Gargi Sarkar

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As a researcher at the intersection of computer security and criminology, I investigate cybercrimes targeting everyday individuals. My work aims to develop efficient and systematic policing procedures to combat these crimes. I have been actively involved in mitigating and synthesizing solutions for cyber-enabled human trafficking and forced criminality affecting victims of trafficking. Currently, I am developing standard operating procedures for police to systematically investigate digital artifacts involved in cybercrimes, incorporating open-source intelligence, and fostering private-government collaboration.

EXPERIENCE

International Institute of Information Technology Hyderabad August 2025 – Present
Post-PhD Research Scientist *Hyderabad, India*

- Leading research in cybercrime investigation, digital evidence analysis, and emerging cybercrime analysis

EDUCATION

Indian Institute of Technology Kanpur 2021 - 2025
Ph.D. in Computer Science and Engineering (Coursework CGPA: 9.5 / 10) *Kanpur, India*

Presidency University 2018 - 2020
Master of Science (M.Sc.) in Mathematics (Marks Percentage: 65.00%) *Kolkata, India*

University of North Bengal 2015 - 2018
Bachelor of Science (B.Sc.) in Mathematics (Marks Percentage: 60.20%) *Siliguri, India*

West Bengal Council of Higher Secondary Education 2015
Higher Secondary (H.S.) (Marks Percentage: 84.20%) *Jalpaiguri, India*

West Bengal Board of Secondary Education 2013
Secondary Education (Marks Percentage: 85.71%) *Jalpaiguri, India*

PUBLICATIONS

Journals

* **Sarkar, G.**, & Shukla, S. K. (2024). Bi-directional exploitation of human trafficking victims: Both targets and perpetrators in cybercrime. Journal of Human Trafficking, 1-22.
* **Sarkar, G.,** & Shukla, S. K. (2023). Behavioral analysis of cybercrime: Paving the way for effective policing strategies. Journal of Economic Criminology, 2, 100034.
* **Sarkar, G.,** & Shukla, S. K. (2024). Reconceptualizing online offenses: A framework for distinguishing cybercrime, cyberattacks, and cyberterrorism in the Indian legal context. Journal of Economic Criminology, 4, 100063.
* **Sarkar, G.,** P.V.S, Charan and Shukla, S. K (Under Review). Understanding Jamtara cybercriminals: poverty, opportunity, and the rise of organized criminal networks (Manuscript under 3rd Phase review on *Humanities & Social Sciences Communications*, Nature Portfolio).
* Sachdeva, A., Saravanan, R., **Sarkar, G.,** Vemuri, K., & Shukla, S. K. (2025). BEACON: A Unified Behavioral-Tactical Framework for Explainable Cybercrime Analysis with Large Language Models. arXiv preprint arXiv:2512.06555. .
* **Sarkar, G.,** & Shukla, S. K. (2025). Cyber Slavery Infrastructures: A Socio-Technical Study of Forced Criminality in Transnational Cybercrime. arXiv preprint arXiv:2510.12814.
* Aljaradat, A., **Sarkar, G.**, & Shukla, S. K. (2024). Modelling the Impact of Cybersecurity on Digital Payment Adoption: A Game-Theoretic Approach. *Journal of Economic Criminology*, 5, 100089.
* **Sarkar, G.,** and Shukla, S. K. (under review). Policing Transnational Cybercrime: A Critical Assessment of the Anticipated Impact of the United Nations Convention against Cybercrime in India and Worldwide. *International Journal of Police Science and Management*).

* Negi, R., **Sarkar, G.,** and Shukla, S.K. (under review). AuditorMatch: A data-driven decision-support system for evaluating and selecting CERT-In empaneled cybersecurity auditors. *Computers & Security.*

Conference Proceedings

* **Sarkar, Gargi,** Hardeep Singh, Subodh Kumar, and Sandeep K. Shukla. "Tactics, techniques and procedures of cybercrime: A methodology and tool for cybercrime investigation process." *In Proceedings of the 18th International Conference on Availability, Reliability and Security*, pp. 1–10, 2023.

RESEARCH

Doctoral Research (Ph.D.) | *Indian Institute of Technology Kanpur*

* **Thesis:** *Digital Investigative Infrastructures for Cybercrime: A Human-Centric Approach from India's Policing Perspective*
* **Supervisor:** Prof. Sandeep Kumar Shukla
* Research integrates investigative tooling, human-centric cybercrime analysis, organized cybercriminal networks, cyber slavery, and international cybercrime law from an Indian policing perspective.

Building Framework for Cybercrime Investigations | ***Funded by Microsoft Research India*** | ***Part of Ph.D. Thesis*** 🔗

* Led the development of "Cybercrime Navigator", a framework and tool designed to improve the efficiency and systematization of policing procedures for cybercrime, detailing specific tactics, techniques, and procedures (TTPs).
* Developed the TTP-based framework that breaks down the entire cybercrime life cycle into 14 distinct stages, each representing intermediate goals (tactics). The framework posits that any cybercrime includes a subset of these tactics. For each stage, a nearly exhaustive set of techniques and sub-techniques used or likely to be used by criminals was defined, along with detailed descriptions and the digital artifacts involved. Ongoing efforts are focused on identifying all possible methods for investigating these digital artifacts.
* Designed and implemented an interactive tool to facilitate navigation and annotation within the framework. Key features include the ability to define layers, highlight, and display TTPs used in the cybercrime execution lifecycle. The tool also features automated modus operandi identification and suggestions based on keywords from victim reports. Its search functionality allows users to discover and highlight predefined cybercrime paths, illustrating how various TTPs are employed throughout the lifecycle. Each technique is documented on dedicated web pages with thorough explanations, related precautions, and applicable procedures and sub-techniques.

Studied Indian Organized Cybercriminal Networks | ***Part of Ph.D. Thesis***

* Conducted an in-depth study of organized cybercriminal networks in India, analyzed organizational structures, social engineering techniques, division of labor, and tiered operational hierarchies using criminological and psychological frameworks, highlighted the transformation of these networks into family-run enterprises and the professionalization of cybercrime through cybercrime-as-a-service
* Findings under review with *Humanities and Social Sciences Communications*.

Cybercrime and Human Trafficking | ***Part of Ph.D. Thesis***

* Explored the bidirectional relationship between cybercrime and human trafficking, demonstrating how cybercrime is both a tool for trafficking and a forced activity imposed on victims.
* Developed a five-tier victimization model based on Indian case data, illustrating trafficking, confinement, and compelled participation in cybercrime.
* One paper published in *Journal of Human Trafficking*; additional work under review.

Legal and Policy Analysis of Cybercrime | ***Part of Ph.D. Thesis***

* Constructed a target-impact and actor-intent model to formally differentiate between cybercrime, cyberattacks, and cyberterrorism, enabling computational classification and clearer legal interpretation grounded in Indian statutes.
* Critically evaluated cross-border policing frameworks, including the Budapest Convention and the proposed UN Convention against Cybercrime, assessing implications for India's diplomacy, sovereignty, and human rights in global cybercrime governance.

Dark Web Analysis and Monitoring | ***M.Sc. Thesis***

* Conducted an in-depth theoretical analysis in my M.Sc thesis on understanding and crawling the Dark Web and therefore, developing a platform to analyze onion URLs and construct connected graphs between onion layers to trace data back. Explored the Dark Web via Tor, attempted to identify imported resources from the surface web, and assessed the feasibility of tracing users. Leveraged this expertise during my Ph.D. to collaborate in developing a Dark Web Monitoring System.

PROJECTS

Cyber Commando Operational Manual | *A Ministry of Home Affairs, India, Initiative*

* Co-authored the **Cyber Commando Operational Manual**, a national-level training resource developed under the Ministry of Home Affairs to strengthen the cyber capabilities of law enforcement personnel.
* Contributed sections on digital forensics, electronic evidence handling, legal and compliance considerations, field operation measurement, search and seizure procedures, and digital evidence analysis.

AI-Enabled National Portal for Efficient Search of Missing People | *Funded by Department of Science and Technology, India*

* Participated in a multidisciplinary research project on cyber-enabled human trafficking and missing persons, contributing to the design and development of a centralized AI/ML-enabled web portal with facial recognition, natural language processing of FIRs, and keyword-based search algorithms for real-time victim identification.

Comparison of Network-based Intrusion Detection Systems | *A semester-long group coursework project*

* Conducted a comparative study of Snort and Suricata intrusion detection systems (IDS) on the C3i Centre laboratory network at IIT Kanpur, evaluating CPU and memory utilization, packet drop rates, and traffic accuracy.
* Addressed high false-positive rates by integrating machine learning; analyzed benchmark datasets (NSA Snort, DARPA, KDD) and evaluated five algorithms to determine the most effective model for IDS enhancement.

Developing Risk-Assessment-Interface | *A semester-long group coursework project*

* Developed the Risk-Assessment Interface, a web application designed to query the national vulnerability database and identify system vulnerabilities based on user-entered information. Users can select listed threats related to the system within the organization, and the application displays the vulnerabilities and risk score accordingly.

Breaking down Cryptosystems | *A semester-long group coursework project*

* Deconstructed several cryptosystems using Python and C code: 6-round and 4-round DES with differential cryptanalysis, 4-round AES with square attacks, and low-exponent RSA vulnerabilities. Additionally, toy hash functions were broken down using brute force methods. Classical ciphers, including the Substitution cipher, Vigenère cipher, Playfair cipher, and Substitution-Permutation networks, were also successfully broken.

ACADEMIC SERVICE

Sub-Reviewer

* ACM SAC 2024: The ACM/SIGAPP Symposium On Applied Computing
* Behaviour & Information Technology
* Computer & Security

Reviewer

* Deviant Behavior
* Journal of Criminal Psychology
* Psychology, Crime and Law
* Security Journal
* Safer Communities

TEACHING

Project Mentor at International Institute of Information Technology (IIIT) Hyderabad

* CG4.402: Introduction to Neuroeconomics (August 2025 - Present) - Mentoring students on projects related to behavioral economics in cyber frauds, guiding research design, methodology, and analysis

Teaching Assistant at Indian Institute of Technology (IIT) Kanpur

* CS203: Mathematics for Computer Science-III (Introduction to Probability) (March 2025 - May 2025)
* CS202: Mathematics for Computer Science-II (Mathematical Logic) (January 2025 - March 2025)
* CS201: Mathematics for Computer Science-I (Discrete Mathematics) (August 2024 - November 2024)
* CS633: Parallel Computing (January 2024 - May 2024)
* CS771: Introduction to Machine Learning (August 2023 – November 2023)
* CS641: Modern Cryptology (January 2023 – May 2023)
* CS628: Computer Systems Security (August 2022 - November 2022)

* CS345: Algorithms II (August 2021 – November 2021) & (January 2022 - May 2022)
* CS961 (e-Masters): Introduction to Cryptography (January 2023 - March 2023) & (March 2023 - Present)
* CS972 (e-Masters): Introduction to Linear Algebra (April 2023-June 2023) & (January 2024 - March 2024)
* **Tutor** for ESC101: Fundamentals of Computing (May 2022 – July 2022)

Teaching Assistant at National Programme on Technology Enhanced Learning (NPTEL))

* Modern Algebra

ACHIEVEMENTS

* **C3iHub Research Fellowship** Awardee for Research in Cybersecurity (2022 – 2025)
* **Darkathon 2022** Finalist – Selected by the Narcotics Control Bureau, Government of India, for innovative solutions targeting anonymity in dark web narcotics markets
* Qualified **GATE 2021** in Mathematics - National-level exam assessing advanced mathematical aptitude for postgraduate programs and public sector roles
* Qualified **JAM 2018** in Mathematics - Competitive national exam for admission to M.Sc. programs in NITs, IITs, and other centrally funded institutions
* Qualified **JEE Mains 2015** - National-level entrance exam for undergraduate engineering programs in NITs, IITs, and other centrally funded institutions

TALKS AND PRESENTATIONS

* Invited for a talk at the **International Conference on Availability, Reliability and Security (ARES), 2023**, Benevento, Italy
* Invited for a talk on the special track for law enforcement officers to investigate cybercrime at **c0c0n - XVI, International Cyber Security Conference**
* Delivered lecture in the **Advanced Certification Program in Cyber Security and Cyber Defense**, hosted by TalentSprint.

ACTIVITIES

Cybercrime Victim Support | ***Social Service Initiative at IIT Kanpur***

* Established and led a cybercrime helpline for students, offering end-to-end support including legal guidance, financial recovery, and reporting assistance, along with conducting proactive awareness sessions on emerging cybercrime methods to improve campus community resilience

Other Notable Contributions

* Organizer, **HACK IITK 2024** - a national-level cybersecurity hackathon hosted at IIT Kanpur
* Presented the **Cybercrime Navigator** tool at the **3rd National Workshop on Technology Innovation in Cyber-Physical Systems (TIPS)**, organized by the Department of Science and Technology, Government of India

TECHNICAL SKILLS

Matlab, C programming, Python, HTML, CSS, Latex, Markdown

REFERENCES

Prof. Sandeep Kumar Shukla

* Poonam and Prabhu Goel Chair Professor, and Dr. Deep Singh and Daljeet Kaur Faculty Fellow
* Department of Computer Science and Engineering, Indian Institute of Technology Kanpur, India
* Email: sandeeps@cse.iitk.ac.in; Mobile: +91 9830442004; Relation: Ph.D. Thesis Supervisor

Prof. Manindra Agrawal

* Institute Director and Professor
* Department of Computer Science and Engineering, Indian Institute of Technology Kanpur, India

* Email: manindra@iitk.ac.in; Mobile: +91 9935062605; Relation: Ph.D. Coursework Instructor and TA Supervisor

Prof. Avishek Adhikari

* Professor and Head
* Department of Mathematics, Presidency University, Kolkata, India
* Email: avishek.maths@presiuniv.ac.in; Mobile: +91 8777323745; Relation: M.Sc. Thesis Supervisor