

# Souvik Mukherjee

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Degree	University/School	Subject/Discipline	Year	CPI/%
Post Graduation	IIT, Kanpur	MS-R, CSE (Cybersecurity)	2023-25	9.80
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	10.00

## RESEARCH EXPERIENCE

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

Guide: Prof. Nisheeth Srivastava

Impact: 50L+ students/year. Project of NTA for JEE Main/NEET UG exams in India (Nov'23 - Present)

- Our research focuses on detecting **GAN-based morphs and Photoshopped morphs**. We have achieved over 95% accuracy in detecting PNG-GAN morphs and over 98% accuracy in 'non-scanned' photoshopped images. We have created a **CNN** that classifies an image as scanned or unscanned with 95% accuracy. Tools: ELA, OpenCV, Pillow, InceptionV3, ResNET50, etc.

## ACADEMIC PROJECTS

### DOM and DFA Attack on AES (CS666: H/W Security for IoT)(A Grade) Guide: Prof. Urbi Chatterjee 🌐 (July'23-Nov'23)

- Determined the 5th byte of 10th round key by **DOM**. Analyzed 10K power traces and CT's with  $2^8$  key guesses, applied inv. S-Box, binned results by LSB & ranked guesses on mean differences across power traces to identify the highest-ranking as the key.
- Conducted fault injection, formed **DFA** eqns., iteratively retrieved key bytes. For 1B, **potential keys, reduced from  $2^8$  to 30**

### Packet Capture Analysis (CS628: CSS)(A Grade) Guide: Prof. Angshuman Karmakar 🌐 (July'23-Nov'23)

- Analyzed .PCAP files using Wireshark to detect **SQL injection** (e.g., UNION SELECT commands) and **XSS attacks** (get root privileges), including session ID theft via cookies.
- Implemented safety measures against XSS and SQL Inj. Skills: Security analysis, Wireshark, vulnerability mitigation.

### Escaping the Caves(CS641)(Modern Cryptology) (A Grade) 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**.

### Breaking Companion Arbiter PUF (CAR-PUF) using ML (CS771) Guide: Prof. Purushottam Kar 🌐 (Jan'24 - Apr'24)

- A CAR-PUF uses two arbiter PUFs and a secret threshold  $\tau$ . For same challenge, if  $|\Delta w - \Delta r| \leq \tau$ , the response is 0; else, it is 1.
- Derived a mathematical proof showing that a CAR-PUF can be compromised by a single linear model.
- Developed code to learn the linear model  $W, b$  using logistic regression with  $C = 1.0$ , mapping 32-dimensional input features to 528 for a better fit. Evaluated hyper-parameters for training time and accuracy.

## SELF PROJECTS

### Project GATE CSE GPT (Winter LLM Bootcamp, Pathway x IIT-K x IIT-BHU, Non-Academic) 🌐 (Feb'24)

Impact: 1L+ students/year

- Developed a real-time chatbot using OpenAI & Pathway for document search & retrieval, helping students with interview prep, PYQ, test-series, & other CSE doubts, to aid who can't afford coaching. It integrates Pathway's LLM App & Dropbox in the backend.
- **API Setup:** The API uses Pathway to process user queries by reading & parsing binary data from Dropbox, **computing embeddings** with the OpenAI API, & indexing them for efficient search. Responses to user is based on these indexed embeddings.
- **User Interface:** Built with **Streamlit**, inputs queries, sends to the API via POST, displays responses, & shows error, if request fails.

### Project Sign Calculator (IITG-RIC Hack Conclave - 2024, Non-Academic) 🌐🌐 (Aug'24)

Impact: 1L+ students/year

- Developed a first-of-its-kind sign language calculator using a deep learning model trained on a Kaggle dataset of hand signs for digits 0-5 and operators (+, -, \*, /). Implemented the project using Python, TensorFlow, and OpenCV, achieving real-time hand gesture recognition and evaluation of mathematical expression on screen with an accuracy rate of 99.90% on test data.

## RELEVANT COURSES AND TECHNICAL SKILLS

- **Mtech Courses** : Introduction to ML, Modern Cryptology, Computer Systems Security, Hardware Security for IOT Devices.
- **Btech Courses** : Data Structures & Algorithms, Computer Architecture, Essentials of ML,Digital Logic, Database Management.
- **Prog./Scripting Languages:** C, C++(proficient), Python (proficient), Java, JavaScript, Verilog HDL, HTML, CSS, MySQL.
- **ML Lib/Tools:** Scikit-learn, Tensorflow, PyTorch, NumPy, OpenCV, Pillow, Pandas, Matplotlib, Git, ~~TeX~~LaTeX, Google Colab, Jupyter.

## POSITIONS OF RESPONSIBILITY & WORK EXPERIENCE

- **Associate Engineer at L&T:** Designed check plates for GD&T of manufactured vehicles body parts. 🌐🌐 (Aug'21-March'22)
- **ESC111/112 Course Admin (Head TA)** : Management of exams, course logistics and duties of other TA's. (Jan'24-May'24)
- **Teaching Assistant** : Two sem of assisting students with doubt resolution, lab test management & grading (Aug'23-May'24)
- **Teaching Assistant** : CS 637: Embedded and Cyber-Physical Systems (Aug'24-Present)
- **Student Guide, Institute Counselling Services, IIT Kanpur:** Mentoring 8 freshmen, giving academic support. (Jul'24-Present)
- **Crew & Coordinator:** in Mechnovate & E-Fest, ASME Chapter, VIT Vellore, ( Media & Management ) 🌐 (Dec'17-Dec'19)

## ACADEMIC ACHIEVEMENTS AND RECOGNITION'S

- **Academic Excellence Award** for the sem. '2023-24 First' for ranking among the **top 10%** in the CSE department.🌐🌐
- **Top** open-source project contributor in Winter LLM Bootcamp, offered by **Pathway X P-Club IIT Kanpur x CoPS IIT BHU** 🌐
- **First Position** among 689 registered participants in the '**Altair Data Science Contest**' conducted by Altair x Techkriti'2024 🌐
- **Selected for ACM India Summer Schools 2024**, held at **IIT Bombay**, offered by Trust Lab, IIT Bombay. 🌐🌐
- **Selected for Sakura Science University Exchange Program 2024**, held at **Japan**, organised by Japan Science and Technology Agency. Among the 5 students, selected from IITK. Visited top Japanese universities, research institutes, & private companies. 🌐🌐
- **Secured All India Rank: 507 in GATE CSE/IT - 2023** among 1.02 lakh candidates nationwide. 🌐Scorecard