Vipul Bansal

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Education

2022–2026 (Expected) **PhD, Industrial Engineering**, *University of Wisconsin Madison*, Madison, WI, USA
Advisor: Prof. Shiyu Zhou
GPA: 3.966/4

2018–2022 **B.Tech, Production and Industrial Engineering**, *IIT Roorkee*, Roorkee, India
Department of Mechanical and Industrial Engineering

Research Interests

Modelling and Decision Making in Smart and Connected Systems

Deep Learning Methods for Industrial AI

Multi-Agent Decision Making

Scalable, Flexible, and Interpretable Modeling for Large Systems

Research Experience

2022–Present **Graduate Research Assistant**, *University of Wisconsin-Madison*, Madison, WI, USA
Supervisor: Prof. Shiyu Zhou
- Advanced modeling and decision-making frameworks for complex and interconnected systems.
- Developed Deep Emission Network Based Hidden Markov Model for time-dependent observations.
- Developed scalable component-wise Markov Decision Process for Condition-Based Maintenance.
- Worked on Physics-Informed Neural Networks (PINNs) for PDEs and LLMs for patient survival prediction.
- Modeling multi-component systems with complex dependencies and decision-making agents.

2021–2022 **Research Intern (Remote)**, *Purdue University*
Supervisor: Prof. Vaneet Aggarwal
- Machine Learning and Quantum Simulation.
- Developed methods to simulate training of Variational Quantum Classifiers.
- Efficient simulation of large-scale quantum circuits.

2020–2021 **Undergraduate Research Assistant**, *IIT Roorkee*, Roorkee, India
Supervisor: Prof. Balasubramanian Raman
- Developed AI-based COVID-19 detection system.
- Developed novel Discriminative Auto-Encoding method for ML problems.
- Computational method for student performance evaluation.

2019–2020 **Undergraduate Research Assistant**, *IIT Roorkee*, Roorkee, India
Supervisor: Prof. Ankit Bansal
- Developed Thermochemical Code for Enhanced Blast Explosives (DRDO project).
- Improved WRF model for solar energy forecasting using AI-based methods.

Published Journal Papers

[1] **Bansal, V.**, Zhou, S. and Strike, N., 2025. Two step training a single physics-informed neural network for solving Navier Stokes equations with various boundary conditions. Manufacturing Letters, 44, pp.48-58, NAMRC 2025

[2] P. Kousoulasa, **V. Bansal**, Z. Xi, S. Zhou, Y. Guo, "Fatigue modeling for laser fused metal components with small data: from scattering to reliability", *ASME, Journal of Manufacturing Science and Engineering*, 2025 (Accepted)

[3] **V. Bansal**, Y. Chen, S. Zhou, "A Rollout Approach for Condition-Based Maintenance of Large Multi-Unit Systems", *Journal of Risk and Reliability, 2025* (Accepted).
❒ *Finalist QCRE Best Student Paper Competition 2023*

[4] **V. Bansal**, S. Zhou, "DEN-HMM: Deep Emission Network Based Hidden Markov Model with Time-Evolving Multivariate Observations", *IISE Transactions, 2025* (Accepted).
❒ *Finalist QCRE Best Student Paper Competition 2024*
❒ *This article will be featured in November 2025 issue of the Industrial and Systems Engineer (ISE) Magazine*

[5] **V. Bansal**, Y. Chen, S. Zhou, "Component-Wise Markov Decision Process for Solving Condition Based Maintenance of Large Multi-Component Systems with Economic Dependence", *IISE Transactions*, 2024.
❒ *Runner Up QCRE Best Poster Competition, IISE Annual Conference & Expo, 2024*

[6] Peddireddy, D., **Bansal, V**., Aggarwal, V., "Classical simulation of variational quantum classifiers using tensor rings", *Applied Soft Computing*, 141, 2023.

[7] Kumar, R., Arora, R., **Bansal, V.**, et al., "Classification of COVID-19 from chest x-ray images using deep features and correlation coefficient", *Multimedia Tools and Applications*, 81(19), 2022.

[8] **V. Bansal**, H. Buckchash, B. Raman, "Computational Intelligence Enabled Student Performance Estimation in the Age of COVID-19", *SN Computer Science*, 2022.

[9] R. Arora, **V. Bansal**, H. Buckchash, et al., "AI-based diagnosis of COVID-19 patients using X-ray scans with stochastic ensemble of CNNs", *Physical and Engineering Sciences in Medicine*, 2021.

[10] **V. Bansal**, H. Buckchash, B. Raman, "Discriminative Auto-Encoding for Classification and Representation Learning Problems", *IEEE Signal Processing Letters*, vol. 28, pp. 987-991, 2021.

Under Review Journal Papers

[11] H. Hu, **V. Bansal**, Y. Chen, S. Zhou, "A Scalable Approach for Condition Based Maintenance of Large K-out-of-N Systems", *IEEE Transactions on Reliability* (Revised and submitted)

[12] **V. Bansal**, S. Zhou, "Deep Belief Enabled Coupled State Transition Model", Naval Research Logistics(Under Review)

[13] H. Hu, **V. Bansal**, Y. Chen, S. Zhou, "Condition-Based Maintenance Planning for Partial Observable Multi-Component Systems",Reliability Engineering & System Safety (Revised and submitted)

[14] **V. Bansal**, P. Kousoulasa, S. Zhou, Y. Guo, "Deep Learning Based Anomaly Detection for Laser-Fused Metal Components Using Pyrometric Data", *ASME, Journal of Manufacturing Science and Engineering*, 2025 (Under Review)

Conference / Workshop Papers

[1] D. Peddireddy, **V. Bansal**, Z. Jacob, V. Aggarwal, "Tensor Ring Parametrized Variational Quantum Circuits for Large Scale Quantum Machine Learning", *QTNML Workshop, NeurIPS 2021*, December 13, 2021, Virtual

Conference / Workshop Presentations

[1] "Two Step Training a Single Physics-Informed Neural Network for Solving Navier Stokes Equations with Various Boundary Conditions", *NAMRC 2025*, June 23–27, 2025, Hyatt Regency, Greenville, South Carolina, USA

[2] "DEN-HMM: Deep Emission Network Based Hidden Markov Model with Time-Evolving Multivariate Observations", INFORMS Annual Meeting, October 20–23, 2024, Phoenix, Arizona, USA

[3] "DEN-HMM: Deep Emission Network Based Hidden Markov Model with Time-Evolving Multivariate Observations", IISE Annual Meeting & Expo 2024, QCRE Best Student Paper Competition 2024, May 18–21, 2024, Montreal, Quebec, Canada

[4] "Component-Wise Markov Decision Process for Solving Condition Based Maintenance of Large Multi-Component Systems with Economic Dependence", IISE Annual Meeting & Expo 2024, May 18–21, 2024, Montreal, Quebec, Canada

[5] "Component-Wise Markov Decision Process for Solving Condition Based Maintenance of Large Multi-Component Systems with Economic Dependence", INFORMS Annual Meeting, October 15–18, 2023, Phoenix, Arizona, USA

[6] "A Rollout Approach for Condition-Based Maintenance of Large Multi-Unit Systems", IISE Annual Meeting & Expo 2023, QCRE Best Student Paper Competition 2023, May 21–23, 2023, New Orleans, Louisiana, USA

Awards & Scholarships

2025 2025 New England Future Faculty Workshop
♦ By Northeastern University

2025 Narayan-Chen Family Graduate Student Support
♦ By UW-Madsion Department of Industrial and Systems Engineering

2025 ASPIRE^2 Future Faculty Identification Program
♦ *University of Texas, Dallas*

2025 National Science Foundation Conference Registration Support Award
♦ *For NAMRC,2025*

2025 Gilbreth Memorial Fellowship, IISE
♦ For scholastic achievement, leadership, and dedication to the ISE profession

2024 Runner Up QCRE Best Poster Competition, IISE Annual Conference & Expo
♦ For Work: "Component-Wise Markov Decision Process for Solving Condition Based Maintenance of Large Multi-Component Systems with Economic Dependence"

2024 NSF 2024 IISE Annual Conference Manufacturing Student Travel Award

2024 Finalist QCRE Student Paper Competition, IISE Annual Conference & Expo
♦ For Work: "DEN-HMM: Deep Emission Network Based Hidden Markov Model with Time-Evolving Multivariate Observations"

2023 Finalist QCRE Student Paper Competition, IISE Annual Conference & Expo
♦ For Work: "A Rollout Approach for Condition-Based Maintenance of Large Multi-Unit Systems"

2023 Student Travel Grants, University of Wisconsin Madison
♦ For Travel to IISE Annual Conference & Expo 2023

2023 Chancellor's Opportunity Award, University of Wisconsin Madison

2022 Rameshwar & Bhagwati Goyal Excellence Award, IITR Heritage Fund
♦ For Academic Excellence

2021 Ishwar & Saroj Singhal Annual Excellence Award, IITR Heritage Fund
♦ For Academic Excellence

2021 Silver Medal for Bosch Traffic Sign Recognition, Inter IIT Tech Meet 9.0

2019–2022 Merit cum means Scholarship, IIT Roorkee
♦ For Academic Excellence

2016 Sir Thomas Kunnappaly Award, Holy Angels School

Delivered Lectures on AI/ML Workshops For IoT Systems & Research Center, UW-Madison

Aug 2025 **Tutorials on Time Series Analytics and Adaptations of Large Language Models (LLMs)**,
Number of attendees: 23
Delivered Lectures:
- Knowledge distillation from LLM
- Pipeline development and chain of thoughts

May 2025 **Tutorials on Methods for Complex Multivariate Time Series Data Analytics**,
Number of attendees: 23
Delivered Lectures:
- Statistical Approaches to Time Series Forecasting
- Modern Forecasting Methodologies and Applications

Jan 2025 **Tutorials on Generative AI**
Number of attendees: 23
Delivered Lectures:
- Adversarial Attacks on Neural Networks
- LLM Models for Generative AI
- Diffusion Models for Generative AI
- Flow Models for Generative AI

Aug 2024 **Emerging Topics on IoT Data Analytics and Industrial AI**
Number of attendees: 25
Delivered Lectures:
- LLM-based Predictive Methods
- Framework Development for Physics-Informed Neural Networks (PINNs)
- Techniques for Temporal Signal Forecasting in Industrial Settings

May 2024 **Tutorial on PyTorch Framework for Machine Learning**
Number of attendees: 23
Delivered Lectures:
- Introduction to Tensors, Autograd, and Machine Learning Concepts in PyTorch
- PyTorch for Deep Learning Applications
- Applying Transfer Learning in PyTorch
- Customizing Deep Learning Tasks using PyTorch
- Solving PDEs and ODEs with PyTorch

Jan 2024 **Tutorial on Reinforcement Learning with Python**
Number of attendees: 22
Delivered Lectures:
- Introduction to Markov Decision Processes (MDP)
- Basics of Reinforcement Learning (RL)
- Introduction to Deep Reinforcement Learning (DRL)
- Application of MDP and RL for Maintenance Decision-Making

Aug 2023 **Tutorial on Pre-Trained AI Models with Hugging Face**
Number of attendees: 24
Delivered Lectures:
- Introduction to Deep Learning Models and the Hugging Face Ecosystem
- Image Processing and Object Detection using Hugging Face Tools
- NLP Techniques for Customer Feedback Analysis
- Image Captioning using Hugging Face Models and GPT-2

Students Mentored

[1] **Samantha Soens (Undergraduate, UW ISyE)**
Project: Deep Learning Based HMM for PDE based Emissions

[2] **Komei Okamoto (Undergraduate, UW ISyE)**
Project: Deep Learning Benchmarking for anomaly detection CNC Machining

[3] **Caiya Wulf (Undergraduate, UW ISyE)**
Project: Deep learning methods for anomaly detection in CNC machining
Now: Commercial Analyst at FORTNA

[4] **Peach Chansaisakhorn (Undergraduate, UW ISyE)**
Project: Battery discharge monitoring and modeling

[5] **Han Hu (Master's, UW ISyE)**
Project: Component-wise MDP for large K-out-of-N systems
Now: PhD Student, UW-Madison

Contributed Writting of Awarded Research Proposals

[1] **Research on Developing Foundation Models for Time Series Analysis**
Dates: Jan 15, 2025 – Ongoing
Sponsor: Oshkosh Corporation

[2] **Metal Additive Manufacturing, Fatigue Scattering, Physics-Informed Machine Learning, Material Characterization**
Dates: Sep 1, 2024 – Aug 31, 2027
Funding Agency: National Science Foundation (NSF)

[3] **Fusion of Siloed Data for Multistage Manufacturing Systems: Integrative Product Quality and Machine Health Management**
Dates: Jan 1, 2024 – Dec 31, 2026
Funding Agency: National Science Foundation (NSF)

Industry Sponsored Research Projects – Student Lead

[1] **Research on Developing Foundation Models for Time Series Analysis**
Dates: Jan 2025 – Ongoing
Industrial Collaborator: Oshkosh Corporation

[2] **Investigation of Solving Stationary NS Equations Using PINN**
Dates: Jan 2024 – Aug 2024
Industrial Collaborator: AO Smith

[3] **New Joint Modeling Approach for Risk Assessment of Digital Medical Records**
Dates: Aug 2023 – Aug 2024
Industrial Collaborator: American Family Insurance

Professional Activities

Reviewer

- IISE Transactions (1)
- Journal of Intelligent Manufacturing (8)
- Applied Soft Computing (1)
- IEEE Transactions on Automation Science and Engineering (2)
- IEEE Transactions on Artificial Intelligence (1)
- IISE Annual Conference and Expo 2024 (3)

2024 **Session Chair**, *INFORMS Annual Meeting*
Invited Session: "Advanced Data Analytics on Reliability and Maintenance"

Aug,2024–Aug,2025 **President**, *SME Student Chapter, UW-Madison*

2019–2022 **Secretary & Data Scientist**, *Data Science Group, IIT Roorkee*

2020–2021 **Student Mentor**, *Student Mentorship Program, IIT Roorkee*

Teaching Experience

2024 Teaching Assistant, ISyE 510, Facility Planning

2023 Teaching Assistant, ISyE 510, Facility Planning

2022 Teaching Assistant, ISyE 415, Introduction to Manufacturing Systems Design and Analysis

Bachelor's Thesis

2021–2022 **Improving WRF model with data assimilation for solar energy forecasting using AI-based methods**
MIED, IIT Roorkee, Supervisor: Prof. Ankit Bansal

Professional Societies

- Society of Manufacturing Engineers (SME)
- Institute for Operations Research and the Management Sciences (INFORMS)
- Institute of Industrial and Systems Engineers (IISE)
- American Statistical Association (ASA)
- International Society of Automation (ISA)