Spandan Anaokar

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Research Interests

Deep Learning, AI, Natural Language Processing, LLM, Recommendation Systems

Education

Indian Institute of Technology Bombay — Mumbai, India
Bachelor of Technology in Engineering Physics — *Nov 2021 – May 2025*

- Cumulative GPA: **9.5/10.0** | Department Rank **5**

*Dual Minor in Computer Science (CGPA **9.75/10.0**) and AI & Data Science (CGPA **10.0/10**)*

Awarded the **Undergraduate Research Award**

Publications and Pre-prints

1. *Shrey Ganatra*, **Spandan Anaokar***, Pushpak Bhattacharya*. **"Timing Matters: Enhancing User Experience through Temporal Prediction in Smart Homes "**.[arXiv] (submitted to AAAI25)
2. *Shrey Ganatra, Swapnil Bhattacharyya, Harshvivek Ankush Kashid, **Spandan S. Anaokar**, Pushpak Bhattacharya and the National Law School.* **"Jago Grahak Jago: Consumer Grievance Redressal through Large Language Models"**. [arXiv] (submitted to Coling25)
3. ***Spandan Anaokar***, Nahush Kolhe*, Prateek Chanda, Ganesh Ramakrishanan.* **"Noise Injection in Sequential Models"**. [arXiv]

** Equal contribution as First Authors*

Research Experience

Detecting and Mitigating Hallucination in LegalLLM — *July 2024 - Present*
Guide: Prof. Pushpak Bhattacharya, CSE Department — *IIT Bombay*

- Utilized Retrieval-Augmented Generation (**RAG**) and prompt engineering with Llama3 to develop a high-precision legal advisory chatbot, outperforming **LoRA** fine-tuned models in collaboration with Meta and National Law School
- Performed an in-depth literature survey on hallucination in LLMs and implemented techniques including Iterative RAG, Agentic Frameworks, and Citation-Enhanced Generation to minimize factual inaccuracies.

Recommendation System for Smart Homes — *July 2023 - May 2024*
Guide: Prof. Pushpak Bhattacharya, CSE Department — *IIT Bombay*

- Developed a **transformer** and **temporal convolution network**-based architecture for predicting the time of the next action in smart homes, incorporating **RBF** and **Time2Vec** embeddings to capture temporal dynamics.
- Reformulated the regression problem as a classification task, achieving a **10%** improvement in accuracy over baseline models, significantly reducing **RMSE** across multiple datasets for smarter home automation.

Noise Injection in Sequential Models — *Jan 2024 - May 2024*
Guide: Prof. Ganesh Ramakrishna, CSE Department — *IIT Bombay*

- Researched the impact of noise injection on sequential models like Transformers and LSTMs, implementing a modified gradient descent algorithm to enhance training stability and robustness in NLP tasks.
- Achieved faster convergence and enhanced generalization across tasks, marking a significant advancement for sequential models, including LLMs, by improving accuracy and robustness in diverse NLP applications.

Matformer: Optimizing Vision Transformers for Long-Tail Image Classification — *Nov 2024 - Present*
Guide: Prof. Ganesh Ramakrishna, CSE Department — *IIT Bombay*

- Conducting research on the Matformer architecture for Vision Transformers, optimizing long-tail image classification and improving Mean Average Precision (MaP) through experimentation with multiple architectural variations.

Automating Nano-Optical Measurement — *July 2022 - Dec 2023*
Guide: Prof. Anshuman Kumar, Physics Department — *IIT Bombay*

- Developed a Python-based automation pipeline for Spatially Resolved Photoluminescence Spectroscopy, enabling nanostructure analysis by integrating parallel communication between Thorlab spectrometer and Nanomax stage..

Technical Skills

Programming Languages: C++, C, Python, Bash, MATLAB
Machine Learning: PyTorch, TensorFlow, LangChain, Keras, OpenCV, Numpy, Pandas, Seaborn
Software: Git, AutoCad, LaTeX, Jupyter, LT Spice, VS Code, ExcelL

Professional and Entrepreneurial Experience

Microsoft IDC-Hyderabad | **Data Science Intern** *May 2024 - Jul 2024*

Worked with the Data Science Team on a local Agentic LLM framework to integrate device and LLMS

- Implemented the ReAct framework to develop a system powered by Phi-3 that autonomously analyzes device logs, detects anomalies, and recommends solutions in real-time, optimized to run locally to ensure data privacy.

NeuralThread.AI | **CTO & Co-Founder** *August 2023 - Present*

Used GenAI to generate images used for advertisement of fasion

- Lead the technical department to work on multiple projects including image generation, segmentation, and used diffusion technology to modify images to create brand advertisement

Technical Projects

NLP and Large Language Models | *Learner's Space* | *Web and Coding Club* *July 2023 - Sept 2023*

- Developed advanced NLP systems leveraging transformer architectures and LLMs for high-precision sentiment analysis, text classification, and chatbot applications, incorporating techniques like n-grams and transformers.

Deep Carlsen | *Seasons of Coding* | *Web and Coding Club* *May 2023 - July 2023*

- Developed a chess engine inspired by the Giraffe research paper, utilizing deep learning to train on 300+ features and integrating Minimax with Alpha-Beta Pruning for efficient game tree analysis and optimal move selection.

JPEG Image Compression | *Course Project* | *Digital Image Processing* *May 2023 - July 2023*

- Developed the JPEG image compression algorithm in Python, utilizing Discrete Cosine Transform (DCT) and entropy encoding, and performed comparative analysis with homogeneous diffusion models.

VanGoghAI | *Institute Technical Summer Project* | *Institute Technical Council* *May 2023 - July 2023*

- Implemented a Neural Style Transfer system using feature allignment with pre-trained VGG19, generating logos and artistic compositions by blending silhouettes and real-life images with diverse artistic styles.

AI Text Generation | *Winter in Data Science* | *Analytics Club* *Dec 2022 - Feb 2023*

- Utilized Wavenet and Bigram models for generating names based on a large database in the MakeMore project.

Teaching Experience

Teaching Assistant (TA) | IIT Bombay

- **PH112: Quantum Physics** | Nominated to conduct a **2-hour revision session** for **1400+ students**, simplifying complex topics and enhancing student understanding.
- **MA108: Differential Equations** | Led problem-solving sessions for **40+ students**, improving their computational skills and understanding of differential equations.
- **CS626: NLP, Speech, and the Web** | Conducted specialized sessions for **graduate students**, deepening their knowledge of NLP techniques and assisting with project guidance.

Mentorship Roles | Maths and Physics Club, Analytics Club

- **Winter in Data Science: RL** | Mentored **12 students** on Reinforcement Learning, guiding them in implementing an RL-based Kung Fu game agent using Pygame.
- **Summer of Science: LLMs** | Mentored **6 students** on Large Language Models, providing hands-on training in model architecture and fine-tuning for NLP tasks.
- **Summer of Science: DSA** | Mentored **6 students** in Data Structures and Algorithms, enhancing problem-solving and competitive programming skills through practical coding exercises.

Key Coursework

Computer Science: Operating Systems, Computer Programming and Utilization, Logic for Computer Science, Data Structure and Algorithms, Design and Analysis of Algorithms, Introduction to ML, NLP and Speech, Optimization for ML, ML in Remote Sensing, Digital Image Processing, Statistical ML and Data Mining

Mathematics: Calculus I & II, Linear Algebra, Differential Equations I & II, Numerical Analysis, Complex Analysis, Probability and Stochastic Processes, Markov Chains and Queuing Systens

Physics: Data Analysis and Interpretation, Photonics, Classical & Quantum Mechanics, Waves and Oscillation, Non-Linear Dynamics, Theory of Relativity, Condensed Matter Physics, Statistical Physics, Electromagnetic Theory, Methods in Analytical Techniques

Electrical: Introduction to Electronics, Microprocessors, Digital Systems

Scholastic and Extra Curricular Activities

Scholastic Achievements	• Attained the pinnacle of academic excellence by achieving an **CPI** of perfect **10/10** in the 4th semester • Secured **All India Rank 646** in **JEE-Advanced** and secured **99.81% Percentile** in **JEE-Mains** • Secured **AIR 14** in the **Aptitude Test** for selection into the Indian Institute of Scientific Education and Research • Qualified for **OCSC Camp** for **IJSO** (International Junior Science Olympiad) by being in the **Top 43** • Qualified for **OCSC Camp** for **IOAA** (International Olympiad of Astronomy and Astrophysics) by being in the **Top 35** across all of India in the **INAO** (Indian National Astronomy Olympiad)
Competitions	• Awarded the **Student of the year** award with rank **3rd** in the entire school by the Times of India NIE • Awarded **Silver Medals** in 6^{th} and 9^{th} grade in the Homi Bhabha Young Scientist Exam, and developed a **60-70 page research project** proposing solutions to real-world **problem statements**. • Awarded a **gold medal twice** in Mathematics Prodigy exam held in 5^{th} and 8^{th} all over **Maharashtra**
Sports	• Played and won **3rd place** in inter-school Chess Competition in Mumbai • Awarded the **Best Student in Sports** certificate in School for winning at local chess championships