Nihar Shah

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Education

Degree	Institute	CPI/%	Year
B.Tech.	IIT Gandhinagar	8.80	2022 - Present
Class XII	Prakash College of Commerce and Science	87.17	2022
Class X	Ryan International school	97.6	2020

INTERNSHIP

- **Research Internship, Purdue University** **[May, 2025 - July, 2025]**
  (Advisor – Prof. Dharmendra Saraswat, Purdue University)
  - Designed and implemented an LLM-orchestrated mission execution framework for UAVs, enabling natural language directives to be translated into executable waypoint-based flight plans.
  - Integrated DJI Matrice 300 RTK with the Onboard SDK (OSDK) using C++ scripts, implementing autonomous waypoint navigation, mission pausing, and return-to-home functionalities with human-in-the-loop supervision.
  - Developed behaviour tree-based mission planning to ensure robust, modular, and interpretable UAV control, mapping high-level LLM outputs to low-level drone API calls.
  - Built a voice-interactive interface by integrating Automatic Speech Recognition (ASR) and Text-to-Speech (TTS) pipelines, enabling real-time verbal mission input.
  - Conducted field tests to validate system performance in agricultural mapping scenarios, focusing on safety, reliability, and operator authority preservation.

- **Summer Internship, Corover.ai** **[May, 2024 - Jul, 2024]**
  (LLM,Real-time Face Recognition, Video Processing, Streamlit, WebRTC, Voice Cloning, Corover.ai)
  - Developed a Python-based simulation for a voice-enabled UPI payment app, integrating SpeechRecognition, gTTS, and APIs like Google Pay for seamless transactions. Also built a real-time face recognition system using OpenCV and deep learning, implementing secure Aadhaar retrieval, data management via CSV, and a Tkinter GUI for interaction.
  - Developed a Bigram Language Model using PyTorch with transformer architecture to generate text from pathology data. Implemented multi-head self-attention and feed-forward layers for effective text generation
  - Worked under the CTO of Corover.ai and lead a team of 3 interns during my tenure at Corover.
  - Developed a real-time text-to-speech system using Bark and Coqui TTS, leveraging deep learning for high-quality audio generation, and created a multimedia processing application in Python for video-to-audio conversion, speech transcription, content summarization, and sentiment analysis.

RESEARCH PROJECTS

- **Outdoor Scene Inverse Rendering using Single Image** **[Dec, 2024 - Ongoing]**
  (Advisor – Prof. Shanmuganathan Raman, IIT Gandhinagar)
  - Designed a pipeline to do 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 techniques for high-fidelity depth map and surface normal reconstruction.
  - Evaluated results on diverse real-world outdoor datasets for geometry and lighting accuracy.

- **Low-Complexity GSC Beamforming via Kronecker Approximation** **[Jan, 2025 - May, 2025]**
  (Advisor – Prof. Nithin George, IIT Gandhinagar)
  - Developed a Nearest Kronecker Product (NKP)-based adaptive GSC beamformer to reduce computational complexity in large microphone arrays.
  - Achieved significant speedup in LMS and RLS updates by decomposing the beamformer weight matrix into low-rank Kronecker factors.
  - Demonstrated superior interference suppression with reduced execution time through simulations, as presented at the Undergraduate Research Showcase 2025.

- **CLIP-Infused Image-Based Rendering (IBRNet) with WaveNet Architecture** **[Aug, 2024 - Dec, 2024]**
  (Advisor – Prof. Shanmuganathan Raman, IIT Gandhinagar)
  - Enhanced IBRNet's robustness to large baseline variations by integrating CLIP embeddings for generalized, high-quality feature representation.
  - Designed a WaveNet-inspired encoder to compress CLIP's 768-dimensional patch embeddings to 32 dimensions while retaining spatial context for efficient query feature mapping.
  - Fine-tuned the encoder-decoder pipeline with pretrained IBRNet weights, improving interpolation accuracy and rendering quality in challenging multi-view reconstruction settings.

PROJECTS

- **Animal Classification Using Custom CNN Models :** **[Apr, 2024 - May, 2024]**
  (Advisor – Prof. Prof. Nipun Batra, IIT Gandhinagar) | *Project Link*

- Developed and evaluated custom CNN models for animal classification across one-vs-rest, binary, and 5-class scenarios using a dataset of 90 animal images.
- Organized dataset for multi-class classification, implemented custom CNN architecture without pre-existing models, and utilized 3-fold cross-validation for robust evaluation.
- Achieved accurate classification results, visualized convolutional layer outputs to interpret learned features, and demonstrated effective model performance through classification matrices.

- **Child Safety App** **[Aug, 2023 - Sep, 2023]**
  (Advisor – Prof. Nithin.V.George, IIT Gandhinagar) | *Project Link*
  - Engineered a mobile app for real-time monitoring of a child's cycle using GPS, accelerometer, and gyroscope data.
  - Implemented features like over-speed detection, fall detection, and boundary crossing for enhanced safety.
  - Ensured secure communication and automatic audio recording for timely parent notifications.
  - Established secure communication via TCP/IP model over the IITGN-SSO network and implemented automatic audio recording on the child's device for unattended alarms, ensuring timely parent notification.

- **Text Generator based upon next character prediction from an MLP:** **[Feb, 2024 - Mar, 2024]**
  (Advisor – Prof. Prof. Nipun Batra, IIT Gandhinagar) | *Project Link*
  - This project involves generating text by predicting the next character based on the last 'k' characters. The model used is a neural network with an embedding layer followed by 2 hidden layers. The model is able to capture the semantics of English language and generate meaningful words and phrases.
  - Observed the difference in results based on the choice of embedding and architecture of the neural network. Performed hyperparameter tuning to get the best results. Learned to deploy an application on Streamlit.

- **Binary Image Classification Using VGG Architecture :** **[Mar, 2024 - Apr, 2024]**
  (Advisor – Prof. Prof. Nipun Batra, IIT Gandhinagar) | *Project Link*
  - Implemented VGG1 and VGG3 architectures for Convolutional Neural Networks and tested their performance on the classification of two image classes.
  - Performed Augmentation over the dataset and trained the VGG3 model over this augmented dataset.
  - Performed Transfer Learning over the pre-trained VGG16 models while both freezing and un-freezing the fully connected layers and compared the performance of all these models by the gradual increase in classification accuracy over the testing images, changes in training and validation losses using Tensorboard.

- **Super Resolution and Image Reconstruction:** **[Mar, 2024 - Apr, 2024]**
  (Advisor – Prof. Prof. Nipun Batra, IIT Gandhinagar) | *Project Link*
  - Implemented image super-resolution and reconstruction using Random Fourier Features and Linear Regression, achieving qualitative and quantitative enhancements with metrics like RMSE and PSNR.
  - Also explored matrix factorization techniques, including Alternating Least Squares and Gradient Descent, to handle incomplete image data.

- **Fuzzy Logic Based App** **[Mar, 2024 - April, 2024]**
  (Advisor – Prof. Nithin.V.George, IIT Gandhinagar) | *Project Link*
  - Engineered a mobile app for real-time monitoring of a child's cycle using GPS.
  - Implemented features like over-speed detection, fall detection, and boundary crossing for enhanced safety using Fuzzy Logic on input parameters acceleration and sound of the user.
  - Implemented automatic audio recording on the child's device for unattended alarms, ensuring timely parent notification.

- **Modelling Oil spillage - Advection-Diffusion Equation(2-D)** **[Apr, 2023 - Jun, 2023]**
  (Advisor – Prof. Dilip Srinivas Sundaram and Prof. Akshaa Vatwani, IIT Gandhinagar) | *Project Link*
  - Conducted the analysis of the Convection-Diffusion Equation within the framework of mathematical modeling.
  - Applied Reynold's Transport Theorem to diverse engineering problems, effectively bridging theoretical concepts with practical applications to showcase a comprehensive understanding of fluid mechanics and system dynamics.
  - Explored the relationships between the Diffusion Equation, Brownian Motion, and derived numerical solutions.

- **Human Activity Recognizer (using Machine Learning) :** **[Jan, 2024 - Feb, 2024]**
  (Advisor – Prof. Prof. Nipun Batra, IIT Gandhinagar) | *Project Link*
  - Made a machine learning model that uses only decision trees to recognise 6 different human activities by utilizing time series data of acceleration involved
  - Learned to handle time series data by employing featurization and dimension reduction. Performed hyperparameter tuning select the best model based on bias-variance tradeoff.
  - Deployed the model and tested the predictions on real acceleration data from collected from a smartphone.

- **Smart Game Engine using C/C++** **[Aug, 2023 - Nov, 2023]**
  (Advisor – Prof. Balagopal Komarath, IIT Gandhinagar) | *Project Link*
  - Developed intelligent game strategies for Connect4, Sudoku, and TicTacToe, improving AI decision-making.
  - Applied graph-based algorithms to create efficient solutions in games like Sim, 3X3 Rubik's cube and UpitUp.

- **Data Narrative of Tennis Major Tournament :** **[Mar, 2023 - May, 2023]**
  (Advisor – Prof. Shanmuganathan Raman, IIT Gandhinagar) | *Project Link*
  - Observed the data of Tennis Major Tournament USA, and analyzed different predictions and trends.
  - Visualized data points, curves, graphs using NumPy, Matplotlib, Pandas, scikit-learn, and SciPy.

- **Evaporative Peltier Cooling Tent, for humidity and temperature regulation** **[May, 2023 - Jul, 2023]**
  (Advisor – Prof. Udit Bhatia, IIT Gandhinagar) | *Newspaper Article*
  - Engineered a smart sensor-based,collapsible temperature and humidity regulating device to assist individuals whoare more susceptible to heat strokes and need a cool environment while working in extreme temperature conditions.
  - Successfully incorporated the Peltier Module for cooling along with the traditional Evaporative based Cooling method to achieve an optimal balance between efficiency as well as sustainability of the cooling model.

TECHNICAL SKILLS

- **Languages:** Python, C, C++, C#, Verilog
- **Tools:** Xilinx Vivado, Android Studio, Git(Basic), TinkerCad, Latex, Unity, Autodesk Fusion360, MATLAB.
- **Libraries:** Streamlit, Tensorflow, Scikit-learn, Pytorch, Seaborn, Matplotlib, OpenCV, Numpy, Pandas, Matplotlib, Sci-Py, TSFEL.

RELEVANT COURSES

- **ML/DataScience :** Machine Learning (A- or 9/10), Data Centric Computing (A- or 9/10)
- **Signals and Systems :** Digital Signal Processing(A or 10/10), Signals, Systems and Random Processes (A- or 9/10)
- **Math:** Numerical Methods (A or 10/10), Linear Algebra and Single Variable Calculus (A or 10/10), Ordinary Differential Equations (A or 10/10), Calculus of Several Variables(A- or 9/10)
- **DSA:** Intro to Computing(A- or 9/10), Data Structures and Algorithms 1 (83/100 and B or 8/10).
- **Others:** Analog Mixed Signal Circuits (A or 10/10), Digital Systems (A or 10/10), Principles and Applications of Electrical Engineering(A or 10/10)

ACHIEVEMENTS

- Achieved All India Rank of **3068** in JEE Advanced ’22, among 1.1 million aspirants.
- Felicitated with Dean’s List award in Semester 2 for excellent academic performance, IITGN.

POSITIONS OF RESPONSIBILITY

- **Senior Executive, Events and Events Management, Amalthea’23** (Technical Summit of IIT GN) : **[Aug, 2023 - Oct, 2023]**
  - Served as the Event Lead for GameJam’23, a global-scale event attracting participants from Malaysia, Italy, Indonesia, and beyond. Coordinated teams and managed event logistics to ensure a seamless experience for all attendees.
  - Organized a Game Development Workshop, drawing 500+ participants from top institutes and promoting game development. Managed workshop logistics and facilitated collaboration between industry experts and attendees.
  - Contributed to event management by ensuring smooth logistics, accommodations, and hospitality. Enhanced the overall experience with attention to detail and efficiency.
- **Team Lead of Group of 30** **[May, 2023 - Jul, 2023]**
  - Led a diverse team of 30 individuals from various disciplines, optimizing their potential through strategic work allocation and fostering a collaborative, healthy work environment. Demonstrated strong leadership by mentoring team members and driving efficient teamwork to meet project deadlines.
  - Acquired hands-on experience in project planning, resource allocation, and problem resolution, contributing to a successful outcome in addressing heatstroke prevention. Displayed effective leadership by guiding the team through challenges and ensuring alignment with project goals.