

PRANAV MILIND KHANOLKAR

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Ph.D. graduate in Mechanical and Industrial Engineering with over 5 years of research experience applying artificial intelligence (AI), machine learning, and automation strategies to solve complex engineering problems. Proficient in Python, deep learning, data analysis, and product lifecycle management, with a strong background in developing scalable, data-driven solutions in practical applications.

EDUCATION

Doctor of Philosophy: Mechanical and Industrial Engineering | University of Toronto, Canada June 2025
Master of Science: Industrial Engineering | The Pennsylvania State University, US May 2020
Bachelor of Engineering: Mechanical Engineering | University of Mumbai, India May 2017

EXPERIENCE

Graduate AI Researcher – Ready Lab, University of Toronto September 2020 – December 2024
Toronto, Ontario, Canada

- Engaged with Canadian and UK industry partners to develop strategic roadmaps enabling SMEs to implement digital threads and AI in their product workflows using cloud data management and virtual machines—projected to save over CAD 337,500 annually.
- Qualitatively and quantitatively analyzed 108 published AI-based methods—including generative AI (GenAI) models, large-language models (LLMs), Agentic AI models, and Machine Learning—that are specifically deployed in different stages of the engineering design process and demonstrated how these methods assist engineers. [[Link to publication](#)]
- Leveraged Natural Language Processing and web-scraping to extract and evaluate the limited prevalence of AI education in 2195 courses offered by 28 accredited 2023-2024 Canadian Mechanical Engineering programs. [[Link to publication](#)] [[Link to dataset](#)]
- Drafted and managed three project proposals totaling CAD 375,250, submitted to NSERC, SSHRC, and MITACS, supporting industry-partnered research initiatives in product design, engineering education, and aerospace design systems.
- Designed and delivered lectures to 200+ students per term on engineering topics (finance, design, manufacturing, professional skills), earning the MIE Teaching Assistant Award for outstanding teaching and student engagement.

Mitacs Accelerate Research Intern – University of Toronto & RPS Composites September 2021 – August 2022
Toronto, Ontario, Canada

- Drafted the grant for the project, ‘A New Automated Approach for Engineering Design and Manufacturing Specification Generation’ in collaboration with industry partner – RPS Composites (*awarded CAD 45,000*).
- Reviewed traditional fibre-reinforced-polymer (FRP) design & manufacturing workflows and software limitations using sensitivity analysis (50+ variations) and engineer interviews to identify inefficiencies and recommend actionable improvements.
- Developed Python-based automation frameworks that generated manufacturing specifications, Bill of Materials, and CNC-compatible DXF files—replacing manual design tasks and improving design cycle speed by 10x. [[Link to publication](#)]
- Developed documentation and conducted online training sessions for effective application of the automation frameworks.
- Integrated automation solutions into the company’s production workflow, contributing to an estimated CAD 10,500 annual savings per product, demonstrating strong ROI and scalable potential across product lines.

Deep Learning Researcher – THRED Lab, The Pennsylvania State University June 2019 – May 2020
State College, Pennsylvania, US

- Researched and implemented AI-based solutions to accelerate finite element analysis of material microstructures, focusing on image-based deep learning methods to enhance computational efficiency without sacrificing accuracy.
- Automated the generation of 6,000 diverse microstructure designs and structural simulations using Abaqus API scripting—creating a robust labeled dataset for training deep learning-based image colorization models using TensorFlow and Keras. [[GitHub](#)]
- Developed and trained a CNN-based image colorization model in Python that predicted strain fields in aluminum microstructures with 96% accuracy, achieving results 20x faster than conventional FEA methods. [[Link to publication](#)] [[Link to dataset](#)]

Engineering Intern – BEST Undertaking June 2015 – July 2015
Mumbai, Maharashtra, India

- Delivered technical insights on chassis, braking, and steering systems to inform design refinements, reducing recurring product issues by 10%—improving overall product reliability and client satisfaction.
- Identified and addressed supply chain inefficiencies influencing product design-to-delivery timelines, driving a 12% productivity gain in workshops and reducing client order lead times—shortening the design-to-market cycle.

SKILLS

Programming Languages: Python, R, Git, MATLAB, SQL

AI: Machine Learning & Deep Learning (Scikit-learn, Keras, PyTorch, TensorFlow), Natural Language Processing (NLTK)

Application: AWS, SolidWorks, Onshape, AutoCAD, Autodesk Inventor, ANSYS Workbench, Abaqus, Power BI, Tableau, NVivo

Research Skills: Statistical Analysis, Literature Review, Qualitative Coding and Analysis, Case Study Analysis, Grant Writing

CERTIFICATIONS

- [AWS Fundamentals Specialization](#) (Amazon Web Services–AWS, Cloud Computing, AWS Management Console)
- [Generative AI Engineering with LLMs Specialization](#) (Prompt Engineering, LLMs, RAG, LangChain, Database Management)
- [IBM AI Engineering Professional Certificate](#) (Tensorflow, PyTorch, Keras, Apache Spark, Deep Learning, Big Data)
- [NLP - Natural Language Processing with Python](#) (Spacy, LDA, Word2Vec, NLTK, NER, Topic Modelling, Sentiment Analysis)
- [Python for Data Science and Machine Learning Bootcamp](#) (Pandas, Seaborn, SciKit-Learn, NumPy, Matplotlib, Plotly)
- [Lean Six Sigma Yellow Belt: Quantitative Tools for Quality and Productivity Professional Certificate](#) (DMAIC, Critical-to-Quality, Failure Modes & Effects, Root Cause Analysis, Heijunka, Kanban, Jidoka, Poka Yoke, Quality Control)
- [Sustainability Consulting](#) (Product Lifecycle Management, Corporate Sustainability, Environmental Management Systems)
- **Product Design and Analysis** – by CADD Centre Training Services Pvt. Ltd. (SolidWorks and ANSYS)

PROJECTS

Comparative Analysis of Self-Supervised Learners [[GitHub](#)]

December 2021

- Reviewed and documented five self-supervised learning algorithms (MoCo, SimCLR, BYOL, SwAV, Barlow Twins), performing comparative analysis to evaluate their strengths and limitations in image classification tasks.
- Conducted T-SNE-based qualitative analysis and quantitative transfer learning evaluation using the CIFAR-10 dataset to assess generalization and out-of-distribution performance of SSL models against supervised baselines.
- Developed an ensemble framework combining SSL and supervised learning methods, resulting in improved image classification accuracy over individual models, highlighting synergy across learning paradigms.

Statistical analyses of the BRFS for Effective Monitoring of Weight-related Concerns [[GitHub](#)]

December 2020

- Analyzed the Behavioral Risk Factor Surveillance System (BRFS) dataset of 437,000+ respondents across 276 variables—including health, demographic, and behavioral data—to uncover patterns and inform predictive modeling efforts.
- Applied K-means clustering to detect correlations between state populations and Body Mass Index (BMI), revealing geographic trends in obesity and population health distribution.
- Developed logistic regression models in R to predict heart attack, cancer, and diabetes diagnoses using smoking, drinking, and BMI as predictors—demonstrating that the inclusion of BMI significantly improved model performance.

Design Improvement of Debris Subsystem for Tennant Floor Scrubbers – Designing Product Families

December 2019

- Led a team of seven graduate researchers to assess product platform opportunities for Tennant floor scrubber models (T300, T500, T600), focusing on improving manufacturing efficiency through component commonality.
- Calculated Product Commonality Index (PCI) and Generational Variety Index (GVI) to identify platform-able components and tradeoffs between variety and commonality, enhancing product family efficiency and design coherence.
- Constructed a Design Structure Matrix (DSM) to evaluate component interface dependencies and risk propagation from design changes, culminating in a comprehensive report with platforming recommendations.

Non-Destructive Testing of Thin Plates using Ultrasonic Guided Waves (Undergraduate Thesis)

March 2017

- Designed and implemented two MATLAB-based algorithms for rapid and accurate damage detection and localization in thin plate structures, for potential integration in aerospace systems, emphasizing early damage detection in composite structures to improve safety, inspection efficiency, and maintenance planning.
- Authored and presented the paper "Development of a Lamb Wave Based Algorithm for Detecting a Damage in Thin Plate Structures" at the ISSS International Conference, showcasing novel techniques for non-destructive testing. [[Link to publication](#)]

PUBLICATIONS

JOURNAL ARTICLES

- **Khanolkar, P. M.,** Gopsill, J., & Olechowski A. (2025). Decoding the Digital Thread Digitalization Approach for Product Design and Development: Benefits, Challenges and Extensions. Artificial Intelligence for Engineering Design, Analysis and Manufacturing Journal 39, e23, 1-20. [Link to paper](#).
- **Khanolkar, P. M.,** Vrolijk, A., & Olechowski A. (2023). Mapping artificial intelligence-based methods to engineering design stages: a focused literature review. Artificial Intelligence for Engineering Design, Analysis and Manufacturing 37, e25, 1–18. [Link to paper](#).
- **Khanolkar, P. M.,** McComb, C. C., & Basu, S. (2021). Predicting elastic strain fields in defective microstructures using image colorization algorithms. Computational Materials Science, 186, 110068. [Link to paper](#)
- Yelve, N. P., Rode, S., Das, P., & **Khanolkar, P. M.** (2019). Some new algorithms for locating a damage in thin plates using Lamb waves. Engineering Research Express, 1(1), 015027. [Link to paper](#)

PEER-REVIEWED CONFERENCE PROCEEDINGS

- **Khanolkar, P. M.,** Lu, J., Hurst, A., & Olechowski A. (2024). Assessing The Prevalence of Artificial Intelligence in Mechanical Engineering And Design Curricula. In International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, American Society of Mechanical Engineers, 2024. [Link to paper](#).
- **Khanolkar, P. M.,** Vrolijk, A., & Olechowski A. (2023). A Case Study of the Decision-Making Behind the Automation of a

Composites-Based Design Process. Proceedings of the Design Society, 3, 49-58. [Link to paper](#).

- **Khanolkar, P. M.**, Gad, M., Liao, J., Hurst, A., & Olechowski, A. (2021). A Pilot Study on The Prevalence of Artificial Intelligence in Canadian Engineering Design Curricula. Proceedings of the Canadian Engineering Education Association (CEEA). [Link to paper](#).
- **Khanolkar, P. M.**, Abraham, A., McComb, C., & Basu, S. (2020). Using deep image colorization to predict microstructure-dependent strain fields. Procedia Manufacturing, 48, 992-999. [Link to paper](#).
- Rode, S., Yelve, N., **Khanolkar, P. M.**, Thube, M., Thampy, A., & Thomas, C., (2017). Development of a Lamb Wave-Based Algorithm for Detecting a Damage in Thin Plate Structures. ISSS International Conference on Smart Materials, Structures, and Systems. [Link to paper](#).

GRANT REPORT

- Olechowski, A., **Khanolkar, P. M.**, Lu, J., & Hurst, A. (2022). Towards a Modern Canadian Engineering Design Curriculum: Balancing Artificial Intelligence and Human Cognition. [Link to paper](#)

DATASETS

- Jia Sheng (Jerry) Lu, **Pranav Milind Khanolkar**, Ada Hurst, & Alison Olechowski. (2021). Keyword-Matching-for-Canadian-Mechanical-Engineering-Programs: Second Release (v1.0.1). Zenodo. [Link to paper](#).
- **Khanolkar, P. M.**, Basu, S., & McComb, C. (2021). Image-based data on strain fields of microstructures with porosity defects. Data in Brief, 34, 106627. [Link to paper](#).

PRESENTATIONS & INVITED TALKS

- **Panelist at DAIR to Innovate 2024** October 2024
Bombardier Centre for Aerospace & Aviation, Centennial College – Downsview Campus, Toronto, Ontario, Canada
Topic: Unlocking new potential with digital technologies and Product Lifecycle Management (PLM)
- **Conference Presenter at IDETC-CIE 2024** August 2024
International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, Washington, DC, US
Topic: Assessing the Prevalence of Artificial Intelligence in Mechanical Engineering and Design Curricula
- **Poster Presenter at MIE Graduate Symposium** June 2024
University of Toronto, Toronto, Ontario, Canada
Topic: Digital Thread-Enabled Data Management Framework for Modelling and Simulation of Electric Vehicle Battery Thermal Management Systems
- **Conference Presenter at ICED23** August 2023
The 24th International Conference on Engineering Design, University of Bordeaux, France
Topic: A Case Study of The Decision-Making Behind the Automation of a Composites-Based Design Process
- **Poster Presenter at MIE Graduate Symposium** June 2023
University of Toronto, Toronto, Ontario, Canada
Topic: Deep Co-design: Streamlining the Electro-Thermal Design Process for Future Automation
- **Guest Speaker at Engineering Education Research Roundtable 2022** April 2022
University of Toronto - Institute for Studies in Transdisciplinary Engineering Education and Practice, Toronto, Ontario, Canada
Topic: Navigating frameworks and methodologies for analyzing engineering curriculum
- **Conference Presenter at CEEA 2021** June 2021
The Annual Conference of the Canadian Engineering Education Association, University of Prince Edward Island, PEI, Canada
Topic: A Pilot Study on The Prevalence of Artificial Intelligence in Canadian Engineering Design Curricula
- **Presenter at THRED Group** November 2019
The Pennsylvania State University, State College, Pennsylvania, US
Topic: Using Deep Image Colorization to Predict Microstructure-Dependent Strain Fields
- **Conference Presenter at ISSS 2017** July 2017
International Conference on Smart Materials, Structures and Systems, IISc Bangalore, India
Topic: Development of a Lamb Wave-Based Algorithm for Detecting a Damage in Thin Plate Structures

AWARDS

- University of Toronto MIE Teaching Assistant Award (CAD 500) 2024-2025
 - University of Toronto MIE Conference Travel Grant (CAD 850) 2023-2024
 - MITACS Accelerate Internship Award (CAD 45,000) 2021-2022
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