Vishal Singh

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EDUCATION

Thapar Institute of Engineering and Technology — Patiala, Punjab
Bachelor of Engineering, Mechanical Engineering — *August 2021 – June 2025*
- Cumulative GPA : **8.98/10.0**

EXPERIENCE

SciML Intern — April 2025 – Present
NMCAD Lab, Indian Institute of Science — *Bengaluru, India*

- Engaged in advanced research at the NMCAD Lab, focusing on the optimization of auxetic metamaterial structures, modeling of fatigue crack growth (FCG), and Industry 4.0 applications. Contributed to **3 journal publications** and **2 accepted conference papers**.

Machine Learning Intern — January 2025 – March 2025
JuliaHub — *Bengaluru, India*

- Enhanced the JuliaSimSurrogates repository by reproducing core pipeline results (DataGeneration, Preprocessing, DigitalEcho) and developing a tutorial for MTK model deployment to support GUI integration.
- Implemented gradient testing in `Surrogatize.jl`, streamlining testing workflows and reducing execution time from **3 hours to 1.5 hours**, enabling scalable training improvements while consistently meeting deadlines.

Samsung PRISM Intern (Remote) — October 2024 – April 2025
Samsung R&D Institute — *Bengaluru, India*

- Developing an advanced video generation framework using **diffusion models** to produce dynamic, high-fidelity visual content. The project is guided by expert mentorship from Samsung's Visual Intelligence Team.

Undergraduate Research Assistant — February 2024 – June 2025
Thapar Institute of Engineering and Technology & IIITDM, Kancheepuram — *Patiala, Punjab*

- Working on diverse research problems across **aerospace engineering, biomedical engineering, and computational solid mechanics.**
- Applying advanced machine learning techniques such as **Physics-Informed Neural Networks (PINNs)** to solve complex real-world challenges. Also exploring **Neural Operators**, **Kolmogorov-Arnold Networks (KANs)** and **Physics-Informed KANs (PI-KANs)** to tackle intricate modeling problems.
- Also involved in various research projects and patent developments, including initiatives in **AI for Science, Healthcare**, and **for Social Good**.

MITACS Globalink Research Intern — June 2024 – August 2024
École Polytechnique de Montréal (Fully Funded) — *Montreal, Canada*

- Developed a predictive method using **Fourier Neural Operator**, **Physics-Informed Neural Operator**, and **DeepONet** to approximate flow in porous media, with **FNO achieving the highest accuracy of 89%**.

Deep Learning Intern — June 2023 – June 2024
SMICR Group, Indian Institute of Technology Delhi — *New Delhi, India*

- **Project: Qualitative Prediction of Boundary Layer Thickness via Machine Learning**
- Developed a **Fourier Neural Operator**-based model to predict boundary layer thickness over a T106A Low-Pressure Turbine blade across varying Mach numbers, achieving **91% accuracy**.
- Captured complex spatial dependencies in boundary layer data using Fourier transforms and deep learning techniques.
- Built conventional **ANN models** to predict skin friction, pressure coefficient, and boundary layer distribution along the blade surface.

TECHNICAL SKILLS

Languages: Python, Julia, MATLAB, LaTeX, SQL

Frameworks: PyTorch, TensorFlow, Keras, OpenCV, Streamlit, MLflow

Developer Tools: Git, VS Code, Google Colab, Jupyter Notebook, Docker

Libraries: Pandas, Numpy, Scikit-Learn, Matplotlib, Seaborn, Hugging Face, PySINDy

Softwares: PowerBI, Creo Parametric, Ansys, AutoCAD, Microsoft Office

PROJECTS

- **Breast Cancer Prediction Web App** 🔗 [Live App](#)
  - Developed a Streamlit web app for breast cancer classification using logistic regression (97% accuracy).
  - Integrated radar chart visualization and modular deployment using serialized model and scaler.

- **Semi-Autonomous Water Cleaning Robot [Final Year Capstone Project]** 🔗 [Project Details](#)
  - Designed and fabricated a river-cleaning robot with ESP32 and BTS7960-based control system.
  - Conducted CAD modeling and ANSYS simulations to optimize fluid flow around the collector.

- **Fourier Neural Operator for Predicting Flow in Porous Media**
  - Generated synthetic flow simulations using the Lattice Boltzmann Method (15 GB dataset).
  - Trained a Fourier Neural Operator model to predict dynamic flow fields under varying conditions.

- **Apple Stock Prediction Using Gaussian Process Regression**
  - Built a GPR-based time series model to forecast stock prices with uncertainty quantification.
  - Applied feature engineering and hyperparameter tuning for improved predictive performance.

PUBLICATIONS

- **Singh, V.**, Harursampath, D., Dhawan, S., Sahni, M., Saxena, S., Mallick, R. "Physics-Informed Neural Network for Solving a One-Dimensional Solid Mechanics Problem." *Modelling*, 2024, 5, 1532–1549. https://doi.org/10.3390/modelling5040080

- Characterization and Detection of Structured False Data Injection in Reinforcement Learning-Controlled Artificial Pancreas Systems [**Submitted to IEEE Transactions on Industrial Informatics**]

- Neural Optimization Machine for Analytical Function Optimization: Application to Auxetic Metamaterial Design [**Submitted to Journal of Computational Science**]

- Neural Optimization of Anti-Tetrachiral Auxetic Metastructures for Advanced Engineering Applications [**Ongoing Manuscript**]

- Kolmogorov Arnold Network Based Data-driven Prognostics for Estimating the Remaining Useful Life of Aircraft Engines in Industry 4.0 [**Ongoing Manuscript**]

CONFERENCES

- Physics Informed Neural Network for Modelling Glucose-Insulin Dynamics for Type 1 Diabetes [**Presented at AICOMAS 2025, Paris 17–21 February 2025**]

- Physics-Enhanced Neural Network Approach for Optimizing Re-Entrant Auxetic Structures in Advanced Engineering Applications [**Accepted at MSML 2025, Naples, Italy, August 4–8, 2025**]

- An Artificial Intelligence-based Design Framework of Optimal Auxetic Metamaterial Structures [**Accepted at I4AM, Indian Institute of Science, Bengaluru, India, January 8–9, 2026**]

- Design and Development of Piezoelectric Auxetic Energy Harvesting Devices for Engineering Applications [**Accepted at I4AM, Indian Institute of Science, Bengaluru, India, January 8–9, 2026**]

PATENTS

- Pseudo-Artificial Pancreas: A Low-Cost AI-Based Insulin Dosage Recommendation System for Type 1 Diabetes [**Patent Filed**]

AWARDS AND ACHIEVEMENTS

- Awarded **Merit Scholarship III** for 2023–24 worth **INR 1,59,000** for securing a position in the **top 10%** of students in the Mechanical Engineering Department (MED), TIET.

- **MITACS Globalink Research Fellowship**: Received a fully funded summer research internship at École Polytechnique de Montréal, Canada (June–August 2024).

- Awarded **Merit Scholarship III** for 2022–23 worth **INR 1,39,000** for achieving a position in the **top 10%** of departmental student strength at MED, TIET.

- Secured **3rd rank** in MED for academic performance in 2022–23; awarded a **certificate** and a cash prize of **INR 2,000**.