Anirban Mukhopadhyay

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Research Interest

I design sociotechnical systems to transform real-world OSINT investigations, focusing on the collection and analysis of publicly available information. My research centers on generating design ideas based on theoretical frameworks, prototyping web applications, and evaluating workflows to address technical and collaborative challenges in OSINT. My published works include developing a flexible crowdsourcing framework for scaling discovery and verification of OSINT (CSCW 24) and efficiently debunking social media misinformation with crowds (DIS 23). In my ongoing projects, I focus on enhancing human-AI interactions to facilitate the collaborative use of generative AI.

Education

Virginia Tech **01/21 – 12/25 (Expected)**
PhD in Computer Science with a focus in Human-Computer Interaction (GPA: 3.97) *Blacksburg, Virginia*
Advisor: Dr. Kurt Luther

Jadavpur University **2014 – 2018**
Bachelor of Engineering in Computer Science (GPA: 8.94/10) *Kolkata, India*

Research Skills and Methods

Design Methods: Co-design, Design-based Research, Research through Design, Scenario-based Design, Contextual Inquiry, Human-Centered Design

Tools and Libraries: Figma, OpenAI Assistants API, LangChain, Tensorflow, pandas, scikit-learn, Unity

Web Development: Django, Flask, Python, C#, React, Java Script, HTML

Design Process: Personas, Journey Mapping, Wire-framing, Rapid Prototyping, Crowdsourcing, Experiment Design, Survey Design, User Interviews, Qualitative Data Analysis, Log Analysis (Telemetry), Usability Evaluations

Work Experience

Microsoft **Summer 2023**
Design Research Intern in Mixed Reality Design and UX Research team *Redmond, Washington*

- Led a generative research study on trust in Copilot-driven AI experiences, enhancing user engagement insights.
- Developed a scenario-based study design after a thorough literature review. This study focused on the effectiveness, preferred methods of interaction, and potential issues in three distinct scenarios faced by information workers depicted through storyboards, each varying in levels of importance and risk.
- Presented recommendations to partner teams for system relevance, transparency, human control, and data privacy based on findings from semi-structured interviews with 8 internal employees.

Microsoft **Summer 2022**
PhD Software Engineering Intern in Mixed Reality Design and UX Research team *Redmond, Washington*

- Explored 3D map interactions in Mixed Reality through a human-centered approach.
- Identified challenges, brainstormed ideas, prototyped and evaluated intuitive navigation interactions with Bing Maps SDK for Hololens 2 using Unity and MRTK.

Microsoft **June 2018 – December 2020**
Software Engineer (Full-stack) in SharePoint Taxonomy *Hyderabad, India*

- Analyzed service telemetry and boosted reliability to 99.99%, ensuring robust user experiences. Developed REST API endpoints and integrated them to modernize the user interface for filtering SharePoint lists using React.
- Collaborated cross-functionally with design and PM teams and geographically distributed development teams.

Research Projects

Enhancing Human-AI Co-Creativity by supporting Leadership Behavior | *LLM Agents* **Summer 2024**

- Developed a generative AI-supported application for 40 students to enhance creative collaboration in creating and iterating over OSINT-based Capture the Flag challenges (CTFs), which are important for learning OSINT skills.
- Explored agentic workflows to improve human-AI collaboration in team settings by supporting leadership behaviors like planning, clarifying, monitoring, and problem-solving in creative tasks. Iterative deployment of the system is planned for Fall 2024.

Generative AI in collaborative OSINT investigations | *Co-design workshop, Focus Group, Survey* **Fall 2023**

- Led a co-design study to introduce LLMs for addressing technical and collaboration challenges in cybersecurity vulnerability assessment using OSINT.
- Conducted 10 two-hour-long design workshops with 6 undergraduates over a year to explore novel design ideas across the intelligence cycle. Applied a matchmaking process using generative AI probes to test collaboration features for evaluating LLM output as a team.
- Investigated the use of generative AI in 3 successful real-world vulnerability assessments for small businesses. Identified design goals for supporting leadership in these team-based investigations.

OSINT Research Studios | *Crowdsourcing, Interview, Survey, Thematic analysis* **Spring 2022**

- Applied Design-Based Research to aid 6 experts including journalists, fact-checkers, and law enforcement officers in leveraging crowdsourcing for social media investigations.
- Collaborated with 30 undergraduates over a semester to refine task decomposition, ensuring ethical and high-quality investigations and boosting expert-led synchronous collaboration.
- Conducted thematic analysis of 10 interviews, including 5 with experts and 5 student focus groups to demonstrate the system's effectiveness in scaling up complex sensemaking tasks.

Collaborative CTFs to investigate misinformation | *Web Development, Log analysis, Visualization* **Spring 2021**

- Developed a web app for 40 students using a Research through Design approach over a semester, blending collaboration and competition to debunk online misinformation.
- Designed surveys, conducted usability evaluations for design iteration and analyzed system logs to assess team strategies and evolving impact of rubric modifications.

Publications

Peer-reviewed Conference and Journal Papers

A. Mukhopadhyay, S. Venkatagiri, K. Luther. 2024. OSINT Research Studios: A Flexible Crowdsourcing Framework to Scale Up Open Source Intelligence Investigations. In Proceedings of the ACM on Human-Computer Interaction 8.CSCW1 (2024): 1-38. https://doi.org/10.1145/3637382 **(CSCW 2024)**

S. Venkatagiri, **A. Mukhopadhyay**, D. Hicks, A. Brantly, and K. Luther. 2023. CoSINT: Designing a Collaborative Capture the Flag Competition to Investigate Misinformation. In Proceedings of the 2023 ACM Designing Interactive Systems Conference (DIS '23). Association for Computing Machinery, New York, NY, USA, 2551–2572. https://doi.org/10.1145/3563657.3595997 **(DIS 2023)**

Selected Workshop Papers and Posters

T. Craycroft, E. Dettman, A. Jones, P. Ludwig, V. Pang, **A. Mukhopadhyay**, K. Luther. OSINT for Cyber Vulnerability Assessments of Virginia Small Businesses. Poster presented at Academic Symposium on Cybersecurity, Emerging Networks, and Technologies (ASCENT) 2024, held at Virginia Tech, Blacksburg.

T. Craycroft, E. Dettman, A. Jones, P. Ludwig, V. Pang, **A. Mukhopadhyay**, K. Luther. Hosting an OSINT-focused Capture the Flag (CTF) Competition: Leveraging Creativity, Collaboration, and Artificial Intelligence. Talk at Academic Symposium on Cybersecurity, Emerging Networks, and Technologies (ASCENT) 2024, held at Virginia Tech, Blacksburg.

A. Mukhopadhyay, S. Venkatagiri, and K. Luther. Developing Collaboration and Competition Skills in a Crowd of Student OSINT Investigators. In Workshop on Supporting Workers in Developing Effective Collaboration Skills for Complex Work. **(CSCW 2023)**

A. Mukhopadhyay, S. Venkatagiri, and K. Luther. Towards Designing a Flexible Expert-led Crowdsourcing Framework for Investigating Misinformation. In Workshop on Designing Credibility Tools to Combat Mis/Disinformation: A Human-Centered Approach. **(CHI 2022)**

A. Mukhopadhyay, S. Kumar, S. R. Chowdhury, and S. Agarwal. On the correlation between facial expression and sentiment conveyed over text during a textual conversation. Poster presented at **MLADS - Synapse 2019**, the internal ML/AI conference of Microsoft held in Hyderabad, India.

Relevant Coursework

HCI: Human-AI Interaction (Explainable AI focus), CSCW & Social Computing, Information Visualization, Usability Engineering, Statistics in Research
Data Science and AI: Human-AI Interaction (Deep Learning focus), Deep Learning, Data Analytics