- Designed and tested **multiple objectives, incorporating physics** into the algorithm to **accelerate convergence**.

Learnings: Bayesian Optimization, Multi-Order and Multi-Objective Optimization

TECHNICAL SKILLS

- **Programming Languages:** (*Advanced*) Python, MATLAB (*Intermediate*) C++, R
- **Computational Skills:** Unix, Git, Hugging Face, PyTorch, High Performance Computing, SolidWorks, LaTeX, BoTorch, GPyTorch, AWS, S3 Bucket
- **Experimental Skills:** 3D printing, Depth Cameras

RELEVANT COURSES

Code	Course Name	Code	Course Name
COMS 574	Introduction to Machine Learning	ME 570	Solid Modeling and GPU Computing
ME 525	Optimization Method for Complex Design	COMS 579	Natural Language Processing
STAT 574	Introduction to Bayesian Data Analysis	ME 590	Deep Learning and Computer Vision

AWARDS/ACADEMIC ACHIEVEMENT

- Won **Research Excellence Award** from Iowa State University, 2025
- Secured **2nd place** in ASME **Computer and Information in Engineering division (CIE) Hackathon, 2021**
- Won **The Thomas L Fagan, Jr. Award for Best Student Paper** at 69th Annual Reliability and Maintainability Symposium, 2023