

DEVANSH LODHA

Machine Learning • Computer Vision

Junior Undergraduate | Computer Science and Engineering

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EDUCATION

Indian Institute of Technology Gandhinagar
B.Tech in Computer Science and Engineering (Honors)

CGPA: 9.19/10
2023-2027

RESEARCH EXPERIENCES

Summer Research Internship Program at IIT Gandhinagar

Gandhinagar, India

Research Intern | Advisor: Prof. Nipun Batra | IIT Gandhinagar | Ongoing

May'25-July'25

- Investigating state-of-the-art Vision-Language Model (VLM) architectures to enhance object detection performance and mitigate domain shift challenges in satellite imagery.
- Creating benchmarks to systematically isolate and analyze specific VLM failure modes, such as deficiencies in fine-grained distinction and spatial reasoning.

SELECTED PROJECTS

Benchmarking Vision-Language Models for Brick Kiln Detection

Prof. Nipun Batra, IIT Gandhinagar | [GitHub Link](#) | [Blog Link](#)

Jan'25-May'25

- Demonstrated that fine-tuned Vision-Language Models (VLMs) outperform a YOLOv11-obb baseline with less than 5% of the training data, achieving superior F1-scores and generalization across diverse geographical regions.
- Engineered a comprehensive evaluation pipeline to benchmark leading VLMs (e.g., Florence-2, PaliGemma, Qwen2.5-VL) on zero-shot capabilities, data-efficient fine-tuning, and cross-domain generalization.
- Implemented data curation and processing workflows using *leafmap* for high-resolution imagery generation and *SAHI* for efficient tiled inference on large-scale satellite images.

BareBonesML: ML from Scratch

Personal Project | [GitHub Link](#) | [Blog Series](#)

Dec'24-Present

- Engineered a NumPy-based autograd engine from scratch, featuring dynamic computational graphs and reverse-mode automatic differentiation for a wide range of operations.
- Constructed foundational neural networks, including MLPs, RNNs (with BPTT), LSTMs, and a full Encoder-Decoder Transformer with self-attention, all from first principles.
- Transitioned the project to PyTorch to implement and train modern architectures, beginning with a Vision Transformer (ViT) for image classification on the CIFAR-10 dataset.

VLMs Are Blind Analysis

Prof. Nipun Batra, IIT Gandhinagar | [GitHub Link](#)

Dec'24-Dec'24

- Systematically evaluated prominent open-source Vision-Language Models (Qwen-VL, Llama-3.2-Vision, Llava-1.6, InternVL2.5, Phi-3.5-vision) on the challenging BlindTest benchmark.
- Developed a standardized evaluation pipeline to reproduce and analyze the findings of the paper [Vision Language Models Are Blind](#), generating model predictions with consistent, structured prompts.

Satellite Solar Panel Detection using YOLO

Prof. Nipun Batra, IIT Gandhinagar | [Blog Link](#)

Feb'25

- Achieved a 0.83 F1-score at an IoU of 0.7 by training a YOLOv11x model to detect solar panels in a high-resolution (31 cm) satellite imagery dataset.
- Engineered a geospatial conversion pipeline using the EPSG:32633 projection to transform bounding box coordinates into precise geographic coordinates for accurate area calculation.

Human Activity Recognition (HAR) with Decision Trees

Prof. Nipun Batra, IIT Gandhinagar | [GitHub Link](#)

Aug'24-Nov'24

- Achieved 85.8% precision and 85.7% accuracy by training a Decision Tree classifier to recognize human activities from time-series sensor data.
- Engineered a feature extraction pipeline using the TSFEL library and applied Principal Component Analysis (PCA) for effective dimensionality reduction on the UCI-HAR dataset.
- Validated the model's performance on real-world data collected using the Physics Toolbox Suite mobile application.

Text Generation via Next Character Prediction

Prof. Nipun Batra, IIT Gandhinagar | [Streamlit App](#) | [GitHub Link](#)

Aug'24-Nov'24

- Developed an unsupervised text generation pipeline using a Multi-Layer Perceptron (MLP) to predict the next character in a sequence.
- Utilized character embeddings to capture contextual patterns from the works of Arthur Conan Doyle ("Sherlock Holmes") and deployed the model as an interactive Streamlit app.

8-Bit Processor Design and Simulation in Verilog

Prof. Joycee Mekie, IIT Gandhinagar | [GitHub Link](#) | [Blog Link](#)

Apr'25-Apr'25

- Designed and implemented a fully functional 8-bit, accumulator-based processor in Verilog from the ground up, featuring a custom 19-instruction ISA.
- Engineered all core modular components, including a 16x8-bit register file, a multi-function Arithmetic Logic Unit (ALU), and a combinational control unit for opcode decoding and data path management.

Carvana Image Segmentation using ResNet-18

Machine Learning Club, IIT Gandhinagar | [GitHub Link](#)

Nov'24-Nov'24

- Achieved over 99.8% segmentation accuracy on the validation set by developing a custom image segmentation pipeline for the Carvana dataset.
- Leveraged transfer learning with a pre-trained ResNet-18 encoder and engineered a custom decoder with ConvTranspose2d layers for fine-grained upsampling.

Convolutional Neural Networks for Edge Detection

Machine Learning Club, IIT Gandhinagar | [GitHub Link](#)

Oct'24-Oct'24

- Secured 1st place in the Intermediate Machine Learning Task at What The Hack 2024 by developing a CNN to learn and approximate the Sobel operator for edge detection.
- Trained the model using L1 loss, the Adam optimizer, and a CosineAnnealingLR scheduler to ensure robust performance in capturing image gradients.

AWARDS AND ACHIEVEMENTS

- **Ranked 6th among 373 students** across all disciplines at IIT Gandhinagar (end of freshman year), earning a selective branch change to Computer Science and Engineering. 2024
- **Dean's List Award recipient** for outstanding academic performance in both Semester I and Semester II at IIT Gandhinagar. 2024
- **Top 20% Departmental Rank:** Recognized by the Head of Department, CSE for academic excellence within the Computer Science and Engineering branch (Letter of Acknowledgement). 2025
- **Awarded NTSE Scholarship**, a prestigious national honor granted by the Government of India to the top 0.1% of students for exceptional academic ability. 2021
- **State Topper** in the Indian Olympiad Qualifier in Physics (IOQP), organized by HBCSE as part of India's official Physics Olympiad program. 2023
- **Shortlisted for Indian Statistical Institute (ISI) Interview**, a distinction earned based on exceptional performance in its highly competitive national entrance examination. 2023

MENTORSHIP AND TEACHING EXPERIENCE

- **Teaching Assistant, ES 335: Machine Learning:** *Selected as a Teaching Assistant for the core undergraduate Machine Learning course. Responsibilities will include conducting tutorials, grading assignments, and mentoring students through complex topics.* Aug'25-Dec'25
- **Tutorial Instructor, AI for Social Good ACM India Summer School 2025:** *Designed and delivered a comprehensive tutorial on Vision Language Models to an audience of over 60 undergraduate and postgraduate participants. The session covered foundational concepts and included a hands-on Jupyter Notebook for practical implementation.* Jun'25
- **Certification in Teaching:** *Completed a rigorous program on effective teaching methodologies, pedagogical techniques, and student mentorship offered by IIT Gandhinagar.* Jan'25

PUBLICATIONS

Benchmarking Vision-Language Models under Distribution Shifts in Satellite Imagery - Devansh Lodha, Rishabh Mondal, Nipun Batra *In Preparation*

SKILLS

Languages: Python C C++ SQL HTML CSS JavaScript Verilog

Tools: Git, GitHub HuggingFace Jupyter Quarto Conda Homebrew Docker Jupyter GroqCloud
LaTeX Remote SSH Linux Server Management (Bash, CLI) NVIDIA CUDA Toolkit Adobe Suite Figma
Xilinx Vivado Autodesk Inventor MATLAB Arduino
Libraries: PyTorch Scikit-Learn Unsloth Maestro Transformers FlashAttention Ultralytics Supervision
Kornia SAHI TSFEL Tensorboard Streamlit Flask NumPy Pandas Seaborn Matplotlib

RELEVANT COURSES

Upcoming Institute Courses: ES 666: Computer Vision, ES667: Deep Learning, CG 501: Computation and Cognition, CS 202: Software Tools and Techniques for CSE, CS 329: Foundations of AI: Multiagent Systems, CS 330: Operating Systems, CS 331: Computer Networks, CS 327: Compilers, CS 432: Databases

Completed Institute Courses: CS 328: Introduction to Data Science [A], ES 335: Machine Learning [A], ES 114: Probability Statistics and Data Visualization [A-], MA 104: Ordinary Differential Equations [A], MA 205: Calculus of Several Variables [A-], MA 103: Calculus of Single Variable and Linear Algebra [A], ES301: Data Structures and Algorithms - II [B], ES 242: Data Structures and Algorithms I [B], ES 214: Discrete Mathematics [A-], ES 204: Digital Systems [A-], ES 116: Principles and Applications of Electrical Engineering [A]

POSITIONS OF RESPONSIBILITY & EXTRA CURRICULARS

- Organizer, Licensee, and Design & Tech Core | TEDxIITGandhinagar**
Sep'24-Present
 - Led and managed a cross-functional team of **80+ students** across Curation, Sponsorship, Event Management, and Design/Tech to execute a globally recognized TEDx event for an audience of 100+ attendees.
 - Directed the **Design and Tech team of 17 members**, establishing the creative vision and overseeing production of all branding materials and digital assets using Adobe Creative Suite, Figma, and Canva.
 - Oversaw all technical production, including videography, lighting design, live streaming, and post-production, ensuring alignment with TEDx's official quality standards for publication on their **42.5M subscriber** YouTube channel.
- Core Member, Machine Learning Club | IIT Gandhinagar**
Oct'24-Present
 - Organized workshops and interactive coding sessions to foster a campus-wide culture of machine learning, introducing foundational and advanced concepts to students of all skill levels.
 - Developed and launched the **Winter ML School website** (Advanced Track) to create structured, self-paced learning paths for beginner and advanced participants.