Agnipratim Nag

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Education

2021 – 2025 **Indian Institute of Technology Bombay**, Mumbai, India

Bachelors of Technology in Engineering Physics

Dual Minor in Computer Science and Artificial Intelligence

GPA: 9.59/10 | Department Rank 3

Received the Undergraduate Research Award from IIT Bombay

Research: Automata Theory, Temporal Logic, Biomedical Imaging, Compressive Sensing

Research Experience

Winter 2023 - Present **Vision, Graphics, Imaging and Learning Laboratory, IIT Bombay**, *Research Assistant*.
Guide: Prof. Ajit Rajwade, Computer Science, IIT Bombay
Title: Level Set Estimation from Compressive Measurements via Shearlet Regularization
Developing a tree-based algorithm augmented with shearlet regularization to estimate level sets of images directly from compressive measurements, that reduces imaging time by 50% - 75%. To be used in image processing pipelines in bioengineering applications such as nuclear magnetic resonance imaging for protein molecules

Winter 2022 - Spring 2024 **IIT Bombay and Max Planck Institute for Software Systems**, *Research Student*.
Guides: Prof. Krishna S, Computer Science, IIT Bombay and Dr. Khushraj M, MPI-SWS
Title: Partially Adjacent 1-Timed Propositional Temporal Logic is Decidable
Showed a theoretical reduction between two temporal logic classes, Partially Adjacent 1-Timed Propositional Temporal Logic (PA 1-TPTL) and Partially Punctual Metric Temporal Logic (PPMTL) to prove decidability
Utilised proof techniques such as projections and relativization to prove equivalence of PA 1-TPTL and PPMTL

Publications and Preprints

Openness and Partial Adjacency in One Variable Timed Propositional Temporal Logic
S.N. Krishna, K. Madnani, **A. Nag**, P.K. Pandya (arXiv)

Hyper Pyramid Adapted Shearlet Transform with Application to Compressive Level Set Estimation
A. Yousuf, **A. Nag**, A. Rajwade (Paper Preparation in Progress)

International Experience

Summer 2024 **NUS Young Fellowship Program 2024**, *National University of Singapore*.
Represented IIT Bombay at the international level among a cohort of student researchers invited to collaborate on potential applications of generative artificial intelligence and machine learning in doctoral research

Professional Experience

Summer 2024 **Databricks**, *Software Engineering Intern*, Bangalore, India.
Designed and implemented a software architecture to enable data storage and exchange functionalities between users and Databricks cloud storage as a part of the Databricks Java Database Connectivity Driver
Received a Pre-Placement Offer for exceptional performance throughout the internship

Entrepreneurial Experience

Autumn 2023 - Spring 2024 **UnearthAI**, *Co-Founder*, Mumbai, India (Pitch Deck).
Connecting talented college students to growing Indian startups for exciting internships
Automated hiring processes by building OpenAI API powered software to intelligently segregate resumes and used NLP models such as ColBERT to match resumes with best-fit roles through a WhatsApp chatbot
Generated 1000$ profit in first two months of operation | Received a grant of 2000$ from IIT Bombay

Other Projects

Spring 2024 **Performance of EV Shuttles in IIT Bombay**, Environmental Research.
Performed a detailed study of the transport landscape at IIT Bombay to contrast usage of transport options
Proposed solutions to improve user experience by reducing travel time and increasing reliability
Surveyed 800 students and staff members across campus and analysed the data, organised
a physiotherapy workshop to assist drivers in reducing back aches and improve working conditions

2022-2023 **ViBe Basket**, Entrepreneurial Project (Pitch Deck).
Developed a software application to intelligently match social groups with outing itineraries
Conducted market research and customer surveys with student populations across the country
Utilised fine tuned NLP models to determine user-outing fit with Discord as the application front end

Spring 2024 **Sparsity Based Denoising for Low Dose Tomography**, Advanced Image Processing Project.
Implemented the K-SVD Algorithm to sparsify low-dose tomographic images for low error reconstruction

Spring 2024 **Don't Let Labels Define You**, Introduction to Machine Learning Project.
Executed clustering algorithms to determine synthetic genres on a dataset of Spotify songs

Autumn 2023 **Image Deblurring via Reverse Heat Equation**, Digital Image Processing Project.
Used various deblurring algorithms to improve image quality on a training dataset of blurry images

Summer 2023 **VanGogh AI - A Generative Painting Agent**, Institute Technical Summer Project.
Implemented Neural Style Transfer to seamlessly blend artwork styles with image content

Spring 2023 **Statistical Analysis of Random Pattern Detection**, Digital Systems Project.
Designed an experiment to verify the Central Limit Theorem from statistics through digital electronics

Winter 2022 **Machine Learning with Quantum Computers**, Winter in Data Science.
Solved the Deutsch-Josza Problem and demonstrated the effectiveness of quantum computing

Spring 2022 **HyperEntropicPingPong**, GameDev Hackathon, Developers' Community.
Designed a basic multi-level 2D ping-pong game with non-classical dynamics and quantum tunnelling

Skills

Programming C++, Python, Java, MATLAB, Git, GitHub, LaTeX, HTML, JavaScript, CSS

Libraries NumPy, Pandas, Matplotlib, Seaborn, OpenCV, Plotly, SciKit Learn, OpenAI API, Google API

Languages English (fluent), Hindi (intermediate), Bengali (intermediate)

Key Courses Undertaken

Computer Science Logic in CS, Computer Programming and Utilisation, Data Structures and Algorithms, Design and Analysis of Algorithms, Introduction to Machine Learning, Foundations of Intelligent and Learning Agents, Digital Image Processing, Advanced Image Processing, Quantum Computing, Operating Systems

Physics Quantum Mechanics, Photonics, Microprocessors, Condensed Matter Physics, Statistical Mechanics, Electromagnetism, Classical Mechanics, Data Analysis,Relativity, Waves, Thermal Physics, Electronics

Mathematics Linear Algebra, Complex Analysis, Calculus, Differential Equations I & II, Numerical Analysis

Teaching and Mentorship

Nov 2022 - Present **IIT Bombay**, *Undergraduate Teaching Assistant*.
Departments of Physics, Mathematics and Computer Science & Engineering
Assisted in the courses Calculus I, Calculus II, Classical Physics, Logic in Computer Science, Introduction to Classical and Quantum Mechanics by conducting weekly interactive problem solving sessions and clearing conceptual doubts for a batch of 45 junior students (agnipratimnag.github.io/teaching)

2023 - 2024 **Department of Physics, IIT Bombay**, *Academic Mentor*.
Mentored 9 sophomore students and assisting them in navigating the department's academic curriculum
Involved in designing event posters and maintaining an alumni database as part of the Outreach subteam

Volunteer Experience

2021-2022 **National Social Service, IIT Bombay**, *Educator*.
Worked with National Service Scheme, IIT Bombay to provide free education available to 110,000+ underprivileged students through educational science videos in the Bangla language on YouTube