

Pahal Dhruvin Patel

[✉ Email](#) [📞 Contact Number](#) [🔗 Personal Website](#) [LinkedIn](#) [GitHub](#)

Education

Indian Institute of Technology Kanpur Major in Physics, Minor in Machine Learning and Literature CPI : 8.5/10 , Machine Learning CPI : 9.5/10	<i>Nov'22 - May'26</i>
Delhi Public School Surat - Grade 11 & 12 Central Board of Secondary Education, Percentage : 97.8 %	<i>April'20 - March'22</i>

Research Experience

Knowledge Distillation in Super Resolution 🔗 Reserach Intern Brown University, Supervisor: Dr. Loukas Gouskos 🔗	<i>Jul'25 – Present</i>
<ul style="list-style-type: none">Designed a cross-resolution 2D CNN for jet classification on the ATLAS Top Tagging datasetImplemented super-resolution models such as ESRGAN on the BSD300 image dataset and ATLAS datasetPreprocessed data into high- and low-resolution jet images to enable multi-resolution comparative trainingIntegrating knowledge distillation to compress models and improve efficiency and scalability on larger datasets	
Explainability in Graph Neural Networks for Jet Tagging 🔗 Research Intern IIT Kanpur, Supervisor: Dr. Sanmay Ganguly 🔗	<i>Apr'24 – present</i>

• Developed a specialized **graph neural network** for **binary jet-tagging** using **PyTorch Geometric** framework

• Enhanced **interpretability** and **trustworthiness** by integrating **explainable AI** tools (e.g., GNNExplainer, Shapley values) to align model behaviour with physics principles

• Preprocessed raw jets into structured **graph representations** using the **FastJet** and **ROOT** analysis frameworks

• Trained and optimized the model to capture detailed **jet substructure**, improving jet-tagging performance.

Multi-modal Semantic Communication in VQA task [🔗](#)
Research Intern | Intent Lab, Supervisor: Dr. Subrahmanya Swamy Peruru [🔗](#)

• Implemented a **multi-modal** semantic communication framework for VQA using **MU-DeepSC**.

• Extended the system with **Vision Transformer** encoders, evaluating multi-scale ViT modules.

• Achieved **78.6%** accuracy using the baseline CNN encoder and improved performance to **82.9%** with a ViT-based semantic extractor under identical channel conditions

Key Achievements

- Achieved a CPI of **9.4** and stood among the **top 10%** of the class for the academic year 2024-25
- Ranked in the **top 15%** out of 1,200 students across the entire campus population in undergraduate studies
- Secured All India Rank in the **top 1%** in JEE Mains 2022 among 1.5 million applicants across India
- Secured All India Rank in the **top 3%** in JEE Advanced 2022 among 200K selected candidates

Course Projects

Privacy in RAG <i>CS787: Generative AI</i> 🔗	<i>Aug'25 – Nov'25</i>
<ul style="list-style-type: none">Built privacy-evaluation pipeline for RAG systems to check leakage detection, mitigation, and utility assessmentbenchmarked privacy defenses (PII sanitize, summarization, prompt engineering) leakage-utility tradeoffsConducted membership-inference auditing via S-RAG, analyzing implicit privacy risks in RAG systems	
Unsupervised Domain Adaptation <i>CS771: Introduction to Machine Learning</i> 🔗	<i>Oct'24 – Nov'24</i>

• Studied **Continual Domain Shift Learning** and analyzed methods such as **RandMix, pseudo-labelling, and prototype contrastive alignment** for improving cross-domain generalization.

• Evaluated how these strategies enhance **model adaptability** with shifting data distributions

• Presented findings to an audience of **50+ students**, highlighting practical trade-offs and best practices for domain adaptation in real-world ML systems

- Built **binary classification** models on **3** datasets using **n-grams**, **XGBoost**, and **deep neural networks**
- Applied preprocessing techniques such as **one-hot encoding**, **emoji-to-text**, and **BERT embeddings** to study cross-dataset feature correlations
- Achieved **97.13%**, **98.77%**, and **93.05%** accuracy through **GridSearchCV**-based optimization

Mentoring Experience

Culinary Arts Club Leader | Media and Cultural Council

July'24 – Sep'24

- Led the **first tenure** with a **20-member team**, managing operations, logistics, and large-scale event planning
- Organised a **community outreach event** teaching **30+ children** from villages on **food safety and nutrition**
- Conduct cooking sessions and competitions that enhance members' culinary skills while fostering team bonding

Student Guide | Counselling Service

Dec'23 – Feb'23

- Mentored six first-year students, supporting them with their arrival, orientation, and transition into IIT Kanpur
- Provided academic, social, and emotional support to help students adapt smoothly to college life and build a strong foundation

Relevant Courses

- Introduction to Machine Learning • Generative AI • Computational Physics • Statistical Mechanics • Probability and Statistics • Linear Algebra • Fundamentals of Computing • Multivariate Calculus • Coursera - Data Structures