Harshit

+91 8295304114 harshitwork4032@gmail.com LinkedIn Github Portfolio ReseachGate

Education

National Institute of Technology, Kurukshetra, *B.Tech in Electrical Engineering (CGPA 7.93/10)* **2021 - 2025**

- **Key Modules :** Basics of Programming, Modelling & Simulation, Control System, Applied Linear and Vector Algebra, Robotics, Microprocessor and MicroController, Virtual Instrumentation, Electric Vehicle, Reliability Engineering, Communications Skills in English, Ethics and Intellectual Property Rights, Business Management.

Area of Interests

- Applied Deep Learning
- ML/LLM Operations
- Model Optimization
- Agentic AI and AI Agents
- Computer Vision
- Generative AI
- Deep Reinforcement Learning
- Multimodality AI

Research and Internship Experience

Research Trainee |*Deep Learning, ComputerVision, Digital image Processing, GenAI* **Jan 2024 - Jun 2024**
Council of Scientific & Industrial Research–Central Scientific Instruments Organization, Chandigarh. **ON-SITE**

- Worked on **generative models** including AE,VAE,Tranformer based AE and Diffusion model for molecules generation.
- Contibuted in a **research paper** on Navigating the Fragrance space Via Generative Models And Predicting Odors.
- Experimented with **self-/supervised** techniques for effective representaton and transfer learning.
- Worked on SOTA classification architecture **AccNet** for time–series data classification from acceleration in 3 dims.
- Implemented **YOLO** model for animal detection, recognition, and annotation classification for labeled data collection.

Deep Learning Intern |*Deep Learning , Audio and Digital processing , Model Optimization* **May 2024 - Jul 2024**
IIT Ropar - Technology & Innovation Foundation (iHub - AWaDH) **REMOTE**

- Utilized **OpenAI API** for synthetic image gen using **DALLE3**, enhancing the dataset for classification of bees species.
- Integrated **GPT-3.5-turbo** via OpenAI API to generate structured **bee-flower relationships**, improving data diversity for model training. [**PPT**]
- Developed a Convolutional Neural Network based bioacoustic classification model architecture to classify beehive state.
- Explored different time-frequency representations of audio, experimented with different networks such as ViT, CNN.
- Improved model's accuracy by 31% & achieved **98.31%** accuracy via **data augmentation** and **hyperparam–tuning**.
- Optimized the network, reducing model size from **21.82 MB** to **1.79** MB and accelerating inference time by **66%**, maintaining the accuracy of **97%**. [**Report**]

Undergraduate Researcher |*Electricity Load Forecasting using ML/DL and Hybrid Models* **Jan 2025 - Present**
National Institute of Technology, Kurukshetra - Electrical Engineering Department **ON-SITE**

- Developed models for **short-term electricity demand forecasting** using hourly time series data and exogenous features like temperature, Weekdays/Weekend demand and holidays, under the supervision of **Dr. Ashwani Kumar**.
- Performed **EDA** (exploratory data analysis) to identify trends, seasonality, and autocorrelation patterns in load data.
- Engineered features such as lag variables, rolling statistics & calendar-based indicators to improve model input quality.
- Built and evaluated **ML** (RF, XGB, SVR, GB, DT, ARIMA), **DL models** (LSTM, GRU, CNN-LSTM, ANN) and **hybrid approaches** (ARIMA+MLP, RF+XGB+ARIMA); used **GridSearchCV** to optimize hyperparameters
- Achieved best results with **RF (MAE: 10.61, RMSE: 13.93, MAPE: 0.89)**; documented findings in a detailed [**report**], delivered a final [**ppt**] summarizing methodology, results and key insights and shared all [**Code**] via GitHub

Projects

Multi-Model Voice & Text Chatbot | Streamlit, LLMs, Reliability [**Source Code**]

- Built a **Streamlit-based chatbot** supporting **text and voice input** with transcription, LLM response generation, and **text-to-speech** output. ***[link]***
- Integrated **OpenAI GPT-3.5-turbo, Groq (DeepSeek-LLaMA-70B), and Gemini Pro 1.5** for **multi-model** response generation with **fallback handling**.
- Implemented **speech-to-text** using **Whisper** and **text-to-speech** using **OpenAI TTS** for full voice interaction.
- Designed a modular, **highly reliable** pipeline (Approach 2) with support for audio files, mic input, and manual text queries; compared it with a basic LLM pipeline (Approach 1 i.e. ***[speech-to-speech Voice-Bot]***).
- Deployed on **Streamlit Cloud** using **secure API key management**; produced system architecture diagrams and Reliability block diagram to visualize design improvements.

Agentic LLM for Autonomous Shopping Assistance |ReAct, Chain of tools, ReST, Multi-Agent [Source Code]

- Built an **Agentic LLM for shopping** with tool-augmented reasoning for multi-step product search and comparison.
- Integrated **external APIs** like Google Search, Firecrawl, and Wikipedia for **real-time knowledge retrieval**.
- Implemented **self-improvement** via adaptive reflection, black-box probing, fine-tuning, and reward ranking.
- Developed an evaluation pipeline for benchmarking and visualizing agent performance on **Webshop tasks**. [*Video*]

Stable Diffusion | Latent Diffusion, U-Net, Variational AutoEncoder, Clip, PyTorch [Source Code]

- Developed SD from scratch in PyTorch, utilizing **latent diffusion** to generate images from text and image prompts.
- Implemented **U-Net architecture** for image generation and classifier-free guidance for conditional sampling.
- Leveraged **CLIP embeddings** for improved text-to-image alignment and **VAE** for compressed latent space encoding.
- Applied principles from **Denoising Diffusion Probabilistic Models (DDPM)** for progressive noise removal and image refinement. [*Referenced implementation repository*]

Chatbot | LLama2(LLM), kivymd, HuggingFace, PyTorch [Source Code]

- Implemented the **LLaMA 2** architecture from scratch using **PyTorch**, incorporating advanced components like **Rotary Positional Embeddings, Grouped Query Attention (GQA), RMSNorm, SwiGLU, and KV caching**.
- **Fine-tuned** the LLaMA 2-7B-chat model on a custom dataset using **PEFT** like **LoRA and QLoRA**. [*NoteBook*]
- Built an interactive GUI using KivyMD, allowing seamless interaction with the fine-tuned model for text generation.

MuJoCoAI | Deep Reinforcement Learning, Q–Learning [Source Code]

- Implemented **DQN** and **A3C** models to enhance decision-making in non-deterministic environments.
- Developed a customizable environment with Kivy for **self-driving cars** and **Lunar Lander** using **OpenAI Gym**.
- Applied **TD3** model to optimize policies in complex **MuJoCo** environments like Ant, Half-Cheetah, and Humanoid.

Sign Language Detection |Action Recognition, ANN, LSTM [Source Code]

- Built a Real-time **sign language detection model**, empowered by **LSTM** layer for enhancing effectiveness.
- Extracted Holistic Key Points of palm and pose using the **Mediapipe** for training & testing action detection model.
- Developed a robust deep neural network using **Tensorflow & Keras**, utilizing a Stacked LSTM layer to effectively process and analyze the pattern from the sequences of detected holistic key points for real-time sign language decoding.

Facial Recognition Application |CNN, Siamese Neural Network, OpenCV, KivyMD [Source Code]

- Built a **deep facial recognition** application for face authentication integrated into a **Kivy** application.
- Built and trained a model **CNN-based Siamese model** using **Tensorflow & Keras**, Implemented data augmentation and dropout methods to improve generalization and reduce overfitting. ***[Siamese Neural Networks paper]***
- Developed a Kivy Application integrated with the DL model, achieving a perfect **precision & recall of 1** on test data.

Technical Skills

Languages & Libraries: C/ C++, Python, MATLAB/Simulink, Git, Numpy, Pandas, TensorFlow, Keras, PyTorch, Matplotlib, OpenCv, Scikit–learn, LaTeX, Langchain, HuggingFace | **Developer Tools**: Visual Studio Code, Jupyter Notebook, Google Collab, MATLAB, PyCharm, Github, Tableau | **Data Structure and Algorithms**: C++ |**Web–Development**: CSS, HTML, javascript, Bootstrap, Streamlit, KivyMD

Achievements

Smart India Hackathon – Winner(Intra College), ***Team Leader & AI Developer*** **NIT, KKR** **Sep 2023**

- Led a victorious team, showcasing AI development skills and strategic leadership in a nationwide hackathon.

Extracurricular ***Sports & Athletics***

- Represented **Haryana Cricket Association** in **U14** and **Vijay Merchant Trophy (U16)** cricket tournaments.
- Secured **third position** in **Intra-State Haryana Government U-17 cricket Tournament**.
- Competed in the **U14 State Level Basketball Tournament** representing Sirsa,Haryana.

Research Papers

- **Harshit**, et al. "CNN Optimization for Beehive Classification using Bioacoustic Signals." *Preprint on[arXiv]* , 2025.
- **Harshit**, et al. "Integrated Simulation Case Study of a Solar-Powered E-Rickshaw with MPPT Control, Hybrid Battery System, and Regenerative Braking for Better Efficiency & Cost-Reduction." *Accepted at ICASF 2025, Abu Dhabi, UAE.*
- **Harshit**, et al. "Comprehensive Evaluation of Different Approaches for Electricity Load/Demand Forecasting — Machine Learning, Deep Learning, and Hybrid Models." *Accepted for presentation at ICCTE-2025, University of North Bengal, India; To be published in Springer LNEE (Scopus Indexed).*
- **Harshit**, et al. "Forecasting Wind Power Generation: A Unified Evaluation of ML, DL, Transformer, and Zero-Shot Models under Diverse Data Configurations." *Manuscript in preparation.*

Position of Responsibility and Presentation

Seminar ***(Github)*** **NIT, Kurukshetra** **March 2025**

- Delivered a **presentation** on Evolution of AI towards Physical AI to class and Associate Prof. K.K Sharma. [**report**]

Embedded System and Robotics Club ***(EMR)*** **NIT, Kurukshetra** **Sep 2022 - Sep 2024**

- Volunteered in workshop, educating participants on constructing and operating line following & remote-controlled bot.
- Participated in a workshop on **DIP** (Digital Image Processing) focusing on **OpenCV, numpy, python, And PyAutoGUI** and created a gesture control video player project.