Shuvam Banerji Seal

BS-MS Student (Chemistry Major, Computer Science Minor) | Reg. No.: 22MS076

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Research Experience

Developing an Advanced Retrieval Model for TREC-Tip of Tongue Queries *2024 (Submitted)*

Guided by Dr. Dwaipayan Roy, Dept. of Computation and Data-Science, IISER-Kolkata

Engineered multi-layer BM-25 filtering system (in Lucene, Java) with dynamic search-domain contraction based on extracted keywords and implemented transformer-based query expansion and semantic matching using Local LLMs though multi-shot and chain-of-thought prompting achieving results on par with specifically-modified DPR models

Computational Modeling of [VO(SALIEP)(DTP)] as Water Reducing Catalyst *2024 (to be submitted)*

Guided by Dr. Soumyajit Roy, Dept. of Chemical Sciences, IISER-Kolkata

Implemented DFT methods (B3LYP) for MO energy calculations and electronic structure analysis using Gaussian and conducted mechanistic studies using transition state theory and reaction pathway analysis catalyst performance prediction for water reduction

On the Nature of Information *2023-24 (Under Review)*

Guided by Dr. Soumyajit Roy, Dept. of Chemical Sciences, IISER-Kolkata

Developed novel mathematical models for information flow analysis and applied entropy principles to quantify information evolution for a set of constraints to identify and characterize critical inflection points in information dynamics

Projects

Developing a complete GUI full-stack application using GTK4 in C *2024 (ongoing)*

Under the supervision of Dr. Kripabandhu Ghosh, Dept. of Computation and Data-Science, IISER-Kolkata

Implementing a complete GUI application in C using GTK4 and Glade using SQLite3 as the local Database Management for CS3101 course (Fundamentals of C Programming and DSA)

Porting the SMC Canteen system for IISER-Kolkata to Python3 Django *2024 (ongoing)*

Student Monitored Canteen System of IISER-Kolkata

Contributing to the SMC system that serves 2000+ students of IISERK by modernizing it to a more modern system running Django Framework

Technical Expertise

Research Computing : Algorithm Development | Information Retrieval (Lucene in Java) | Bio-Informatics | Molecular Dynamics | DFT Computations
Programming Languages : Python | C/C++ | Java | Rust | QBASIC | GWBASIC | Fortran
Python Libraries: : Numpy | Pandas | Matplotlib | Tensorflow | Transformers | NLTK | Spacy | Plotly | Manim
Scientific Software : LAMMPS | VMD | Gaussian | Origin Pro | Scilab
Bio-Informatics : PyMol | ChimeraX | PyDock | AutoDock Vina
Development Stack : Full Stack (HTML/CSS/Javascript) | Databases (MongoDB, MySQL, SQLite3) | Version Control (Git) | Containerization (Docker) | CMake | Make
Framework : Django
GUI Development : GTK4 in C | QT in C++ | Glade for Designing
Operating Systems & Server Management : Linux | Server Handling- SSH, OpenSSL | CUDA Programming (Python)
Additional Tools : LaTeX| Shell Scripting (Bash) | UI/UX Design (Figma) | HTML E-mailing

Education

Indian Institute of Science Education and Research - Kolkata *CGPA: 8.2*
BS-MS (Chemistry Major, Computer Science Minor) 2022-2027 *(expected)*

Calcutta University *CGPA: 8.308*
B.Sc Honours in Physics (1st Year Only) 2021-2022

Jodhpur Park Boys' High School *83%*
Higher Secondary Education in Physics, Mathematics, Chemistry, Computer Science (WBCHSE) 2019-2021

The New Horizon High School *83.75%*
Secondary Level Schooling(Engligh Medium) under WBBSE 2009-2019

Professional Experience

Private Educator & Technical Trainer *2018-Present*
Advanced Computing & Basic Sciences Instruction (Self-Employed) Kolkata

- Developed and conducted courses in Computer Science, Physics, Chemistry and English for High School students (ICSE, CBSE, WB Board)
- Mentored 50+ students for Board and competitive examinations

Technical Consultant *2021-Present*
Self-Employed Kolkata

- Designed and implemented high-performance computing solutions
- Expertise in system optimization, BIOS/UEFI configuration, and OS installation
- Successfully completed 30+ custom build projects with 100% client satisfaction

Published Author *2020*
MindScapes (ISBN: 978-9389923209) Kolkata

- Published creative work focusing on scientific and philosophical themes
- Conducted workshops on technical and creative writing

Achievements & Honors

Hackathons:

StatusCode1 (Awarded 1st Rank in GIAN Track) *2024*
Developed an AI-based Search Engine for GIAN's Database For Abandoned US Patents IIIT-Kalyani

- A searching algorithm based on Nomic Embeddings of the patent abstracts and similarity computations thus enabling the user to search for patents in natural language without the use of specific terminologies.
- Also created a web-scraping algorithm to get the patent data using Selenium, BeautifulSoup and fake_useragent for anti-scraping measures by the website

Smart India Hackathon (Participated) *2024*
Problem ID: SIH1701 and SIH1734 SIH-2024

- Proposed a "Context-Aware AI Framework for Commerical Courts (2015) Cases' Retrieval and Predictive Analytics" utilizing RAG, based on embeddings produced from the Legal documents (1701)
- Proposed a "Next-Gen Air Quality Mapping: A Deep Learning Approach with SRDIFF and Kolmogorov Arnold Networks" (1734)

StatusCode0 (Awarded 1st Rank in MATLAB Track) *2023*
Developed a Domestic Waste Type Data analysis tool for a proposed Start-Up Solution IIIT-Kalyani

National Level Basic Sciences Competitions:

Mimansa (Zonal Topper) *2024*
Contributed to the team in Mathematical problem solving IISER-Pune

NAEST-National Anveshika Experimental Skill Test (Zonal Runners Up) *2023*
Create extensive experimental setup using homely items- see papers NANI, IIT Kanpur and Shiksha Sopan

Competitive Examinations:

Qualified JEE Mains and Advanced *2022*
Ranked in Top 0.1 fraction of Candidates

Qualified IAT(IISER-Apitude Test) *2022*
Ranked in top 0.06 fraction of candidates

Qualified WBJEE *2022*
Ranked in Top 0.05 fraction of Candidates

Scholarships and Honors:

Reliance Foundation Undergraduate Scholar *2023*
Qualified the RF-UG Aptitude test to be in the top 5000 students to be awarded this

Best Young Scientist Speaker on NanoTechnology *2019*
Successfully presented at the prestigious conference World Science Conference, Jadavpur University

Leadership & Community Impact

Event Management: Organized Anicon 2.0 (500+ participants) | Coordinated Various Technical Workshops

Social Impact: COVID-19 relief coordinator | Educational mentor for Ek-Pehal program

Additional Activities: District Level Debate and Quiz finalist | Shotokan Karate practitioner | 4th Year Art and Painting Student with major works in Stroke art and Portraits

References available upon request