



# Souvik Mukherjee

Computer Science & Engineering

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📁 Portfolio

Education	University/School	Subject/Discipline	Year	GPI/%
Post Graduation	IIT, Kanpur	MS-R, CSE (Cybersecurity)	2023-25	10.0 (**)
Graduation	VIT, Vellore	Major, ME and Minor, CSE	2017-21	9.16
Intermediate/+2	Sri Chaitanya, Vizag (HSC)	STEM	2015-17	92.00
Matriculation	Sri Chaitanya, Vizag (SSC)	STEM	2015	10.0

## RESEARCH EXPERIENCE

### • Face Morphing Attack Generation and Detection (Digital Forensics) (M.S-R Thesis);

Guide: Prof. Nisheeth Srivastava

Impact: 10L+ students/year

(Nov'23 - Present)

- **Face Morphing:** A digital image manipulation technique that seamlessly blends two facial images, creating a fake blended face of two subjects.
- **Misuse:** A deceptive tool in exams, where a morphed image combines the faces of a bright and a dull student, allowing the latter to pay the former to take exams on their behalf, thus gaining admission.
- **Types:** Majorly two types of morphs, Landmark based and Deep-Neural-Network based (GAN/style-GAN). Done on two format's of images, JPG and PNG.
- **Progress made:** We have achieved close to 99% accuracy for PNG's and around 60% for JPEG's, using Error Level Analysis (ELA) and contours in image processing. We're still working on JPEG's to improve accuracy.

## PROJECTS

- **DOM and DFA Attack on AES (CS666: H/W Security for IoT)(A Grade)** Guide: Prof. Urbi Chatterjee 🌐 (July'23-Nov'23)
  - **For the DOM/DPA analysis, Objective:** Recovering AES secret key bytes using Differential Power Analysis (DPA).
  - **Technique Used:** Implemented Difference of Mean Attack with zero and one bin arrays and successfully retrieved asked key bytes from power traces.
  - **In DFA analysis:** We conducted the **fault injection** and **formed equations** to iteratively retrieve the key of said bytes.
- **Packet Capture Analysis (CS628: CSS)(A Grade)** Guide: Prof. Angshuman Karmakar 🌐 (July'23-Nov'23)
  - **Objective:** Analyzed .PCAP files for SQL injection and XSS attacks using Wireshark.
  - **Methodology:**
    - \* Filtered HTTP packets to identify potential SQL injection commands like UNION SELECT.
    - \* Detected session ID theft via cookies and MD5 hashed password theft.
  - **Insights:**
    - \* Recognized vulnerabilities in MD5 hashed passwords, susceptible to rainbow table attacks.
    - \* Implemented safety measures against XSS and SQL injection attacks.
  - **Skills:** Security analysis, Wireshark, vulnerability mitigation.
- **Designing efficient NTT, PWM & I-NTT (CS674 PQS) (A Grade)** Guide: Prof. Debapriya B. Roy 🌐 (July'23-Nov'23)
  - Firstly, we're given 2 functions, we computed the **Fourier transform** for each one of them (using the **Cooley-Tukey NTT algorithm**). Secondly, we performed **point wise multiplication** to the transformed functions.
  - Lastly, we did **inverse NTT** on the last output. (Using the **Gentleman-Sande inverse INTT algorithm**)
- **Breaking Companion Arbiter PUF (CAR-PUF) using ML (CS771)** Guide: Prof. Purushottam Kar 🌐 (Jan'24 - Apr'24)
  - A CAR-PUF employs two arbiter PUFs, along with a secret threshold value  $\tau$ . Given same challenge to both, the absolute difference in timings is calculated. If  $|\Delta w - \Delta r|$ , is less than or equal to  $\tau$ , the response is 0; otherwise, it's 1.
  - Derived a detailed mathematical derivation demonstrating how a CAR-PUF can be compromised by a single linear model.
  - Wrote a code to solve this problem by learning the linear model  $W, b$  using the training data. Model used was '**model = LogisticRegression(C=1.0)**'. We mapped input features from 32 dimensions to 528, to get a proper linear fit. We had also computed how various hyper-parameters affected training time and test accuracy.
- **Escaping the Caves(CS641)(Modern Cryptology)** Guide: Prof. Manindra Agrawal 🌐 (Jan'24 - Apr'24)
  - Methodically **Analyzed and Decoded** a range of cryptosystems namely, **Substitution cipher, PlayFair cipher, EAEAE, DES**.
  - Utilized advanced techniques to exploit cryptosystems, methods such as **frequency analysis, differential cryptanalysis**.
- **Project GATE CSE GPT (Winter LLM Bootcamp, Pathway x IIT-K x IIT-BHU, Non-Academic)** 🌐 (Feb'24)
  - **Impact: 1L+ students/year**
  - A chatbot-GPT powered by **OpenAI & Pathway**. Aims in helping students with interview, PYQ, test-series, the main exam and other common doubts, related to GATE CSE exam, specifically who are facing difficulty in affording coaching, with the help of Pathway's LLM App, and a **Dropbox** at backend
  - The LLM App enables AI-powered search from multiple unstructured documents like prev. interview experiences, PYQ's, topper's notes, etc and indexes input data in real-time just after you upload files to the cloud storage.

## RELEVANT COURSES AND TECHNICAL SKILLS

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- **Mtech Courses** : CS771 Introduction to Machine Learning, CS641 Modern Cryptology, CS628 Computer Systems Security, CS666 Hardware Security for IOT Devices, CS674 Post Quantum Security
- **Btech Courses** : CSE2003 Data Structures & Algorithms, CSE2004 Database Management System, CSE2001 Computer Architecture, ONL1021 Essentials of Machine Learning and Organization, CSE1003 Digital Logic and Design
- **Programming/Scripting Languages**: C, C++, Python, Java, JavaScript, Verilog HDL, HTML, CSS, MySQL.
- **ML Libraries/Utilities/Tools**: Scikit-learn, Tensorflow, PyTorch, NumPy, OpenCV, Pillow, Pandas, Matplotlib, Git,  $\LaTeX$ , Google Colab, Jupyter.

## POSITIONS OF RESPONSIBILITY/EXPERIENCE

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- **Head TA**, for the second semester in the **ESC111/112, Fundamentals of Computing**, which included, management of examinations and duties of other TA's, apart from the basic doubt resolving. (Jan'24-May'24)
- **Teaching Assistant** : Two semesters of assisting **ESC111/112, Fundamentals of Computing** students with doubt resolution, lab test management and grading assignments (Aug'23-May'24)
- **Graduate Engineer Trainee (GET) & Associate Engineer at L&T Technology Services** 🌀🌀 (Aug'21-March'22)

## ACADEMIC ACHIEVEMENTS AND RECOGNITION'S

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- Awarded with the **Academic Excellence Award** for the semester '2023-24 First' for ranking among the **top 10%** of scorers in the department. 🌀
- My project was recognized among the **top 3** open-source projects in the Winter LLM Bootcamp cohort, offered by **Pathway X P-Club IIT Kanpur x CoPS IIT BHU** 🌀
- Selected for **ACM India Summer Schools 2024**, to be held at **IIT Bombay**, offered by Trust Lab, IIT Bombay. 🌀  
Only **40 students are shortlisted from all over India**, based on profile shortlisting.  
Name of the school offered: Theoretical Foundations of Cryptography (To be held from June 3 to 13, 2024)
- Attended the workshop on Data and AI with Microsoft Azure held On Campus (on 10 April 2024, at L7 (LHC))

## CERTIFICATIONS

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- Supervised Machine Learning: Regression and Classification, by **deeplearning.AI & Stanford** 🌀
- Advanced Learning Algorithms, by **deeplearning.AI & Stanford** 🌀
- The joy of computing using Python, by **NPTEL, IIT Madras** 🌀
- Introduction to Generative AI, by **Google Cloud Skills** 🌀
- Data Analytics Methods for Marketing by **Meta** 🌀
- Participated in the **ISRO- Outreach Programme**: and completed the following courses:
  - Basics of Remote Sensing Geographical Information System and Global Navigation SatelliteSystem 🌀
  - Overview of Web GIS Technology 🌀
  - Earth Observation for Carbon Cycle Studies 🌀

## EXTRA-CURRICULARS

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- Part Of **American Society of Mechanical Engineers (ASME) college chapter, VIT Vellore** . 🌀 (Dec'17-March'19)  
I have made significant contributions in roles such as coordinator, events management, and primarily as a member of the design team. My skills encompass proficiency in Photoshop and Premiere Pro.
- **2018, Crew member, Mechnovate 2018**, an event by **ASME India, VIT Vellore** 🌀
- **2019, Coordinator, International Conference on Materials, Manufacturing and Modelling (ICMMM) 2019**, organized by the School of Mechanical Engineering (SMEC), VIT in association with ASME Chapter, VIT 🌀
- **2019, Manager, E-Fest Asia Pacific 2019**, an event by **ASME, USA** 🌀🌀

## NATIONAL LEVEL EXAMS TAKEN

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- **Graduate Aptitude Test in Engineering, GATE in CSE, All India Rank: 507, Score: 690, Percentile: 99.33**
  - Fundamental of computer science and engineering, Data Structure and Algorithms, Database, Computer Architecture, Computer Networks, Operating Systems, Compiler Design, Theory Of Computation, Digital Logic and Design, Discrete & Engineering Math. 🌀**Scorecard**