**Piyush Raj** | **22B3323**
**Economics** | **B.S.**
**Indian Institute of Technology Bombay** | **Gender: Male**
**DOB: 21/12/2003**

| Examination | University | Institute | Year | CPI / % |
|---|---|---|---|---|
| Graduation | IIT Bombay | IIT Bombay | 2026 | |
| Intermediate | ISC | Hill Top School | 2022 | 95.00% |
| Matriculation | ICSE | Hill Top School | 2020 | 96.50% |

Pursuing a Minor in **Data Science** from the Center for Machine Learning and Data Science department, IIT Bombay

## Scholastic Achievements

- Achieved **AIR 602** and **932** in JEE Mains and Advanced, ranked among top **0.6%** applicants *(2022)*
- Received an **AP** grade in the course **CS101** given to **15** students out of a batch of **748** students *(2023)*
- Branch changed to **Economics**, among **top 10%** of **1.2k+** students given this opportunity *(2023)*
- Achieved **AIR 8** in ISI Entrance Examination and Interview among **50,000+** candidates *(2022)*
- Selected for the prestigious **KVPY Scholarship** with **AIR 680** among **1.5** lakh candidates *(2021)*

## Olympiad and Competition Experience

- Ranked among the **top 30** nationally in the **Indian Astronomy Olympiad** Qualifiers (**IOQA**) *(2022)*
- Ranked among the **top 100** nationally in the **Indian Chemistry Olympiad** Qualifiers (**IOQC**) *(2022)*
- Placed among the top **4%** nationally in the **Indian Mathematics Olympiad** Qualifier (**IOQM**) *(2021)*
- Achieved **AIR 8** and **AIR 6** at **TOSC Logic Fest**, Techkriti '21 and '20 held at IIT Kanpur *(21 & '20)*

## Professional and Research Experience

**Patent Journaling Intern** | *Industrial Research Consultancy Center* *(May '24 - Jul '24)*

- Worked in a team of **13** to prepare **documentations** for **600+** patents to be listed on the **IRCC website**
- Prepared a high-level intelligible synopsis of **35+** patents across **8+** scientific domains for licensing pitches
- Interviewed **15+** professors and research groups to identify **commercial applications** for their patents

**High Dimensional Nearest Neighbour search** | *Research Intern* *(May '24 - ongoing)*

*Guide: Prof. Ajit Rajwade* | *Supervised Learning Project* *IIT Bombay*

- Built on a novel **group testing NN** method having **100% recall** as part of an **Amazon**-funded project
- Tested a **grouping** approach on a **743** dimensional dataset, querying **10k** test vectors in just under **2193**s
- Implementing a new approach using **softmax features** on **VGGnet** to improve the paper's query time

## Key Projects

**Playing Games via Reinforcement Learning Agent** | *Summer of Code* *(Jun'23 - Aug '23)*

- Simulated **distributions**, **markov processes** and **decision-making frameworks** to develop proficiency
- Successfully trained a **Q-learning** agent to play **frozen lake** achieving a **100%** optimal simulated play
- Trained **DQN** and **PPO** agents to play **blackjack**, achieving a **42%** win rate with a **no memory** approach
- Trained a **PPO agent** to play STREET FIGHTER II beating the **Level 6 fighter** with an **80%** win rate

**Face Image Generation using DC-GAN and VAE** | *Winter in Data Science* *(Dec '23 - Jan '24)*

- Reviewing and implemented introductory papers for **GANs** and **VAEs** over the **celebA** image dataset
- Trained a **Vanilla GAN** framework over **100K+** images, with a **1.46** generator loss and a **77.6%** accuracy
- Implemented a **VAE**, training over **160K+** images and **4K** epochs achieving a validation kl loss of **18.30**

**Predict data using noisy parameters** | *Prof. Vinay Kulkarni* | *Course Project* *(Oct '23 - Nov '23)*

- Reduced **model complexity** using **PCA** to reduce the number of controllable parameters to **8** from **20**
- Enhanced data quality using **coupled MA** and a **29.5** deviation cap, improving model accuracy by **14.4%**
- Trained a **SLR** model, to predict **time series data** with a **0.82** Rsquare, **1.38** MAE and **2.66** RMS metric

**Autonomous Payload Delivery Bot** | *Prof. Joseph John* | *Course Project* *(Apr-Jun '23)*

- Utilised an **Arduino UNO** to coordinate **sensors** and **L298N** motor drivers for **autonomous** navigation
- Integrated a system of **IR sensors** and **SG 90** micro servos to effect a **detection** and **delivery** system
- Successfully navigated around bends, climbing a **30° incline**, and delivered a **300g payload** as required

**Sudoku Extraction and Solving using CNNs and DL** | *Self Project* *(Jan '24 - Feb '24)*

- Used **HoughLines** to detect a sudoku in a live feed and overlay the solution using **findHomography**
- Used a **VAE** to generate **artificial training images** of digits, observing a **0.32%** increase in accuracy
- Trained a **CNN** digit classifier on **MNIST** and **10K+** artificial images with a final accuracy of **99.59%**
- Optimized the model architecture to take **less than 0.1s** on average to provide reliable solution overlays

**Creating Algo-trading Strategies using Pine Script** | *Investment Team* *(Apr '24 - May '24)*
- Fine-tuned indicators like **Stoch RSI** and **MACD** to identify entry and exit opportunities over **NIFTY50**
- Constructed a **VWMA-RSI** strategy offering a **502.7%** return and a **4.3** sortino ratio over **10 years**
- Created an accurate and visual **back-testing framework** using historical data using **pandas**, and **yfinance**

**Equity Report Analysis** | **Equity Research Competition** | *Finance Club* *(Sept '23 - Oct '23)*
- Prepared an equity report for the **small-cap** solar company **Sterling & Wilson** which finished top **10**
- Constructed a **Discounted Cash Flow (DCF) Model**, showing the stock to be undervalued by **75.09%**
- Presented an **investor pitch deck** to a panel of **10** banking officials and an audience of **20+** people

**Analysis of a Combinatorial Game** | *Prof. Urban Larssson* | *Course Project* *(Feb '24 - Mar '24)*
- Used **CGSuite** to create a modified **Attacking Queens** game ruleset to perform theoretical analysis
- Analyzed the game trees to determine **equilibria** positions, **game values** and ruleset **tempereature**

**Competitive Programming** | *Summer of Code* *(May '24 - ongoing)*
- Explored problem-solving techniques like **dynamic programming**, **greedy approaches**, and **backtracking**
- Developed **problem-solving** prowess, with over **120** successfully solved challenges from prominent platforms

**Creating an Optimised Portfolio using Asset Pricing Theory** | *Finsearch* *(May '23 - Jul '23)*
- Created a **long-term**, **low-risk** portfolio worth **10 lakh INR** in the **mid and small cap** equity market
- The portfolio has a projected **y-o-y growth rate** of **22.4%** based on asset pricing theories like **CAPM**

**Financial Derivatives and Pricing Models** | *Summer of Quant* *(Jun '24 - ongoing)*
- Researched and prepared a report on the **financial derivatives** and their use and impact on the market
- Reviwed option pricing models like the **Black-Scholes**, **Binomial**, and **Monte-Carlo** methods

**Developing Single Player Games from Scratch using RL** | *Self Project* *(Jun '24 - ongoing)*
- Created single player game environments like **Othello**, **Tic-Tac-Toe** and **Snake** from scratch in **Pygame**
- Use models at **different training stages** to make AI players of varying **difficulty** for **Othello** and **Snake**

## Positions of Responsibility

**Quant Analyst** | *Investment Team* | *Finance Club* *(Jul '23 - May '24)*
*A dedicated **22-member** team of focused investment enthusiasts with a drive to manage a student-run fund*
- Created **5 equity trading strategies** from scratch, giving an average profit of **356.8%** over **10** years
- Actively managed a **INR 5 lakh** fund invested in **mid** and **small cap equities** and **options markets**
- Conducted analysis of startups like **Thekabadiwala** and **Smytten** with VC partner **Roots Ventures**

**Summer Course Teaching Assistant** | **CS101** | *Prof. Varsha Apte* *(Sept '23 - May '24)*
*Part of a **4-member** team formed after rigorous interviews to assist the professor in teaching **25+** students*
- Assisted in conducting **lab sessions** for **programming practice** attended by the students over the summer
- Aided the professor in conducting **2+** one-on-one **help sessions** to assist the struggling students

**Sports Secretary** | *Hostel Council* | *Hostel 5* *(Sept '23 - May '24)*
*Worked in a **25-member** council formed through a rigorous interviews catering to **500+** hostel residents*
- Recruited the hostel **tennis** and **basketball** teams finishing **2nd** and **4th** among **11** participating hostels
- Organized the **Pentafiesta** sports festival and cricket league attended by more than **500** hostel residents
- Spearheaded the **maintenance** of basketball and volleyball courts used by **50+** hostel residents

## Technical Skills

- **Programming Languages:** Python, C++, Java, R Programming, mySQL, HTML5, ROS
- **ML and Data Science:** Nupmy, Pandas, Matplotlib, SciPy, Sklearn, Pytorch, TensorFlow, Optuna
- **Software:** MS Excel, Google Workspace, Git, LaTeX, Canva, AutoCAD, Fracktory, Linux, CGSuite

## Key Courses Undertaken

| | |
|---|---|
| **Economics** | *Econometrics, Macroeconomics, Microeconomics, Math for Economics |
| **Mathematics** | Decision Analysis and Game Theory, Linear Algebra, Stochastic Models, Inferential Statistics, Differential Equations, Real Analysis, Higher Calculus |
| **Inter-Department** | *Digital Image Processing, Introduction to ML, Programming for Data Science, AI and Data Science, Quantum Physics, Entrepreneurship |

***finishing Nov'24***

## Extracurricular Activities

- Mentored **6** teams and a total of **24** students for **RL optimized trading** under **Finsearch** *(Jun '24)*
- Mentored **6** students for **Gen-AI** over the summer under the **Summer of Science** initiative *(May '24)*
- Selected for the **15**-member **Inter-IIT Basketball Camp**, receiving professional training *(Sept '23)*
- **Winners** in the **INSYNC Freshie Group Dance Competition** among **20+** participants *(Feb '23)*
- Pitched a **cloud kitchen startup** idea in **EnB Buzz** competing against **100+** participants *(Dec '22)*
- Received an **honourable mention** in the **English Debate Competition** at the school level *(Aug '20)*