

# 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 CAD, with a strong background in developing scalable, data-driven solutions in both academic and industry settings.

## SKILLS

**Programming Languages:** Python, R, MATLAB, HTML, SQL

**AI:** Machine Learning & Deep Learning (Sckit Learn, Keras, PyTorch, TensorFlow), Natural Language Processing (NLTK)

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

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

## EXPERIENCE

**Graduate Researcher** – Ready Lab, University of Toronto

September 2020 – December 2024

Toronto, Ontario, Canada

- Generated actionable roadmaps and best practice guidelines for small-to-medium enterprises (SMEs) to adopt digital threads and AI in product design processes—leveraging cloud data management systems and virtual machines—based on case studies of successful research–industry collaborations (*PhD Dissertation, successfully defended*).
- Qualitatively and quantitatively analyzed 108 published AI-based methods—including generative AI (GenAI) models, large-language models (LLMs), agent-based modelling, probabilistic 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 375,250 CAD, submitted to NSERC, SSHRC, and MITACS, supporting industry-partnered research initiatives in product design, engineering education, and aerospace design systems.

**Mitacs Accelerate Research Intern** – University of Toronto & RPS Composites

September 2021 – August 2022

Toronto, Ontario, Canada

- Received Mitacs Accelerate Internship Award for the project, ‘A New Automated Approach for Engineering Design and Manufacturing Specification Generation’ in collaboration with industry partner – RPS Composites.
- Reviewed and reported the shortcomings of the industry’s traditional composite design process, software limitations, using sensitivity analysis and qualitative interviews with the company’s engineering team.
- Developed Python-based software programs for automating the design of composite-based products and their manufacturing specifications, bill of materials, and drawing-exchange-format (DXF) files for CNC machining.
- Deployed these automation programs which proved 10x faster than their traditional design processes. [[Link to publication](#)]

**Graduate Researcher** – THRED Lab, The Pennsylvania State University

June 2019 – May 2020

State College, Pennsylvania, US

- Researched and analyzed image-based AI algorithms related to the research project on improving the speed of finite element analysis of material microstructures without compromising the accuracy of the results.
- Formulated automation scripts in Abaqus FEA backend to generate 6,000 diverse microstructure designs and corresponding structural analyses—creating a labelled dataset to train deep learning-based image colorization algorithms.
- Developed CNN-based image colorization algorithms for predicting structural strain fields in aluminum microstructures with 96% accuracy and 20x faster than the traditional finite element analysis software (Abaqus FEA). [[Link to publication](#)] [[Link to dataset](#)]

## CERTIFICATIONS

- [AWS Fundamentals Specialization](#) (Amazon Web Services, Cloud Computing, AWS Management Console, Docker, Kubernetes)
- [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)
- Product Design and Analysis** – by CADD Centre Training Services Pvt. Ltd. (SolidWorks and ANSYS)

## EDUCATION

**Doctor of Philosophy: Mechanical and Industrial Engineering** | University of Toronto, Canada

December 2024

**Master of Science: Industrial Engineering** | The Pennsylvania State University, US

May 2020

**Bachelor of Engineering: Mechanical Engineering** | University of Mumbai, India

May 2017

## **PROJECTS**

### **Comparative Analysis of Self-Supervised Learners**

*December 2021*

- Reviewed and documented five self-supervised learning (SSL) algorithms (MoCo, SimCLR, BYOL, SwAV, Barlow Twins).
- Performed qualitative analysis using T-SNE plots on these five SSL algorithms using the CIFAR10 dataset and their comparison with supervised learning method for classification.
- Facilitated quantitative analysis of these self-supervised learning (SSL) algorithms by evaluating their models' transfer learning ability using out-of-distribution testing for image classification.
- Developed an ensemble of these five SSL methods and supervised learning methods to assess the improvement in image classification compared to the individual methods.

### **Statistical analyses of the BRFSS for effective monitoring of weight-related concerns**

*December 2020*

- Analyzed the Behavioral Risk Factor Surveillance System (BRFSS) dataset, containing information on 276 variables that include interview information, location, demographics, health, and medical information of 437436 respondents.
- Processed K-means clustering to observe the patterns based on the US state population and Body Mass Index (BMI).
- Created logistic regression models in R-programming to predict Heart Attack Diagnosis, Cancer Diagnosis, and Diabetes Diagnosis, with Drinking and Smoking as the predictors.
- Executed logistic regression tests to analyze if adding a BMI score to the prediction models with only Drinking and Smoking as the predictors of such disease diagnoses will render the model a better fit.

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

*December 2019*

- Led a team of seven graduate students to assess the product platforms for Tennant Floor Scrubber models T300, T500 and T600.
- Evaluated and established the current commonality between the three scrubbers' components/modules that can be platformed for improved efficiency in a manufacturing system.
- Calculated the commonality assessment using the Product Commonality Index (PCI) for the debris subsystem.
- Implemented a variety assessment using the Generational Variety Index (GVI) by mapping consumer needs to engineering requirements and current components of the scrubbers.
- Performed a Commonality-Variety Tradeoff for design assessment and changes to be recommended.
- Constructed a Design Structure Matrix (DSM) to analyze the interface between components to assess the propagation, risk and impact due to design-changes and documented a report highlighting the recommendations for improving design and platforming.

### **Remote Order Taking – Discrete Event Simulation**

*May 2019*

- For a given dataset, processed and optimized the number of servers required for a drive-through restaurant chain in the area to improve efficiency according to desired performance standards using discrete event simulations in Python.
- Conducted a sensitivity analysis to observe the change in the required number of operators if more branches were added.
- Quantified the uncertainty based on input distribution models fitted according to given data.

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

*March 2017*

- Developed two new algorithms using MATLAB for damage detection, localization, and refinement in thin plate structures.
- Documented the entire project in a technical paper 'Development of a Lamb Wave Based Algorithm for Detecting a Damage in Thin Plate Structures', and presented it in ISSS International Conference on Smart Materials, Structures and Systems July 5-7, 2017, Bangalore, India. [[Link to publication](#)]

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## **OTHER EXPERIENCE**

### **Teaching Assistant – MIE258 Engineering Economics & Accounting – University of Toronto** *Toronto, Ontario, Canada*

*Fall 2024, Fall 2023, Fall 2022*

- Taught the following topics: Cash Flow Analysis, Financial Comparison Methods, Financial Accounting, Replacement Decisions, Taxes, Inflation, Dealing with Risk and Uncertainty, Emission Policy, and Business Plans.
- Led weekly tutorials and Q&A sessions for approx. 50 students on concepts of engineering economics and accounting.
- Supervised and graded midterm and final exams—providing detailed feedback on how students can improve their understanding on concepts of engineering economics and accounting.

### **Teaching Assistant – APS100 Orientation to Engineering – University of Toronto** *Toronto, Ontario, Canada*

*Term: Fall 2024, Fall 2023*

- Facilitated active online learning activities and sessions for classes of 300-325 students to assist them in early engineering management skills such as time management and engineering ethics.

### **Section Editor, Engineering – The Canadian Science Fair Journal** *Toronto, Ontario, Canada*

*July 2022 – June 2024*

- Monitored a team of five graduate students and researchers across different universities in Canada to review and publish research projects conducted by high-school students (aged 12-18 years).
- Reviewed and published research articles by mentoring young authors through the process of writing their first scientific paper.

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## **LANGUAGES**

- English, Hindi, Marathi, German (Level A1, A2; Goethe Institute certified)
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