Dr. Vibhor Pandhare

Assistant Professor
Department of Mechanical Engineering
Indian Institute of Technology Indore

Room No. 211-G, HUB Building,
IIT Indore, Khandwa Road, Simrol,
Madhya Pradesh, 453552, India

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(P) +91-860-217-6319

Digital Twin and Artificial Intelligence Lab (DTAIL)
Webpage: www.vibhorpandhare.in

RESEARCH AIM

Creating data-driven decision-support systems using digital twins and industrial artificial intelligence for applications in the Healthcare and Manufacturing sector.

EDUCATION

University of Cincinnati (UC), Cincinnati, OH, USA *Aug. 2017 – Nov 2021*

- *Ph.D.* in Mechanical Engineering
- Dissertation Title: *Domain-based Collaborative Learning for Enhanced Health Management of Distributed Industrial Assets*
- Advisor: Prof. Jay Lee
- GPA: 4.0/4.0
- Graduate Researcher at the NSF Industry/University Cooperative Research Center (I/UCRC) for Intelligent Maintenance Systems (IMS)

Indian Institute of Technology Indore (IIT Indore), India *Jul. 2011 – Jun. 2016*

- *5 Year B. Tech + M. Tech Dual Degree*
- Mechanical Engineering, specialization in Production and Industrial Engineering
- Thesis Title: *A Social Network for Machines – Realizing INDUSTRY 4.0*
- Advisor: Prof. Bhupesh Kumar Lad
- GPA: 8.0/10.0

EXPERIENCE

Indian Institute of Technology Indore, Indore, India *Jun. 2023 – Present*
Assistant Professor, Dept. of Mechanical Engineering
Research Interests:

- Artificial Intelligence, Probability and Statistics
- Smart Manufacturing, Cyber Physical Systems
- Reliability Engineering, Prognostics and Health Management

Kennametal, Latrobe, PA, USA *Nov. 2021 – Apr. 2023*
Smart Factory Engineer

- Identifying high ROI use cases for critical asset life improvement, process optimization and scrap reduction.
- Develop algorithms to derive actionable insights from large volumes of machine/process/business data.
- Deploy and manage machine learning models for scalable use.

GRANTS & SPONSORED PROJECTS

Charak Center for Digital Healthcare (PI) *Mar. 2024 – Sep. 2025*
Capacity Building in Cyber Physical Systems, IITI DRISHTI CPS Foundation under the National Mission on Inter-disciplinary Cyber-Physical Systems, DST, India
Grant Amount: INR 2,50,00,000 (Recurring) + INR 50,00,000 (Non-Recurring)

- To promote translational research in the domain of digital healthcare for India by working in partnership with researchers, healthcare professionals, policymakers and start-ups for problem identification, solution development, field implementation and

commercialization of next-generation digital healthcare technologies based on digital twins and cyber-physical systems.

Critical Care Digital Twin - Pathway towards Affordable Healthcare (PI) *Nov. 2023 – Jan. 2025*
Transforming Systems through Partnership India Grant, Royal Academy of Engineering, United Kingdom
Grant Amount: £65,000
- Supporting healthcare professionals in the effective utilization of critical care facilities by improving the hospital decision support system through incorporating equipment data feeds, alarms, and clinical understanding.
- UK Partner: University of Cambridge

Autonomous Relationship Mapping in a Network of Industrial Digital Twins (PI) *Jun. 2024*
Young Faculty Research Seed Grant – Dream Lab, IIT Indore, India
Grant Amount: INR 5,00,000
- Travel Grant for to conduct collaborative research at Politecnico di Milano, Italy.

Autonomous State Mapping and Inference (ASMI): Making Industrial Digital Twins Self-Aware (PI) *Sep. 2023 – Sep. 2025*
Young Faculty Research Seed Grant, IIT Indore, India
Grant Amount: INR 10,00,000
- Developing the ability for the digital twin to be self-aware, i.e., the ability to perceive its state through dynamic knowledge acquisition and utilize it to facilitate inferences for optimal decision-making.

INTERNSHIPS

Kennametal, Latrobe, PA, USA *May. 2021 - Aug 2021*
Data Scientist Intern
- Evaluating critical equipment and failure modes work predictive maintenance.
- Evaluating the suitability of data, sensors, acquisition hardware and configuration.
- Aggregating selected data sources into a structured dataset for model development.
- Building an analysis pipeline for real-time health assessment of selected equipment.
- Validating and deploying the analysis pipeline on the shopfloor.
- Performance optimization during automatic cutting operation

Mazak Corporation, Florence, Kentucky, USA *Jan. 2021 – Apr. 2021*
Analytics Intern
- Development of health assessment and diagnose algorithms for machine tool Spindles.
- Exploration of algorithms for model adaptation across multiple machines.

Plastic Omnium Auto Exterior, Arevalo, Madrid, Spain *Jun. 2019 – Aug. 2019*
Data Analyst Intern (Predictive Maintenance)
- Performed a proof-of-concept for predicting failures in Injection Molding Machine using high-frequency current signal.
- Developed systematic methodology to select critical assets for predictive maintenance using historical failure data.
- Defined a domain ontology for preliminary text mining of maintenance records.

Indian Institute of Technology Bombay (IIT Mumbai), India *Jul. 2016 – Jul. 2017*
Research Associate, National Center for Aerospace Innovation and Research
- Developed statistical models for reliability estimation of naval equipment
- Considered Data availability from perfect time to failure data to expert judgement
- Designed a web-application for commercialization of the solution as a product
- Supervisor: Prof. Makarand Kulkarni

AVTEC Ltd., Pithampur, Madhya Pradesh, India *Oct. 2015 – Mar. 2016*
Graduate Intern
- Implementation and Validation of a Machine Simulator (Digital Twin): A Case Study

Piaggio Vehicles Pvt. Ltd., Baramati, Maharashtra, India *May. 2014 – Jun 2014*
Summer Intern
- Complete Process Analysis of Supply Input and Supply Quality Control
- Application of KANBAN System on 4-Wheeler Assembly Line

Tata Motors Pvt. Ltd., Pune, Maharashtra, India *May. 2013 – Jun 2013*
Summer Intern
- Designing of Fixtures for Automation of Manufacturing Processes in Gear Factory

Geekware, IIT Indore, India *Jan. 2014 – Dec. 2015*
Co-founder
- A student-driven virtual market for goods and services for the IIT Indore community

Previtix, DSSE, IIT Bombay, India *May 2021 – Jan. 2022*
Level 2, Cohort 4, IDEAS Program for student teams to develop basic prototypes of innovative concepts and discover the product-market fit. Offered by Desai Sethi Centre for Entrepreneurship.
Co-founder
- Tailored Human-in-the-loop Industrial AI solutions via a subscription-based platform

INDUSTRY & COLLABORATIVE RESEARCH PROJECTS

Kennametal Inc., India *June 2024 onwards*
- Design and Development of Digital Threads for Process Optimization
- Dieset Condition Monitoring and Useful Life estimation for Optimal Asset Utilization

Digital Twin and Artificial Intelligence Lab (DTAIL), IIT Indore

Cummins India Ltd., India *June 2024 onwards*
Digitalization of End of Line Visual Inspection on the Assembly Line
Digital Twin and Artificial Intelligence Lab (DTAIL), IIT Indore

Dozee, India *June 2024 onwards*
Advancing Data-Driven Decisions in Contactless Remote Patient Monitoring
Digital Twin and Artificial Intelligence Lab (DTAIL), IIT Indore

Politecnico di Milano, Milan, Italy *Sep. 2019 onwards*
Field Synchronized Digital Twin Development
DTAIL, IIT Indore and IMS Center, University of Cincinnati

National Institute of Standards and Technology, U.S.A. *Nov. 2018 – Nov. 2021*
Development of Health Assessment Tool using NIST Inertial Measurement Unit (IMU)
IMS Center, University of Cincinnati

Hiwin Corporation, Taiwan *Sep. 2020 – Nov. 2021*
Physics-informed Digital Twins for Robust Ball Screw Condition Monitoring
IMS Center, University of Cincinnati

Mazak Corporation, Florence, KY, U.S.A. *May. 2019 – Dec. 2019*
Expansion of Spindle Health Assessment Tool to Multiple Machine Models
(*Demonstrated at MAZAK DISCOVER 2019,* Florence, KY)
IMS Center, University of Cincinnati

Weichai America Corp., IL, U.S.A. *May. 2018 – May. 2019*
Condition Monitoring of Diesel Engines using Engine Control Unit (ECU) Data
IMS Center, University of Cincinnati

Plastic Omnium, Anderson, SC, U.S.A. *Mar. 2018 – Apr. 2021*
Designing a Predictive Maintenance Tool for Injection Molding Machine using Text-Mining on Maintenance Records
IMS Center, University of Cincinnati

Procter & Gamble Co, Lima, OH, U.S.A. *Jan. 2018 – Dec. 2018*
A Feasibility Study on Designing a Predictive Solution for Capping Quality Control
IMS Center, University of Cincinnati

Mazak Corporation, Florence, KY, U.S.A. *Jan. 2018 – Sep. 2018*
Design and Development of a System for Spindle Health Assessment and Fault Diagnosis (*Demonstrated at IMTS 2018, Chicago*)
IMS Center, University of Cincinnati

Indian Naval Ship Maintenance Authority (INSMA), India *Jul. 2016 – Jul. 2017*
Design and Development of a Reliability Estimation Tool for Naval Equipment
NCAIR, IIT Bombay

IEDC, Ministry of Sci. & Tech., Govt. of India, India *Mar. 2015 – Mar. 2016*
A Smart Communication Network for Shop-floor Planning in Industries
Intelligent Manufacturing Planning Lab, IIT Indore

IEDC, Ministry of Sci. & Tech., Govt. of India, India *Mar. 2014 – Mar. 2015*
Design and Development of a Smart Manager Android App for Industries
Intelligent Manufacturing Planning Lab, IIT Indore

AWARDS HIGHLIGHT

- *Long-Term Incentive Award, Focused Recognition,* Kennametal*,* Oct 2022
- *Best Thesis - Innovative Student Projects Award*, Indian National Academy of Engineering (INAE), 2016
- *Institute Silver Medal for Best All-Rounder*, Indian Institute of Technology Indore, India, 2016
- *Impact Award,* (x4) Kennametal, Mar 2022, Aug 2022, Dec 2022, Apr 2023
- *Third Position (Global)*, *ARAMIS European Innovation Challenge,* 2020
- *Manufacturing Today Award*, National Technical Institutes Competition, India, 2016
- *Academic Excellence In M.Tech*, Indian Institute of Technology Indore, India, 2016

OTHER HONORS

- *Senate Member,* Alumni Representative, Indian Institute of Technology Indore, *2016*
- *Panelist, Short-term Project Selection Committee*, IIT Indore DRISHTI CPS Foundation, 2022
- *Delegate, Start-Up India Policy Launch* by the Prime Minister of India, 2016
- *Delegate, Smart Manufacturing Summit*, Confederation of Indian Industry, 2015
- *Delegate, India International Science Festival*, IIT Delhi, New Delhi, India, 2015
- *Exhibitor, Mazak Spindle Health Monitoring System,* MAZAK DISCOVER, KY, 2019
- *Exhibitor, Mazak Spindle Health Monitoring System*, IMTS, Chicago, IL, 2018
- *Exhibitor, Robot Health Monitoring System*, Foxconn Groundbreaking, WI, 2018

INVITED TALKS

- *Invited Talk, Digital Twin for Manufacturing,* Hosted by NIT Puducherry, May 14, 2024
- *Speaker at NSM HPC Research Week*, Hosted by IIT Madras, Nov. 25, 2023
- *Guest Lecture, Collaborative Learning for Manufacturing-as-a-Service*, University of Maryland, College Park, USA, Oct 2, 2023
- *Invited Talk, 'A introductory course on Cyber-Physical Production System',* IIT Indore, 2021

POSITIONS

IIT Indore

- *Faculty Coordinator,* CHARAK Center for Digital Healthcare
- *Committee Member,* Department Post Graduate Committee (DPGC)
- *Program Coordinator,* MS (Research) in Mechanical Engineering
- *Faculty Coordinator,* Prof. Deepak Phatak Tinkerers' Lab
- *Faculty Coordinator,* Digital Drive - Artificial Intelligence and Data Science Module, IIT Indore and CNHI Industry Collaborative Course

Community

- *Member*, Industrial Automation and Robotics Sectional Committee, PGD 18, Bureau of Indian Standards (BIS)
- *Indian Nominee,* ISO/TC 184/SC 1/WG 11, for developing the ISO Standard ISO/AWI 23704-4 'Reference Model for Cyber-Physically Controlled Smart Machine Tool Systems (CPSMT)- Part 4: Part 4: Requirements and guidelines for implementing reference architecture of CPSMT for subtractive manufacturing.'

TEACHING EXPERIENCE

Quality Management (UG VI Sem - Compulsory) *Spring 2024*
Course Coordinator and Instructor
No. of Students: 84
Dept. of Mechanical Engineering, IIT Indore

Smart Manufacturing (PG II Sem - Compulsory) *Spring 2024*
Instructor
No. Students: 25
Dept. of Mechanical Engineering, IIT Indore

Engineering Mechanics (UG I Sem - Compulsory) *Autumn 2023*
Course Coordinator and Instructor
No. Students: 462 (divided in two sections)
Dept. of Mechanical Engineering, IIT Indore

Introduction to Industrial Artificial Intelligence *Spring 2021*
Teaching Assistant
IMS Center, University of Cincinnati

Introduction to Industrial Big Data Analytics *Spring 2020, 2019*
Teaching Assistant
IMS Center, University of Cincinnati

Industry Training: Applications of Industrial AI *Multiple Occasions*
IMS Center's Industry Members' Training Module
IMS Center, University of Cincinnati

Reliability Engineering *Fall 2015*
Teaching Assistant
Intelligent Manufacturing Planning Lab, IIT Indore

PATENTS

Granted

- *Method and System for Providing Smart Communications for Distributed Operations Planning in an Industrial Network*
  B. K. Lad, M. S. Kulkarni, **V. Pandhare**, N. Agrawal, K. Upasani, M. Bakshi
  2016, Indian Patent Application No. 201621007003
  Date of Filing: 29/02/2016; Date Published: 20/10/2017; Date Granted: 15/02/2024
  Patent Number: 511113

Published

- *Monitoring System For Estimating Useful Life Of A Machine Component*
  M. Azamfar, **V. Pandhare**, M. Miller, F. Li, P. Li, J. Singh, H. Davari, J. Lee, J. Sanders, K. Yamaguchi (in partnership with Mazak North America)
  2021, Patent No. US- 20220187798- A1
  Date of Filing: 15/12/2021
  Date Published: 16/06/2022

- *Tool Condition Monitoring System*
  M. Azamfar, **V. Pandhare**, M. Miller, F. Li, P. Li, J. Singh, H. Davari, J. Lee, J. Sanders, K. Yamaguchi (in partnership with Mazak North America)
  2021, Patent No. US- 20220187164- A1
  Date of Filing: 15/12/2021
  Date Published: 16/06/2022

Filed

- *Design and Development of Triboelectric Nanogenerator based Machine Skin Integrated with Smart Controller for Digital Twin Development*
  D. Jaurker, **V. Pandhare**, I. A., Palani, S. Joshi
  Indian Patent Application No. 202421017372
  Date of Filing: 11/03/2024

PUBLICATIONS

Google Scholar Profile

Metrics as of	Avg. Impact Factor	Citations	h-index	i10-index
Jun 2024	8.35	1176	8	8

International Journals

- **Pandhare V.**, Negri E., Ragazzini L., Cattaneo L., Macchi M., Lee J., *Digital Twin-enabled robust production scheduling for equipment in degraded state*, Journal of Manufacturing Systems, 2024, vol. 74, pp. 841-857, https://doi.org/10.1016/j.jmsy.2024.04.027, Impact Factor = 12.1

- **Pandhare V.**, Miller M., Vogl W. and Lee J., *Ball Screw Health Monitoring with Inertial Sensors*, IEEE Transactions on Industrial Informatics, June 2023, vol. 19, no. 6, pp. 7323-7334, , https://doi/10.1109/TII.2022.3210999, Impact Factor = 12.3

- **Pandhare V.**, Li X., Miller M., Jia X. and Lee J., *Intelligent Diagnostics for Ball Screw Fault Through Indirect Sensing Using Deep Domain Adaptation,* IEEE Transactions on Instrumentation and Measurement, 2021, vol. 70, pp. 1-11, https://doi.org/10.1109/TIM.2020.3043512, Impact Factor = 5.6

- Negri E., **Pandhare V.,** Cattaneo L., Singh J., Macchi M. and Lee J., *Field-synchronized Digital Twin framework for production scheduling with uncertainty*,

Journal of Intelligent Manufacturing, 2020, vol. 32, pp. 1207–1228, https://doi.org/10.1007/s10845-020-01685-9, Impact Factor = 8.3

- Upasani K., Bakshi M., **Pandhare V.**, and Lad B. K., *Distributed Maintenance Planning for Industry 4.0*, Computers and Industrial Engineering, 2017, vol. 108, pp. 1-14, https://doi.org/10.1016/j.cie.2017.03.027, Impact Factor = 7.9

- Lee J., Davari H., Singh J., and **Pandhare V.**, *Industrial Artificial Intelligence for Industry 4.0-based Manufacturing Systems*. Manufacturing Letters, 2018, vol. 18, pp. 20-23, https://doi.org/10.1016/j.mfglet.2018.09.002, Impact Factor = 3.9

- Upasani K., Bakshi M., **Pandhare V.**, and Lad B. K., *Memetic Algorithm to Optimize Preventive Maintenance Schedule for a Multi-component Machine*, International Journal of Performability Engineering, vol. 12, No. 2, Mar. 2016, pp. 183-195, https://doi.org/10.23940/ijpe.16.2.p183.mag

International Conferences

- Singla S., Bhattacharjee S., **Pandhare V.**, Deriving Inferences through Natural Language from Structured Datasets for Asset Lifecycle Management, *Accepted as a regular paper at the 6th IFAC Workshop on Advanced Maintenance Engineering, Services and Technologies (AMEST 2024), Cagliari, Italy from Jun 12-14, 2024*

- **Pandhare V.**, Jia X. and Lee J., *Collaborative Prognostics for Machine Fleets Using a Novel Federated Baseline Learner*, In Annual Conference of the PHM Society, 2021, vol. 13, no. 1, https://doi.org/10.36001/phmconf.2021.v13i1.2989

- **Pandhare V.**, Singh J and Lee J., *Convolutional Neural Network Based Rolling-Element Bearing Fault Diagnosis for Naturally Occurring and Progressing Defects Using Time-Frequency Domain Features*. 2019 Prognostics and System Health Management Conference (PHM-Paris), May 2019, https://doi.org/10.1109/PHM-Paris.2019.00061

- Negri E., Cattaneo L., **Pandhare V.,** Macchi M. and Lee J., *Integrating PHM into production scheduling through a Digital Twin-based framework*, IFAC Conference on Advanced Maintenance Engineering, Services and Technology (AMEST), vol. 55, no. 19, pp. 31-36, 2022, https://doi.org/10.1016/j.ifacol.2022.09.180

- Azamfar M., Jia X., **Pandhare V.**, Singh J., Davari H. and Lee J., *Detection and diagnosis of bottle capping failures based on motor current signature analysis*. Procedia Manufacturing. vol. 34, pp. 840 – 846, Jan. 2019, https://doi.org/10.1016/j.promfg.2019.06.165

- Agrawal N., **Pandhare V.**, and Lad B. K., *A Bayesian Algorithm for Cyber-Physical System Realization for Industry 4.0*, 3rd International Conference on Business Analytics and Intelligence, Data Centre & Analytics Lab, IIM Bangalore, India, 2015

National Conferences (India)

- **Pandhare V.**, Sankhla V. K., and Lad B. K., *Design and Development of a Machine Simulator for Cyber-Physical Systems Based Operations Planning*, Proceedings of the 57th National Convention of IIIE, SVNIT, India, Nov. 2015, pp. 807-812.

Book Chapters

- Lee, J., Jia, X., **Pandhare, V.** and Miller, M. *Analyzing data obtained via wind farm supervisory control and data acquisition,* Utility-Scale Wind Turbines and Wind Farms (IET), p.105, 2021, ISBN: 9781839530999

- Lee J., Singh J., Azamfar M. and **Pandhare V.**, *Industrial AI and predictive analytics for smart manufacturing systems*, Smart Manufacturing (Elsevier), pp. 213-244, 2020, ISBN: 9780128203804

REVIEWER

Journal	*Impact Factor*
• Elsevier Journal of Industrial Information Integration	11.72
• Elsevier Reliability Engineering and System Safety	6.19
• IEEE Transactions on Reliability	5.87
• IEEE Transactions on Instrumentation & Measurement	5.60
• Elsevier Measurement	5.13
• IEEE/ASME Transactions on Mechatronics	5.30
• Journal of Low Frequency Noise, Vibration and Active Control	2.37
• Springer Cluster Computing	1.81
• International Journal of Prognostics and Health Management	1.63
• Exploration of Digital Health Technologies	

STUDENTS AND STAFF

Post-Doctoral Fellow

1. **Dr. Rishi Kumar**, *CHANAKYA Post-Doctoral Fellow,* PhD: BITS Pilani
Research Area: Intelligent scheduling using field-synchronized industrial digital twins.

Post Graduate Students

1. **Ajinkya Kulkarni**, M.Tech in Advanced Manufacturing, June 2024
Development of cyber-physical PLM environment using ISO 23704 standard

2. **Abhishek Tiwari**, M.S.(Research) in Mechanical Engineering, June 2025
A scalable algorithm for autonomous state detection in industrial digital twins.

3. **Manoj Thummala**, M.Tech in Advanced Manufacturing, June 2025

B.Tech Students

1. **Shagun Ghatak**, B.Tech in Mechanical Engineering, June 2025
Autonomous Relationship Mapping in a Network of Industrial Digital Twins

2. **Aditya Suwalka**, B.Tech in Mechanical Engineering, June 2025
Privacy-preserved Distributed Model Training for Trustworthy AI

3. **V Purushothaman**, B.Tech in Mechanical Engineering, June 2025
Utilization monitoring using computer vision-based state detection

4. **Avni Gupta**, B.Tech in Mechanical Engineering, June 2025
AI-based design & modeling of a random positioning platform for simulated altered gravity (Co-supervisor with faculty from Biosciences and Biomedical Engineering Dept.)

Research Staff

Project: **Critical Care Digital Twin - Pathway towards Affordable Healthcare**
Funding Agency: Transforming Systems through Partnership India Grant 2023, Royal Academy of Engineering

1. **Soumyabrata Bhattacharjee** (Feb 2024 onwards)
2. **Aakash Mittal** (March 2024 onwards)
3. **Farnaz Kazi** (June 2024 onwards)
4. **Yash Khandelwal (**June 2024 onwards)
5. **Aarzoo Thaman** (Nov 2023 onwards, Student Thesis, M.E. in Computer Science and Engineering, Thapar Institute of Engineering and Technology)

Internships

1. **Sanchit**, B.Tech, Production & Industrial Engineering, IIT Delhi '25
Internship Period: December 2023
Deriving inferences through natural language from structured datasets

2. **Yash Khandelwal**, B.E., Mechanical Engineering, SGSITS Indore '24
Internship Period: March - May 2024
Design of data collection mechanism for digital twin development of critical assets like vehicles and gearboxes.

3. **Aridaman Bhadauria**, B.E. in Computer Science and Engineering, KIIT '26
Internship Period: March - May 2024
Camera Automation for Enhancing Computer-Vision Driven Data Collection

4. **Reeaa Rana**, B.Tech in Artificial Intelligence and Data Science, NMIMS Indore ‘26
Internship Period: May - July 2024
Scenario-Driven Data Collection and Analysis for Lung Disease Detection

5. **Somya Jain**, B.Tech in Production Engineering, NIT Tiruchirappalli ‘25
Internship Period: June - August 2024