

**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
- Developed a PoC of a Unified Audio LM achieving WER of 8.9%, BWER of 58.7% and an F1 score of 82%
- Maintained performance while generalizing across similar parameter models, with  $\sim 600$  tokens/s &  $\sim 300$  ms latency
- 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: Hongpeng Cao | 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

Guide: Piyush Jaiswal | ML Internship - Contextual Chatbots

- 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, et al. Accepted at SMM4H 2023 (Social Media Mining for Health Applications)

### MAJOR PROJECTS.

## Text to SVG Generation

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

#### 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)

## **Robust Digital Image Watermarking**

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%

(Aug'23 - Jun'23)

(Aug'23 - Nov'23)

- Jan' 23)

# Fractal Curves for Tool Path Generation

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

- 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

## Unsupervised Structural Optimization

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

# End to End Phone Calling Android Application

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

# Control Theory Bootcamp

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

# Blockchain Development and Smart Contract Implementation

Seasons of Code | Web  $\bar{\mathscr{G}}$  Coding Club

- Implemented a fully functional Blockchain in Javascript, exploring its core components for deep understanding
- Optimized Smart Contracts for Banking and Ballot systems, focusing on gas efficiency and improved performance
- $\bullet \ \ {\rm Developed\ a\ robust\ DFS\ Application\ on\ Ethereum,\ leveraging\ web 3. js\ and\ ethers. js\ libraries\ for\ seamless\ integration\ and the seamless\ and the s$

# POSITIONS OF RESPONSIBILITY.

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**
- 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**

# Web Coordinator | Student Alumni Relations Cell, IIT Bombay

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

#### 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 (PH 112) | Differential Equations (MA 108) (Apr' 23 - Jun' 23)

- 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

# TECHNICAL SKILLS.

Programming	Python, Matlab, C/C++, Javascript, Bash, Android Studio, Git, SQL, $IAT_EX$
Data Science	PyTorch, TensorFlow, Numpy, Pandas, OpenCV, Matplotlib, Scikit-Learn, Scipy, NLTK
Development	HTML, CSS, Bootstrap, Tailwind CSS, Django, Node, React, React Native
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## KEY COURSES.

ML & StatisticsOptimization Theory, Games and Information, Fundamentals of Digital Image Processing, Statistical Machine Learning & Data Mining, Introduction to Data Science, Introduction to Machine<br/>Learning\*, Probability and Stochastic Processes I\*, Deep Learning - Theory and Practice\*Computer ScienceData Structures & Algorithms, Discrete Structures, Computer Networks\*Ongoing

# EXTRA CURRICULAR ACTIVITIES

- Successfully observed and documented 50+ bird species across diverse habitats in Maharashtra (Mar'23 Present)
- 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)

# OTHER PROJECTS\_

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(Aug' 23 - Nov' 23)

(Jan' 24 - Apr' 24)

(Jun'22 - Jul'22)

(Jun'23 - Aug'23)

(May'22 - Jul'22)

(May'22 - Jun'23)