Muskaan Jain

+91 9059148253 muskaanjain2512@gmail.com
B.Tech., Computer Science and Engineering, Indian Institute of Technology, Bombay

Education

Indian Institute of Technology Bombay 2022 – 2026 (Expected)
B.Tech. in Computer Science and Engineering
CPI: 9.09/10.00

FIITJEE Junior College, Hyderabad 2021 – 2022
Telangana State Board of Intermediate Education
Grade: 97.5%

Delhi Public School, Hyderabad 2019 – 2020
Central Board of Secondary Education
Grade: 95.8%

Honors and Awards

- All India Rank 104 in JEE Advanced (out of 155,000 candidates) 2022
- All India Rank 258 in JEE Mains (out of 1,000,000 candidates) 2022
- All India Rank 29 in Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship, SA Stream 2021
- Selected for the Orientation Cum Selection Camp, Indian National Chemistry Olympiad 2021, 2022
- Qualified for the second stage in Olympiads: IOQC, IOQP, IOQA, and IOQM (HBCSE) 2021

Publications

Fast Spectral Reward Learning from Pairwise Matchings (Ready for submission to Arxiv, and will be submitted to ICML in Jan 2026)

Research Experience

Fast Spectral Reward Learning from Pairwise Matchings Autumn 2025
Prof. Arpit Agarwal, Department of Computer Science and Engineering, IIT Bombay

- Formulated a spectral algorithm for fast reward learning from human pairwise preference data by modeling it as a Markov chain, and estimating its stationary distribution.
- Implemented random-walk simulations and spectral clustering to approximate stationary distributions efficiently.

Transition State Prediction in Chemical Reactions Autumn 2025
Prof. Raghavan B. Sunoj, Department of Chemistry, IIT Bombay

- Developing chemistry-informed generative models for predicting transition-state energies and structures in multi-step organic reactions.
- Designing a novel molecular representation employing locally complete graphs, that can identify a wide range of atomic interactions and understand electron density distributions.

AI/ML Techniques for Fitting Epidemiological Models Spring 2025
Prof. Ajit Rajwade, IIT Bombay

- Designed compartmental models to analyze HPV infections and cervical cancer progression in India.

- Used Laplacian and Gaussian priors with alternating minimization to fit sparse infection and recovery data, and implemented algorithms for estimating missing data and validating SICR model robustness.

Indicness Metric for Visual Language Model Captions Autumn 2024
Prof. Ganesh Ramakrishnan, IIT Bombay

- Devised a quantitative "Indicness" metric to assess cultural fidelity of image captions from vision-language models.
- Built a YOLOv5-based pipeline integrating object, symbol, and text analysis via OCR and color detection, and combined weighted submetrics to evaluate cultural awareness of multimodal models.

Internship Experience

Notification Dashboard Application Summer 2025
Google | Cloud Billing & FinOps
Built a shim layer on top of the existing Chime notification engine for low-latency multi-channel delivery, and packaged an Angular-based Notification Panel component integrating real-time updates from the Chime database.

Headroom Drag Analysis Summer 2024
Google | Search SSI
Implemented a pipeline to query traces and compute drag times for critical-path elements in search latency analysis. Aggregated metrics and identified key optimization targets, improving user-visible search latency.

Projects

Performing Long-Horizon Optimization in Recommendation Systems Spring 2025
Prof. Arpit Agarwal | Course Project: Human-Centered AI
Developed a dual Hawkes process framework to model user engagement, distinguishing short-term (System 1) and long-term (System 2) behaviors. Implemented Ogata's thinning algorithm to enable adaptive, feedback-driven recommendation loops, and achieved a 20% improvement in long-term user utility through simulation experiments that analyzed stability and intensity-time dynamics.

Machine Learning Models Spring 2025
Prof. Sunita Sarawagi | Course Project: Advanced Machine Learning
Built denoising diffusion probabilistic models (DDPM) and extended them to conditional DDPMs. Implemented large language model decoding strategies, including speculative sampling for accelerated inference, and applied Gaussian Process regression to approximate the Branin–Hoo function using multiple kernels and acquisition strategies for comparative evaluation.

BlindSight: Multilingual Voice-Assisted Navigation System Autumn 2024
Prof. Pushpak Bhattacharyya | Course Project: Natural Language Processing
Developed an intelligent navigation aid integrating real-time video analysis, multilingual scene descriptions, and speech-based guidance to improve accessibility for visually impaired users. Leveraged VisionGPT-based prompt engineering, YOLO World for obstacle detection, and Statistical Machine Translation with text-to-speech synthesis for real-time audio feedback.

Natural Language Processing Models Autumn 2024
Prof. Pushpak Bhattacharyya | Course Project: Natural Language Processing
Implemented a Hidden Markov Model (HMM) using the Viterbi algorithm for parts-of-speech tagging and extended it to Conditional Random Fields (CRF), improving tagging accuracy to 97%. Also de-

signed a Support Vector Machine (SVM)-based Named Entity Recognition (NER) system, optimizing feature engineering for enhanced entity classification.

Image Processing and Analysis Autumn 2024
Prof. Ajit Rajwade | Course Project: Fundamentals of Digital Image Processing
Implemented the JPEG compression algorithm for grayscale and color images by incorporating YCbCr color space conversion and chrominance downsampling, achieving 3–12x compression ratios. Built a PCA-based face recognition system using eigenfaces and eigencoefficient differences, and designed bilateral and mean-shift filters to denoise images affected by Gaussian noise.

Teaching Experience

Teaching Assistant, Data Structures and Algorithms Autumn 2024
Department of Computer Science and Engineering, IIT Bombay
Conducted weekly tutorials for undergraduate students, developed theoretical and programming problems; supervised 200 students doing lab assignments; graded theory and lab exams.

Leadership and Service

Department Academic Mentor (CSE Department) 2024 - 2025
Selected from 90 applicants to mentor 5 second-year undergraduates in navigating academics and balancing a healthy lifestyle; guided them in securing corporate and research internships.

Technical Skills

Programming: C++, C, Python, Java, Bash, Sed, Awk, VHDL, Assembly
Web Development: HTML, CSS, Angular, Typescript, JavaScript, NodeJS, Express, Bootstrap
Libraries: NumPy, PyTorch, TensorFlow, Matplotlib, Pandas, SpaCy, NLTK
Software: MySQL, MATLAB, Git/GitHub, LaTeX, Pyomo, ModelSim Altera, Fusion360

Selected Coursework

- Advanced Machine Learning
- Human-Centered AI
- Speech and NLP
- Digital Image Processing
- Logic and Theory of Computing
- Artificial Intelligence and Machine Learning
- Design and Analysis of Algorithms
- Data Analysis and Interpretation
- Calculus (Differential & Integral)
- Data Structures and Algorithms

Extracurricular Activities

- Represented IIT Bombay as a member of the Institute Women's Basketball Team, securing the Winners title, and being awarded the *Most Valuable Player* at the 57th Inter IIT Sports Meet 2024
- Member of the Institute Women's Swimming Team at the Inter IIT Sports Meet 2023, 2024

References

- **Prof. Arpit Agarwal** — Assistant Professor, Department of CSE, IIT Bombay
  aarpit@cse.iitb.ac.in
- **Prof. Raghavan B. Sunoj** — Professor, Department of Chemistry, IIT Bombay
  sunoj@chem.iitb.ac.in
- **Prof. Ajit V. Rajwade** — Professor, Department of CSE, IIT Bombay
  ajitvr@cse.iitb.ac.in