NIHAR SHAH

Machine Learning • Computer Vision • Natural Language Processing
Senior Undergraduate | Electrical Engineering | Minors in Computer Science and Engineering

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EDUCATION

Indian Institute of Technology Gandhinagar (IITGN) — CGPA: **8.80**/10
B.Tech in Electrical Engineering with Minors in Computer Science and Engineering[Transcript] — 2022 - 2026

Prakash College of Commerce and Science — Percentage: **87.17**
Class XII, Maharashtra State Board — 2020 - 2022

Ryan International school — Percentage: **97.6**
Class X, Indian Certificate of Secondary Education — 2006 - 2020

WORK EXPERIENCE

Research Intern, Purdue University

Prof. Dharmendra Saraswat | Purdue University — *May 2025 - July 2025*

- Conceived and built an **LLM-orchestrated mission execution framework** for UAVs, translating natural language directives into executable waypoint-based flight plans.
- Integrated **DJI Matrice 300 RTK** with the Onboard SDK (OSDK) using C++ scripts for autonomous waypoint navigation, mission pausing, and return to home with human in the loop supervision.
- Formulated **behavior tree-based mission planning** to ensure robust, modular, and interpretable UAV control by mapping high-level LLM outputs to low-level drone API calls.
- Built a **voice-interactive interface** by integrating ASR and TTS pipelines, enabling real-time verbal mission input.
- Conducted agricultural field tests to validate system performance in mapping scenarios, emphasizing safety and operator authority preservation.

Summer Intern, Corover.ai

LLM, Speech, Vision, Video Processing — *May 2024 - Jul 2024*

- Constructed a **voice-enabled UPI payment simulator** integrating SpeechRecognition, gTTS, and Google Pay APIs for seamless transactions, and a real-time **face recognition system** using OpenCV and deep learning for secure Aadhaar-based authentication.
- Built a **Bigram Language Model with transformer architecture** in PyTorch to generate text from pathology data, incorporating self-attention and feed-forward layers.
- Created real-time **TTS systems using Bark and Coqui**, and built a multimedia processing app for video-to-audio conversion, speech transcription, and sentiment analysis.
- Worked directly under the **CTO of Corover.ai** and led a team of three interns during my tenure at Corover.

RESEARCH PROJECTS

Outdoor Scene Inverse Rendering using Single Image

Prof. Shanmuganathan Raman | IIT Gandhinagar — *Dec 2024 – Ongoing*

- Formulated a pipeline to perform **inverse rendering** of outdoor scenes from a single RGB image by estimating lighting (SH coefficients) using VQGAN-based feature extraction.
- Implemented **2D and 3D Gaussian Splatting** for high-fidelity depth map and surface normal reconstruction.
- Evaluated geometry and lighting accuracy across diverse real-world outdoor datasets.

Low-Complexity GSC Beamforming via Kronecker Approximation

Prof. Nithin George | IIT Gandhinagar — *Jan 2025 – May 2025*

- Devised a **Nearest Kronecker Product (NKP)-based adaptive GSC beamformer** to reduce computational complexity in large microphone arrays.
- Achieved speedup in LMS/RLS updates by decomposing weight matrices into low-rank Kronecker factors.
- Demonstrated improved interference suppression with reduced execution time at the **Undergraduate Research Showcase 2025**.

CLIP-Infused Image-Based Rendering (IBRNet) with WaveNet Architecture

Prof. Shanmuganathan Raman | IIT Gandhinagar — *Aug 2024 – Dec 2024*

- Enhanced IBRNet's robustness to large baseline variations using **CLIP embeddings** for generalized, high-quality feature representation.

- Designed a **WaveNet-inspired encoder** to compress CLIP's 768-dimensional embeddings to 32 dimensions while retaining spatial context.
- Fine-tuned the encoder-decoder pipeline with pretrained IBRNet weights, improving interpolation accuracy and multi-view rendering quality.

SELECTED PROJECTS

Animal Classification Using Custom CNN Models

Prof. Nipun Batra | IIT Gandhinagar | Project Link *Apr 2024 - May 2024*

- Architected and benchmarked custom CNN models for multi-class animal classification using a dataset of 90 images.
- Configured and trained models without pre-trained architectures, using 3-fold cross-validation for robustness.
- Visualized convolutional features and compared accuracy across multiple architectures.

Child Safety App

Prof. Nithin V. George | IIT Gandhinagar | Project Link *Aug 2023 - Sep 2023*

- Built a mobile app for real-time monitoring of a child's bicycle using GPS, accelerometer, and gyroscope data.
- Developed features like fall detection, over-speed alerts, and geofencing, ensuring secure communication via TCP/IP over the IITGN network.
- Added automatic audio recording and parent notification for safety assurance.

Text Generator using MLP

Prof. Nipun Batra | IIT Gandhinagar | Project Link *Feb 2024 - Mar 2024*

- Built an MLP-based character-level text generator predicting next characters from context embeddings.
- Performed hyperparameter tuning and deployed the interactive application using Streamlit.

Binary Image Classification using VGG Architecture

Prof. Nipun Batra | IIT Gandhinagar | Project Link *Mar 2024 - Apr 2024*

- Engineered VGG1 and VGG3 CNN architectures and tested them for binary image classification.
- Performed augmentation and fine-tuned pre-trained VGG16 models using transfer learning.
- Compared model performance using accuracy, loss curves, and TensorBoard visualizations.

Super Resolution and Image Reconstruction

Prof. Nipun Batra | IIT Gandhinagar | Project Link *Mar 2024 - Apr 2024*

- Devised image super-resolution and reconstruction using **Random Fourier Features** and Linear Regression.
- Quantitatively evaluated improvements using PSNR and RMSE metrics; also explored matrix factorization (ALS, GD) for incomplete image recovery.

Fuzzy Logic Based App

Prof. Nithin V. George | IIT Gandhinagar | Project Link *Mar 2024 - Apr 2024*

- Developed fuzzy logic control for monitoring child safety using accelerometer and sound data.
- Constructed rule-based decision systems to detect abnormal motion and trigger automatic safety actions.

Modelling Oil Spillage – Advection-Diffusion Equation (2D)

Prof. Dilip Srinivas Sundaram & Prof. Akshaa Vatwani | IIT Gandhinagar | Project Link *Apr 2023 - Jun 2023*

- Modeled 2D advection-diffusion of oil spills using partial differential equations and finite difference methods.
- Analyzed concentration profiles and linked diffusion models with Brownian motion and Reynolds transport theorem.

Human Activity Recognition (HAR)

Prof. Nipun Batra | IIT Gandhinagar | Project Link *Jan 2024 - Feb 2024*

- Trained Decision Tree-based classifiers to recognize six human activities using accelerometer data.
- Applied featurization and PCA for dimensionality reduction and bias–variance optimization.

Smart Game Engine using C/C++

Prof. Balagopal Komarath | IIT Gandhinagar | Project Link *Aug 2023 - Nov 2023*

- Built intelligent game engines for Connect4, Sudoku, and TicTacToe using algorithmic optimization.
- Applied graph-based and search algorithms for efficient strategy computation.

Data Narrative of Tennis Major Tournaments

Prof. Shanmuganathan Raman | IIT Gandhinagar | Project Link *Mar 2023 - May 2023*

- Analyzed and visualized tennis tournament data using NumPy, Matplotlib, Pandas, and scikit-learn.
- Derived player performance trends through data storytelling and analytics.

Evaporative Peltier Cooling Tent

Prof. Udit Bhatia | IIT Gandhinagar | Newspaper Article *May 2023 - Jul 2023*

- Engineered a collapsible, sensor-based cooling tent for temperature and humidity regulation in outdoor conditions.
- Combined Peltier modules and evaporative cooling for efficient and sustainable temperature control.

AWARDS AND ACHIEVEMENTS

- Achieved All India Rank of **3068** in JEE Advanced '22, among 1.1 million aspirants.
- I was awarded the Dean's List award in Semester II and Academic Citation in semester VI for excellent academic performance and 9 + SPI in Semesters I, II, V, and VI (4/6 semesters).

SKILLS

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

Tools: Xilinx | Vivado | LaTeX | Git | Git Workflows | MATLAB | Android Studio

Libraries: OpenCV | PyTorch | TensorBoard | NumPy | Pandas | Plotly | Seaborn | Scikit-Learn | Streamlit | TSFEL | SFML .

RELEVANT COURSES

ML / Data Science: • Machine Learning [**A-**] • Data Centric Computing [**A-**]

Signals & Systems: • Digital Signal Processing [**A**] • Signals, Systems and Random Processes [**A-**]

Mathematics: Numerical Methods [**A**] • Linear Algebra & Single Variable Calculus [**A**] • Ordinary Differential Equations [**A**] • Calculus of Several Variables [**A-**]

Data Structures & Algorithms: • Introduction to Computing [**A-**] • Data Structures and Algorithms I [**B (83/100)**]

Electrical & Systems: • Analog and Mixed Signal Circuits [**A**] • Digital Systems [**A**] • Principles and Applications of Electrical Engineering [**A**][1]

POSITIONS OF RESPONSIBILITY & EXTRA CURRICULAR

- **Senior Executive, Events and Events Management, Amalthea'23** *Aug 2023 - Oct 2023*
  - Served as the Event Lead for **GameJam'23**, a global-scale event attracting participants from Malaysia, Italy, and Indonesia. Coordinated cross-functional teams and managed event logistics to ensure smooth execution.
  - Organized a large-scale **Game Development Workshop** with 500+ participants from top institutes, facilitating collaboration between industry experts and students.
  - Contributed to end-to-end event management, ensuring efficient logistics, hospitality, and coordination across multiple teams.
- **Team Lead, Heatstroke Prevention Initiative** *(Evaporative Peltier Cooling Tent Project)* *May 2023 - Jul 2023*
  - Led a multidisciplinary team of 30 students, managing project planning, task distribution, and resource allocation to ensure timely completion of the prototype.
  - Fostered collaboration and guided the team through technical challenges, ensuring efficient execution of a low-cost, sensor-based heatstroke prevention solution.

[1] **B** = 8/10, **A-** = 9/10, **A** = 10/10.