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' photoshoped 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 priveleges), including session ID theft via cookies.
- Implemented safety measures against XSS and SQL Inj. 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)

- Computed the Fourier transform for two given functions using the **Cooley-Tukey NTT algorithm**. Performed point-wise multiplication on the transformed functions. Applied the **Gentleman-Sande inverse NTT** algorithm to the final output.

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 τ. 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.

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, 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**