



Dhvanil Gheewala

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🔗 [dhvanil-cse.github.io](https://github.com/dhvanil-cse)

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Education

Indian Institute of Technology Bombay

B.TECH WITH HONORS IN COMPUTER SCIENCE AND ENGINEERING

(Oct.2022 – Jun.2026)

(GPA : 8.69/10)

Key Courses : Formal Methods in Machine Learning, Logic and Automata Theory, Automated Reasoning, Game Theory and Algorithmic Mechanism Design, Selective Areas of Mechanism Design, Implementation of Programming Languages, Abstractions and Paradigms of Programming

Research Interests

Formal Verification, Game Theory, Programming Languages

Honors and Achievements

- Secured an **All India Rank 335** in **JEE Advanced '22** among **160 thousand** candidates (2022)
- Secured an **All India Rank 659** in **JEE Mains '22** among 1 million candidates with **100 percentile** in **Maths** (2022)
- Awarded the prestigious **Kishore Vaigyanik Protsahan Yojana Scholarship** (KVPY) scholarship by the Indian Government with **All India rank of 342** in **SA stream** in 2020 and **606** in **SX stream** in 2021 (2020,2021)
- Cleared **PRMO 2019** from Gujarat, Daman, Diu, Dadra & Nagar Haveli and advanced to **HBCSE's RMO** (2019)

Research Experience

QBF Proof Systems and Skolem Synthesis

IIT Bombay

Guide: Prof. Supratik Chakraborty

(Jan 2025 - May 2025)

- Studied foundational QBF proof systems: Q-Resolution, LD-Q-Res, \forall Exp+Res, AReQS, QRAT and analysed soundness
- Explored extraction of Skolem functions from proofs using DAG-based method given by [Balabnov and Jiang](#)
- Devising a method to extract Skolem/Herbrand functions from LD-Q-Res proofs without converting to Q-Res

Revenue Maximising in Intermediary Network Auctions

IIT Bombay

Guide: Prof. Swaprava Nath

(Jan 2025 - May 2025)

- Structured the INA problem as a weighted unidirectional graph with agents and seller as vertices and cost as edge weights, specifying type distributions and valuation models for intermediaries and buyers in a Bayesian setting
- Formulated allocation and payment functions for line and star graphs based on [Myerson's theory](#)
- Established that intermediary network auction design in general tree networks is at least as hard as the Unit-Demand Multiple-Object (UDMO) auction problem, which to date has only approximate algorithms

Work Experience

Product Engineer Intern : Optimising Whisper for Low Resource Languages

Sprinklr, Gurugram

Manager: Yoginkumar Patel

(Summer 2025)

- Fine-tuned both Whisper-large and Whisper-small models on a low-resource language along with its closest high-resource counterpart for ASR; evaluated and benchmarked performance against zero-shot baselines
- Performed knowledge distillation from Whisper-large to small using subsampling techniques and pseudolabelling
- Experimented with freezing lower encoder layers and WER threshold and other hyperparameters to improve WER
- Further improved WER by incorporating secondary labels as prompts into the distilled Whisper model

Workflow Optimization for BharatGen

IIT Bombay

Guide: Prof. Ganesh Ramakrishnan

(Sept. 2024)

- Implemented a Python script using the YouTube Data API v3 to identify copyright-free videos by analyzing metadata such as title, description, and license type for training BharatGen on agricultural knowledge
- Developed an automated pipeline integrating Google Sheets, Google Drive, and Gmail to streamline task allocation, file sharing, and real-time notifications for annotators and verifiers in the BharatGen project
- Built a Gradio-based web application with Ngrok integration for collection of diverse public audio recordings

- Implemented an automated system for generating various problem types, facilitating both course instructors in creating assignments and users in practicing independently in **Flask** using **BeautifulSoup** and **SOAP connection**
- Extended and **created templates** and **blueprints** and implemented a system for **finding derivation of grammar**, **verifying the correctness** of user-provided answer and created proper **feedback mechanism** by utilising the functions from backend and **store** all the necessary **user data** in a **database** for further help of user
- **Dockerised backend** and **frontend** of both upcoming and current version of **Automata tutor** for the ease of deployment regardless of the operating system and environment

Key Projects

Robust Non-Probabilistic Shield for Environmental Uncertainty

Guide: Prof. Supratik Chakraborty

Course Project

(Autumn 2024)

- Developed a robust pre-emptive non-probabilistic shield for safe reinforcement learning to handle up to k oblivious steps in n-step windows under partial environmental observability
- Implemented a PerceptionLossSimulator integrated with a dynamic shield wrapper for real-time safe action recommendations in response to probabilistic perception loss in RL environments like Slippery Cliff and Hello Lava Gap
- Demonstrated theoretical guarantees and empirical evaluation of conservative safety policies, showing that the synthesized shield maintains strict safety constraints and terminates safely when no safe action remains

Simulation of a P2P Cryptocurrency Network

Guide: Prof. Vinay Ribeiro

Course Project

(Spring 2025)

- Developed a discrete-event simulator for a P2P cryptocurrency network, incorporating transaction generation, network topology, block mining, propagation delays, and state transitions in both the mempool and canonical blockchain
- Implemented Proof-of-Work consensus with fork resolution, block validation, genesis block setup, and recovery from out-of-order and orphaned blocks using a blockchain tree structure.
- Simulated selfish mining and eclipse attacks in a controlled blockchain environment, modeling private chain strategies, strategic block release, and visibility manipulation of honest peers
- Mitigated eclipse attack by priority-based message handling and peer blacklisting, and benchmarked performance

Compiler for Simple C-like Language

Guide: Prof. Uday Khedkar

Course Project

(Spring 2025)

- Built a compiler for a C-like language, enabling support for conditionals, ternary operators, relational and arithmetic expressions, function calls, control flow, and recursion
- Generated intermediate representations- Abstract Syntax Trees, Three Address Codes, Register Transfer Language, MIPS assembly code with register allocation, using tools like lex and yacc for scanning and bottom-up parsing

MangoDB : An Advance IMDB clone

Guide: Prof. S. Sudarshan & Prof. Suraj Shetiya

Course Project

(Spring 2025)

- Built an IMDB clone using PSQl, React.js, and REST APIs, enabling users to discover, track, and review movies, TV shows, & books with advanced search and recommendations based on popularity, ratings, genres & user's favourites
- Implemented a secure signup system with email verification and a safeguard against DoS attacks
- Integrated pre-trained language models to generate review summaries and developed a weighted recommendation system based on genre, decade, cast, and ratings, enhancing user engagement and content discovery
- Built features allowing users to follow others, view their opinions enhancing community interaction

A 4-Piece Chess Relocation

Guide: Prof. Ashutosh Kumar Gupta

Course Project

(Spring 2024)

- Developed an optimization framework using Stockfish to simulate and evaluate 4-piece pre-game relocations in chess, using combinatorial search and heuristic pruning to identify maximum advantage strategies

xv6 Operating System

Guide: Prof. Mythili Vutukuru

Course Project

(Spring 2024)

- Implemented file operations like **reading**, **opening** and **deleting** in a simple **filesystem** over an emulated disk
- Implemented **multi-threaded programming in C** using **locks and semaphores** available in pthreads API

- Implemented on-demand paging and copy-on-write optimization for shared pages, added new memory management functions, a weighted round-robin scheduler, and a simple shell for user command execution in xv6

Sound based Data Link Layer

Guide: Prof. Vinay Ribeiro

Course Project
(Autumn 2024)

- Implemented a sound-based link layer protocol using 4-bit tone encoding with RZ signaling for reliable transmission
- Designed an error control system using a custom CRC-k algorithm with Hamming distance 5 and Welch's method for signal denoising; integrated CSMA/CA with RTS/CTS and dynamic backoff to efficiently manage collisions

Homomorphic Encryption for k-NN on the Cloud

Season of Code

Web and Coding Club, IIT Bombay
(Summer 2023)

- Implemented a **research paper** by Youwen Zhu, Zhiqiu Huang and Tsuyoshi Takagi on **Secure and controllable k-NN query** over encrypted cloud data with confidentiality and maintaining **data privacy** and empowering **data owners** with **query control**, ensuring they maintain **control** over **data access** and **queries**
- Innovated the database security with **Homomorphic Encryption**, **Docker**, **sockets**, and **SageMath** for efficiency
- Set up an infrastructure comprising **Cloud Server**, **Query Server**, and **Data Owner** with **secure communication** via socket programming in a containerized environment using Docker

Into the RLverse

Analytics Club IIT Bombay

Winter in Data Science 2023
(Winter 2023)

- Implemented a range of algorithms, including **Thompson Sampling (TS)** and the **Upper Confidence Bound (UCB)**, for addressing **Multi-Armed Bandits (MAB)** by estimating the anticipated reward for each action
- Understood various concepts like **Monte Carlo algorithms**, **TD algorithms**, **eligibility traces** along with their convergence proofs and implementing these to solve environments like Snake, Tic-Tac-Toe, etc
- Implemented RL models such as **Deep Q Networks**, **Dueling Deep Q Networks** to find **optimal policies** for various RL environments such as **CartPole** and **Atari: Breakout** from the **OpenAI gymnasium**

Other Projects

Smart Contracts & DeFi Simulation

Guide: Prof. Vinay Ribeiro

Course Project
(Spring 2025)

- Designed and implemented a fully functional Decentralized Exchange (DEX) using Solidity, modeling constant-product AMM logic, LP token issuance, swap functionality, and arbitrage opportunities across asymmetric liquidity pools
- Developed a complete simulation and testing pipeline using Hardhat and JavaScript, enabling analysis of DEX dynamics, slippage behavior, and arbitrage profitability under varying liquidity and trade scenarios

Algorithmic Trader

Guide: Prof. Ashutosh Kumar Gupta

Course Project
(Autumn 2023)

- Executed **algorithmic trading strategies**, including arbitrage and median filter, while managing the order book through advanced **Data Structures and Algorithms (DSA)** to match compatible stocks **optimizing trade execution**
- Developed a **market simulation** featuring various traders and an autotrader that achieves **profitability within asymptotically polynomial time** that provides summary for all the traders and their profit at the end of the day
- Executed **OOPs** in **C++** and created **self-customised data structures** to store and retrieve data efficiently

Routing Protocol Implementation

Guide: Prof. Vinay Ribeiro

Course Project
(Autumn 2024)

- Implemented a distance-vector routing protocol via custom `send_segment`, `receive_packet`, and `do_periodic` functions with periodic updates, packet forwarding, and split horizon optimization to prevent count-to-infinity issues

Neural Networks and Large Language Models

Learners' Space

Web and Coding Club, IIT Bombay
(Summer 2023)

- **Fine-tuned a Pre-trained Model for Language Identification:** Fine-tuned **MT5 model**, utilized **pipelines** and **transformers** for language identification, and implemented **Gradio** for streamlined app deployment
- **Skip-gram Word Embeddings:** Analyzed **2-D** and **4-D word vector similarities** through a neural network lens
- **Sentiment Analysis:** Developed a **binary classification** system for **movie reviews**, distinguishing between positive and negative sentiments with an accuracy of 86% using an **LSTM** and **Recurrent Neural Network**

Data Compression and Text Processing

Guide: Prof. Ashutosh Kumar Gupta

Course Project
(Autumn 2023)

- Utilized C++ to implement well-known compression algorithms like **Run Length Encoding (RLE)** and **Huffman**, incorporating compression and decompression functionalities using **trie structures**
- Executed the **KMP Pattern Matching Algorithm**, showcasing precise string pattern matching; Designed and implemented fundamental data structures (Heap, Red-Black Tree) in C++ for efficient operations

Customised Web Crawler

Guide: Prof. Kameswari Chebrolu

Course Project
(Spring 2023)

- Implemented a **Web Crawler** using **BeautifulSoup**, **NumPy**, and **Matplotlib** which can parse websites for links
- Programmed the code to handle different recursion threshold specifications and output categorization demands and also simplified representation of the amount and size of file types consisting of webpages with Bar charts

Reading Projects

Disintegration Game

Guide: Prof. Urban Larsson

Course Project
Spring 2025

Created a 2-player combinatorial strategy game on a 3D graph with node removal mechanics and chain reactions, and analyzed game tree outcomes using concepts like canonical forms, temperatures and atomic weights; explored the All-Small Variation to understand strategic move optimization, enhancing skills in combinatorial game theory

Shor's Algorithm

Guide: Prof. Manoj Prabhakaran

Course Project
Spring 2024

Explored Peter Shor's 1994 quantum algorithm for integer factorization, analyzing its super-polynomial speedup over classical methods and its implications for cryptography, as a comprehensive review of quantum computing principles

Position of Responsibility

Events Coordinator

Techfest, IIT Bombay

(Jun 2023 - Dec 2023)

- Successfully **coordinated** and **managed 200+ College Ambassadors** for the execution of **Techfest zonals**
- **Contacted** and **Invited professors** from all over the globe to display their projects and research in an exhibition
- Coordinated significant events like **Cyclothon** and **stem cell donation** in collaboration with a prominent NGO

Mentor - Brain Tumor Detection

Analytics Club IIT Bombay

Winter in Data Science 2023
(Winter 2023)

- Guided students in mastering **Convolutional Neural Networks (CNNs)** and hands-on implementation using **PyTorch** for robust **Brain Tumor Detection** models that can detect tumor upto the accuracy of 89%
- Mentoring on the fundamentals of **Neural Networks**, emphasizing the **Linear algebra** and **Calculus** involved and practical application through **NumPy** implementations, reducing reliance on pre-existing frameworks

Volunteer Tutor for Underprivileged Students

National Service Scheme (NSS)

(2022-2023)

- Participated in a year-long NSS initiative, mentoring Class 12 students preparing for the JEE entrance exam
- Taught basic topics in Physics and Mathematics, like Kinematics, Newton's Laws of Motion, and Trigonometry

Technical Skills

Languages

C/C++, Python, HTML, CSS, \LaTeX , Bash, Sed, Awk, VHDL, Arduino IDE, MIPS, x86, XML, Scheme, Haskell, Prolog, Yacc/Bison, Solidity

Software

Docker, Git, Ubuntu, MATLAB, SageMath, Z3, Flask, MySQL, Node.js, REST APIs, CGSuite

Libraries

PyTorch, TensorFlow, scikit-learn, Pandas, NumPy, Matplotlib, Seaborn, Transformers, Datasets, spaCy, NLTK, Socket, NetworkX, Weights & Biases (wandb)

Extracurricular Activities

- Conducted a preliminary research on "**Malabar Jewellers**" as a part of Management Course project (2022)
- Built a strategy for playing The **Actual War** as a part of **CodeWars** organized by WnCC, IIT Bombay (2023)
- Participated in **XLR8** and successfully made a remote-controlled 4-wheeler bot that completed the track (2022)
- Audited the "**Neural Networks and Deep Learning**" course on **Coursera**, instructed by **Andrew Ng** (2023)
- Attended the "**Vijyoshi Camp**" at **IISc Bangalore** and gained insight about their ongoing research project (2021)
- Actively engage in badminton, cycling, walking, and exploring diverse places, their history and cultures