Darshan Makwana
Mechanical Engineering
Indian Institute of Technology Bombay

21D100003
B.Tech.
Gender: Male
DOB: 04/12/2003

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2025	8.89
Intermediate	HSC	S K Somaiya	2021	9.68
Matriculation	SSC	M D Bhatia	2019	9.04

Pursuing Dual Minors in **Computer Science** and **Artificial Intelligence & Data Science**

Scholastic Achievements

- Awarded **Branch Change** to Mechanical Engineering based on outstanding academic performance *(2022)*
- Amongst **top 1 percentile** of students in JEE out of **1+ million** candidates across India and abroad *(2021)*
- Awarded the prestigious **NMMS** Scholarship among **0.1+ million** talented candidates across the nation *(2018)*
- Amongst the **top 1%** at National level **Homi Bhabha Balvaidynanik** out of **1+ million** candidates *(2017)*

Internships & Research Experience

Audio Language Model for Instruction based Speech to Text *(May' 24 - Jul' 24)*

Guide: Harsh Kotta | AI Product Internship - Sprinklr Voice Team *Sprinklr Inc*

- Devised and Benchmarked **Audio Quantization** techniques for efficient representation in Transformer based LMs
- Conducted a PoC of a Unified LM that has generalized capabilities of **Text to Speech**, Word Boosting and NER
- Experimented and explored Novel Multi Modal Training paradigms for Text + Speech and Text + Image modalities

System Identification and Deep RL for Robust Quadruped Robot Control *(Jun' 23 - July' 23)*

Guide: Prof Marco Caccamo | Research Internship - Quadruped Robotics *TUM, Germany*

- Conducted **literature review** on system identification techniques and their applications to **Quadruped Robots**
- Developed and refined a system model, leveraging **system identification techniques** developed in the control domain to accurately represent the **Dynamics** and **Uncertainties** of a quadruped robot in the simulation
- Implemented various approaches to obtain system models for **MPC**, and compared them against **model free DRL**

Development and Testing of models for Product Photography Generation *(Feb' 23 - Apr' 23)*

Guide: Vignesh Bhaskaran | ML Internship - Diffusion Models *Hexo AI*

- Conducted literature review of latent diffusion models by comparing their architecture basis degree of **photorealism**
- Devised a text **conditional latent diffusion** model from scratch for generation of flowers from textual captions
- Worked in a team of **3** to deliver **robust and high fidelity** image inpainting models with **Textual Conditioning**

Stress testing Contextual AI Chatbots for B2B markets *(Dec' 22 - Jan' 23)*

Guide: Piyush Jaiswal | ML Internship - Contextual Chatbots *64Squares*

- Developed methods to analyze **unstructured** data on human dialogues improving natural language unit predictions
- Trained **Bert** and **Spacy** language models with **DIET** classifier for robust and accurate intent and entity predictions
- Performed stress testing on various proprietary models to determine their **stability** and improve their **resilience**

Publications

- COVID-19 Self diagnosis classification using BERT and LightGBM models: Shayona@SMM4H-23 *(Jul' 2023)*
  R Chavda, **Darshan Makwana** (2 others) accepted at SMM4H 2023 (Social Media Mining for Health Applications)

Major Projects

Robust Digital Image Watermarking *(Aug'23 - Nov'23)*

Guide: Prof Ajit Rajwade | Course Project - Fundamentals of Digital Image Processing

- Developed an Image Watermarking technique that embeds watermark in the **LSB space** to maintain **high fidelity**
- Benchmarked the watermarking technique with gaussian and salt & pepper noise of varying strength on **SIPI** dataset
- Achieved high quality image **reconstruction** and preservation with a PSNR of **51.15** and an average NCC of **80%**

Text to SVG Generation *(Aug'23 - Jun'23)*

AI Genesis Hackathon | HackerEarth

- Fused a differentiable vector rasterizer with a **latent diffusion model** for SVG generation using textual captions
- Built a pipeline to vectorize text2img diffusion samples and **fine-tuning** it with a Score based Distillation Loss
- Created a sleek UI using **Gradio** where users can **sample**, **Upload** and **edit** the generated SVGs from the pipeline

Unsupervised Structural Optimization *(Jan' 24 - Apr' 24)*

Guide: Prof Avinash Bhardwaj | Course Project - Operations Modeling and Analysis

- Created a framework for optimizing a structure under given constraints and loadings while minimizing the cost
- Formulated the problem as matrix equations and implemented an iterative solver for searching the optimal structure
- Implemented Topological Evolution via **NEAT** in the framework for searching the optimal topology of the structure

Fractal Curves for Tool Path Generation *(Aug' 23 - Nov' 23)*

Guide: Prof Gurminder Singh | Course Project - Manufacturing Processes II

- Developed algorithms that leveraged **fractal curves** for robust **Tool Path Planning** in **layered 3d printing**
- Implemented a **Recursive decomposition** based **fractal filling** for determining the trajectory of the printing tool

Physics Informed Neural Networks for Solving Differential Equations *(May'22 - Jul'22)*

Summer of Science | Maths & Physics Club

- Implemented a fully functional **Neural Network** using a novel approach for calculating the **Entropy Loss** and the **Backward Pass** from scratch using only **Numpy** library for understanding the core aspects of a NN
- Achieved an accuracy of **97%** on a **butterfly classification system** trained on Leeds wildlife butterfly dataset
- Developed an **OCR Neural Network** for solving **PDEs** using **Physics Informed Neural Networks (PINNs)**

Image to Image Translation with CycleGAN *(Dec'22 - Jan'23)*

Using GANs to create Art | Kaggle Hackathon

- Implemented a Conditional **Generative Adversarial Network** to achieve translation of images to monet paintings
- Built the **CycleGAN** model in **pytorch** and trained it on monet paintings dataset to achieve image style transfer
- Built a pipeline for evaluating the Modified FID (MiFID) from the generated samples achieving an **MiFID** of **52.23**

End to End Phone Calling Android Application *(Jun'22 - Jul'22)*

Phonathon | Student Alumni Relations Cell (SARC)

- Created an **Android Application** using **React Native** as a framework for the event of phonathon under SARC
- Implemented a **Normalized** database structure for authenticating, registering and logging users and alloting a group of alumni to a particular user model which resulted in **300%** y-o-y increase in participation for the event
- Ideated a **novel** approach for detecting **fraudulent phone calls** from a user and disqualifying them from the event

Linear Programming based Portfolio Optimization *(Jan'23 - Apr'23)*

Guide: Prof Ankur Kulkarni | Course Project - Games and Information

- Developed a portfolio optimization model using **MDP** framework, resulting in a **10%** increase in investment returns
- Utilized **linear programming** techniques to optimize a stock portfolio while maintaining a consistent level of risk
- Used **simulation-based** optimization, leading to **12%** increase in profit compared to traditional benchmarks

Control Theory Bootcamp *(Jun'23 - Aug'23)*

Learner's Space | Electronics & Robotics Club

- Utilized mathematical modeling techniques to analyze and predict system model of a bot and the actuator system
- Implemented a **Proportional Integral Derivative** (PID) controller in python to balance a seesaw with a ball
- Expanding knowledge base through exposure to various control theory topics, including optimal/adaptive control

Positions of Responsibility

Machine Learning Mentor | Summer of Science | MnP Club *(May' 23 - Jul' 23)*

Created teaching materials for helping to understand and visualize various machine learning algorithms

- Mentored 7 students to make them acquainted with **SOTA** Machine Learning algorithms and their use cases
- Collaborated to take part in various Machine Learning hackathons with the mentees, securing top **1%** in 2 of them

Teaching Assistant | Quantum Physics | Differential Equations *(Apr' 23 - Jun' 23)*

Academic Post to guide fresher students through academic difficulties in PH112 and MA108

- Conducted weekly tutorial sessions for a batch of **40** students to discuss solutions to preassigned tutorial problems
- Solved queries throughout the semester and conducted **extra doubt solving** sessions for students facing difficulties

Web Coordinator | Student Alumni Relations Cell, IIT Bombay *(May'22 - Jun'23)*

*Part of a 60 member team responsible for fostering relations among **60K**+ alumni and students*

- Worked in a team of **5** to handle the social activity and web presence of Student Alumni Relations Cell
- Responsibe for developing various websites and game leading to **5000**+ registrations with **150 % y-o-y** increase
- Databased and interacted with **100**+ Alumnis during the **35th Phonathon**, telephonic marathon of IIT Bombay

Core Team Member | Data Analytics and Visualization Team, UGAC *(Jul'22 - Apr'23)*

*Part of a **12 member** team working to provide **data-centric solutions** to the Institute and external organizations*

- Collaborated with **Prof. Sunita Sarawagi** from **CSE, IITB** for projects leveraging public **Indian datasets**
- Dissected and Interpreted **national data** on power and coal usage for gaining useful insights from the data
- Conducted a session for explaining a research paper on **Efficient Graph based Image Segmentation**
- Compiled Case studies and Analysis reports from trends in data on **course grading** and **semester exchange**

Technical Skills

Programming	Python, Matlab, C/C++, Javascript, Bash, Android Studio, Git, SQL, LaTeX
Data Science	PyTorch, TensorFlow, Numpy, Pandas, OpenCV, Matplotlib, Scikit-Learn, Scipy, NLTK
Development	HTML, CSS, Bootstrap, Tailwind CSS, Django, Node, Angular, React, Firebase

Key Courses

ML & Statistics	Optimization Theory, Games and Information, Fundamentals of Digital Image Processing, Statistical Machine Learning & Data Mining, Introduction to Data Science, *Introduction to Machine Learning, *Probability and Stochastic Processes I, *Deep Learning - Theory and Practice
Computer Science	Data Structures & Algorithms, Discrete Structures, Computer Networks **Ongoing*

Extra Curricular Activities

- Represented IITB for Adobe Content Simulation Challenge at **Inter IIT Tech Meet 12.0** at IIT Madras *(Dec'23)*
- Developed a **Tower Defence AI** Algorithm for competing in Correlation One's Programming Challenge *(Jun'23)*
- Acquired Rank **45** among **230**+ teams in **Inter IIT Hackathon - Convolve** hosted by IIT-Guwahati *(Dec'22)*
- Secured Global Rank **171** among 11K participants in **Codechef November Starters Challenge** *(Nov'22)*