Ankush Kumar Mishra

PhD Candidate in Mechanical Engineering, Iowa State University
Research Scholar at ComPM Lab and IDEA Lab
Google Scholar LinkedIn Website
Email-id : **akmishra@iastate.edu**, Phone No. : **+1 515-708-6982**

INTERESTS / RESEARCH AREAS

Self Driving Labs (SDLs), Machine Learning, Bayesian Optimization, Adaptive Design of Experiment, Additive Manufacturing, Computational Material Science, Robotics, Uncertainty Quantification

ACADEMIC DETAILS

Degree	Discipline	Institute	GPA
PhD. (2021- *Dec'* 25)	Mechanical Engineering **Minor**: Statistics Advisor: Dr. Baskar Ganapathysubramanian Dr. Adarsh Krishnamurthy	Iowa State University Ames, Iowa	3.97/4
M.S.(with Thesis) (2021-2023)	Mechanical Engineering Advisor: Dr. Chao Hu	Iowa State University, Ames, Iowa	3.96/4
M.S.(with Thesis) (2017-2020)	Aerospace Engineering Advisor: Dr. PA Ramakrishna	Indian Institute of Technology, Madras, India	9/10
B.Tech (2013-2017)	Mechanical Engineering	Maulana Abul Kalam Azad University of Technology, India Formerly WBUT	8.98/10

PUBLICATIONS

- **A Mishra**, SH Goh, B Ganapathysubramanian, A Krishnamurthy, "Real time 3D reconstruction for enhanced cybersecurity of additive manufacturing processes", **Journal of Manufacturing Processes, 2025** DOI
- **A Mishra**, N Baishnab, O Wodo, B Ganapathysubramanian, "Identifying Representative Sub-domains in 3D Microstructures for Accelerated Structure-Property Mapping in Organic Photovoltaic", **Computational Materials Science, 2024** (Equal Contribution) DOI
- **A Mishra**, J Mauthe, N Luke, A Amassian, B Ganapathysubramanian, "Interpretable Spectral Features Predict Conductivity in Self-Driving Doped Conjugated Polymer Labs" (Under Review)
- **A Mishra**, X Liu, C Hu, P Wang, "Reliability-informed End-of-use Decision Making for Product Sustainability using Two-stage Stochastic Optimization", **Applied Mathematical Modelling, 2023**. (Equal Contribution) DOI
- **A Mishra**, S Wong, B Ganapathysubramanian, E Gomez, " Machine learning driven analysis yields insight into the processing robustness of organic photovoltaics" (Under Review)
- **A Mishra**, B Ganapathysubramanian, G Panchapakesan, " *spec2ham*: Inverse design of Hamiltonian Parameters from Spectroscopy" (Under Preparation)
- J Mauthe, **A Mishra**, A Sarkar, B Guo, G Thapa, J Schroedl, N Luke, JS Neu, SJ Kwon, M Chauhan, T Wang, T Trapier, H Ade, D Ginger, W You, R Ghosh, B Ganapathysubramanian, A Amassian, "AI-Guided High Throughput Investigation of Conjugated Polymer Doping Reveals Importance of Tuning Undoped Polymer Order" (Accepted - **Matter**)
- R Tali, **A Mishra**, D Lohia, J Mauthe, JS Neu, SJ Kwon, Y Olanrewaju, A Balu, G Trajcevski, F So, W You, A Amassian, B Ganapathysubramanian, "Shared Experiment Aggregation and Retrieval System (SEARS) for studying doping in organic semiconductors" (Accepted - **Digital Discovery**)
- M Saddati, **A Mishra**, N Baishnab, O Wodo, B Ganapathysubramanian, "Data-Driven Framework for Morphology–Performance mapping: Virtual Instruments, High Performance Computing, 3D Microstructures", (Under Review)
- T Li, J Liu, A Thelen, **A Mishra**, XG Yang, Z Wang, C Hu, "Coupling a Capacity Fade Model with Machine Learning for Early Prediction of the Battery Capacity", **Applied Energy, 2025** DOI

- N Baishnab, **A Mishra**, H Liu, O Wodo, B Ganapathysubramanian, "Feature Engineering and Surrogate Modeling for Mapping Performance from Chemistry and Microstructure in Organic Materials" (Under Preparation)
- V Muralidharan, **A Mishra**, J Afful, C Hau, B Ganapathysubramanian, "A Building Energy Simulation Algorithm to Quantify Evapo-transpirative Cooling", (Under Preparation)
- A Jignasu, K Marshall, **A Mishra**, LN Rillo, B Ganapathysubramanian, A Balu, C Hegde, A Krishnamurthy, "Slice-100K: A Multimodal Dataset for Extrusion-based 3D Printing" **The Thirty-Eighth Annual Conference on Neural Information Processing Systems, NeurIPS 2024** DOI
- X Liu, **A Mishra**, C Hu, P Wang, "Multi-stage Product Family Design for Reliability with Remanufacturing" , **2023 Annual Reliability and Maintainability Symposium (RAMS)**. DOI
- A Tran, K Maupin, **A Mishra**, Z Hu, C Hu" Additive Gaussian Process Regression for Metamodeling in High-Dimensional Problems " **International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC-CIE 2023)** DOI
- S Goh, **A Mishra**, M Govindarasu, B Ganapathysubramanian, A Krishnamurthy, "Assessing the Cybersecurity of Connected 3D Printers Using Large Language Models (LLMs)" **53rd SME North American Manufacturing Research Conference (NAMRC 53, 2025)**DOI
- **A Mishra**, R Siddharth, PA Ramakrishna, "Throttling of a Fuel Rich Propellant Using Controlled Kerosene Injection", **12th International High Energy Materials Conference & Exhibit (HEMCE 2019)**.

TECHNICAL SKILLS

- **Programming Languages:** *(Advanced)* Python, MATLAB *(Intermediate)* C++, R
- **Computational Skills:** Unix, Git, Hugging Face, PyTorch, High Performance Computing, SolidWorks, LaTeX, BoTorch, GPyTorch
- **Experimental Skills:** 3D printing, Depth Cameras, Rocket and Ramjet Test Firing, Crawford and Window Strand Burner Test, Solid Propellant Casting

RESEARCH EXPERIENCE

- **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 *Jsc*, 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 *Jsc*, maintaining **99% accuracy**.

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

- **Reliability-Informed Two-Stage Stochastic optimization for Optimum End of Use Decision Making Policy for a Product Family considering Demand Uncertainty.**
  - Optimized **reliability-informed Remaining Useful Life (RUL)** thresholds for a product family, targeting **multiple objectives** for **OEMs** across several life cycles.
  - Incorporated **demand uncertainty**, achieving notable 10% reduction in cost, energy, and emissions using **two-stage stochastic optimization**

  Learnings: Reliability modeling, stochastic optimization, life-cycle analysis, collaboration with industry partners

WORK EXPERIENCE

- **Amazon Robotics**
  Data and Applied Scientist Co-op *19/08/2024 - 10/01/2025*
  - 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 lattice parameters from density of states.
  - Designed and tested **multiple objectives, incorporating physics** into the algorithm to **accelerate convergence**.

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

- **Department of Mechanical Engineering - Iowa State University, Ames, USA**
  Graduate Teaching Assistant *01/01/2021 - 05/15/2021 and 07/16/2021 - 12/31/2021*
  - **Responsibilities**: Conducted and graded labs for Fluid Flow (ME 3350) at Iowa State University for 50 students.
  - Held doubt-solving sessions, exam reviews, and grading for a class of 70 students.

- **Department of Mechanical Engineering - Iowa State University, Ames, USA**
  Graduate Research Assistant *05/16/2021 - 07/15/2021 and 01/01/2022 - till date*
  - **Responsibilities**: Conducted detailed research studies under faculty supervision, contributing to data collection, analysis, and interpretation in line with project objectives.
  - Assisted in the preparation and publication of research findings, including drafting sections of research papers and presenting results at academic conferences.

AWARDS/ACADEMIC ACHIEVEMENT

- Won **Research Excellence Award** from Iowa State University, 2025
- Won **The Thomas L Fagan, Jr. Award for Best Student Paper** at 69^{th} Annual Reliability and Maintainability Symposium, 2023
- Secured **2nd place** in ASME **Computer and Information in Engineering division (CIE) Hackathon, 2021**
- **National Science Foundation (NSF)** Travel Award Recipient, **NAMRC 2025**
- Obtained full tuition scholarship for undergraduate studies from the Government of West Bengal, India

RELEVANT COURSES

Code	Course Name	Code	Course Name
COMS 574	Introduction to Machine Learning	STAT 587	Statistical Method for Research
ME 525	Optimization Method for Complex Design	ME 591	Probabilistic Engineering Analysis and Design
STAT 574	Introduction to Bayesian Data Analysis	ME 590	Deep Learning and Computer Vision
ME 570	Solid Modeling and GPU Computing	COMS 579	Natural Language Processing