Dhairya Kantawala | **23B3321**
Mathematics | **B.S.**
Indian Institute of Technology Bombay | **Gender: Male**
DOB: 20/07/2005

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2027	9.65
Intermediate	CBSE	Green Valley High School	2023	94.00%
Matriculation	CBSE	V & C Patel English School	2021	93.80%

*Pursuing a **Minor** in **Artificial Intelligence and Data Science** from **C-MInDS**, IIT Bombay*

Scholastic Achievements

- Awarded an **AP Scholar Award** with **perfect scores** in Calculus BC, Physics C: Mechanics, and Chemistry *('22)*
- Secured All India Rank 1039 in JEE Mains 2023, being in the **top 0.1%** of **1 million+** candidates nationwide *('23)*
- Qualified for Regional Round for **International Finance Olympiad (IFO)** conducted **by IIFM and ET** *('19)*

Professional Experience

Mechanistic Interpretability of ML models | *Research Intern: UST, Hong Kong* *(May '25 – July '25)*

- Investigated GPT-2 small hallucination phenomena through mechanistic interpretability by applying **Transformer Lens**, linear probing, causal patching, and Ecco visualization library to dissect and visualize transformer internals
- Designed and ran custom experiments and algorithms on the **HPC cluster** to isolate layer 4 anomalies as sources of hallucinations, guiding analysis, detailed documentation, and targeted follow-up investigations with collaborator

Automating ETL process using NLP | *Winter Intern: Book My Diamond, Mumbai* *(Dec '24 - Jan '25)*

- Streamlined the **extract, transform, and load process** for diamond data using NLP and **embeddings** to automate **field** and **value** mapping, enabling conversion of raw data into a standardized company database format
- Developed a system for **duplicate detection** and **field mapping review**, using a **cosine distance function** to identify similar mappings, enabling automation while allowing manual edits to resolve errors and ensure accuracy

No-Code Solution for Algorithmic Trading | *Summer Intern: Breakout Investing* *(Jul '24 - Oct '24)*

- Designed the **end-to-end** architecture for a no-code algorithmic trading platform, utilizing the **LangChain library** in Python to effectively integrate front-end and back-end components, enhancing functionality and user interaction
- Transformed raw company data into **vector embeddings** using **Pinecone**, effectively enabling the re-training of a **Large Language Model** (**LLM**) to intelligently and swiftly generate trading algorithms from user prompt input

Key Projects

Eigenvector Mean-Reversion Trading | *Course Project: Prof. Manjesh K Hanawal* *(Apr '25 – May '25)*

- Analyzed **10** years of daily data on **500** stocks using spectral decomposition, eigenvector clustering, and z-scores
- Backtested an investment thesis yielding ***Rs.*35L** profit on ***Rs.*50L** capital (**12.2%** p.a.), beating Nifty 500 by **3%**

Music Classification Using MFCC Features | *Course Project: Prof. Vinay Kulkarni* *(May '24 - Jul '24)*

- Focused on improving model accuracy through **feature engineering** and **dimensionality reduction**, achieving a perfect score of **30/30** and securing **1st place** in a class of 200+ for the classification project with **MFCC** features

Option Trading Strategies | *Summer of Science (SoS), MnP club, IIT Bombay* *(May '24 - Jul '24)*

- Conducted research on option trading strategies using **Option Volatility and Pricing by Sheldon Natenberg**
- Developed a deep understanding of derivative trading strategies, emphasizing key **technical indicators** and the **Greeks** that influence market behavior and help assess risk and potential profitability in various trading scenarios

Time Series Analysis of Sales Data | *Seasons of Code (SoC), WnCC, IIT Bombay* *(May '24 - Jul '24)*

- Developed a robust expertise in advanced **time series analysis** methods, including **S-ARIMA** and **LightGBM**, to effectively model, analyze, and accurately predict sales trends across various market conditions and scenarios
- Developed a robust **XGBoost** forecasting model, achieving a competitive **9.47%** Symmetric Mean Absolute Percentage Error **(SMAPE)**, demonstrating its **significant** potential impact on business outcomes and strategic

Interest Rate Hike Prediction Model | *FinSearch, Finance Club, IIT Bombay* *(Jun '24 - Aug '24)*

- Developed a machine learning model to predict interest rate hikes by scraping news data, building an LSTM model on the daily news data, focusing on **sentiment analysis** and keyword extraction to gauge potential policy changes

Equity Research Competition | *Research project, Finance Club, IIT Bombay* *(Sep '24)*

- Did comprehensive stock analysis using macroeconomic factors, **SWOT analysis**, and key quantitative metrics
- Developed an investment thesis through assessments of the industry and company to predict stock price movements

Other Projects

Introduction to Hyperbolic Geometry | *Course Project: Prof. Sudhir Ghorpade* *(Aug '23 - Nov '23)*

- Delved into hyperbolic geometry, a fascinating branch of **non-Euclidean geometry**, focusing on how it deviates from Euclidean concepts by **re-imagining space** and distance, offering a radically different mathematical framework

Origami and Mathematics | *Course Project: Prof. Madhusudan Manjunath* *(Aug '23 - Nov '23)*

- Researched origami constructions, focusing on folding techniques for **angle trisection** and **cube root extraction**
- Explored how **origami axioms** and **algebraic geometry** solve polynomials and higher-dimensional constructions

Geospatial Mapping and Visualization of Tree Data | *Self Project* *(Dec '24)*

- Collected tree data from an NGO and visualized it using **GeoPandas** with **age-based and type-based** coding
- Enhanced the visualization by adding insights on top tree species, age distribution, and other important attributes

Sudoku Solver Algorithm in C++ | *Self Project* *(Mar '24 - Apr '24)*

- Developed a **recursive backtracking algorithm** to solve Sudoku puzzles, while ensuring valid number placement
- Implemented logic to **handle unsolvable cases**, ensuring the program backtracks **when no valid solutions** exist

GPT-2 Small From Scratch Implementation | *Self Project* *(May '25 – June '25)*

- Developed a custom language model using PyTorch with byte-pair encoding, self-attention and **transformer layers**
- Created comprehensive notes detailing the **linear algebra and calculus** underpinning the model's architecture

Pair Trading Strategy Using Polynomial Regression | *Self Project* *(May '25 – June '25)*

- Designed a robust market-neutral pairs strategy using **polynomial regression** and **ADF, Engle–Granger** tests
- **Backtested** the pipeline in Python (Backtrader/Cerebro), demonstrating robust returns on historical equity data

Modern Portfolio Theory Optimization Visualization Dashboard | *Self Project* *(June '25)*

- Built an interactive Markowitz optimizer in **Python/Streamlit**, visualizing **efficient frontier** and capital line
- Backtested via **Monte Carlo** and **CAPM**/Sharpe analysis, displaying **10-year** performance metrics graphically

Personalized Cold Email Generation Engine | *Self Project* *(Jan '25 - Feb '25)*

- Developed automated Selenium scraper extracting **1000+ profiles** and research interests from university websites
- Implemented **NLP-based** email personalization with **transformer model**, generating tailored emails for professors

Positions of Responsibility

Institute Academic Coordinator | *Student Support Services, UGAC* *(June '24 - March '25)*

- Acquainted and assisted **over 1,000 undergraduate** students with their course registration process in the institute
- Curated and ran **Mental Health Mondays** on social media to actively promote student well-being and awareness
- Executed a **1 week** long orientation for **1500+ UG new entrants** along with **2000+** parents in an offline setting

Linear Algebra and Differential Equations | *Teaching Assistant, Math Department* *(Jan '25 - April '25)*

- Helped prepare the tutorial solution booklet, coordinated peer discussions, and supported overall course logistics

Calculus | *Teaching Assistant, Math Department* *(Aug '24 - Nov '24)*

- Assisted **30+** first-year students in weekly **tutorial** sessions through problem solving and **doubt clarification**
- Organised and conducted **TSC** (Tutorial Service Centre), providing a recap of the course to over 300+ students

Technical Skills

Programming	Python, R, C++, LaTeX, Azure, Jupyter Notebook, AWS, Pinecone database, SQL, Spark
Libraries	TensorFlow, Keras, PyTorch, scikit-learn, NumPy, Pandas, MatPlotLib, LangChain, streamlit
Data Analysis	BeautifulSoup, Excel, Power BI, Data Cleaning, Statistical Analysis, Data Interpretation

Extracurricular Activities

Origami	• Created and managed online origami **portfolio** for 5 years, showcasing intricate designs
International Exposure	• Attended Summer School at the **University of Oxford**, where I gained invaluable global exposure in Business and Entrepreneurship, enhancing my understanding of markets • Participated in **British Origami Society** Convention, connecting with over 85 origamists, exchanging techniques, ideas, and fostering deeper appreciation for the art • Attended **Pacific Coast Origami Convention (PCOC) hosted by OrigamiUSA**, enhancing my origami skills while networking with global artists and enthusiasts
Volunteering	• Volunteered as a **Data Visualization Specialist** for **Data Science for Anand Good (DSAG)**, delivering insights and visualizations to support data-driven decisions • **Mentored and guided** JEE Aspirants of 2024 and 2025 batches from across the nation • Volunteered to teach **Mathematics** to students under **Educational Outreach**, **NSS**