Anirban Mukhopadhyay

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Research Interest

I design sociotechnical systems that support and transform real-world investigations involving publicly available information (OSINT). My ongoing research focuses on generating and evaluating design ideas for Generative AI to address technical and collaborative challenges with OSINT investigations. My published works include developing a flexible crowdsourcing framework to scale up discovery and verification of OSINT (CSCW 24) and efficiently debunking mis and disinformation with crowds (DIS 23). Broadly, I am interested in developing effective human-AI interactions for collaborative sensemaking.

Education

Virginia Tech **January 2021 – Present**
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, Scenario-based Design, Research through Design, Contextual Inquiry, Human-Centered Design

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

Web Development: Django, Python, C#, Java Script, HTML, D3.js

Tools and Libraries: Figma, Balsamiq, Unity, Tensorflow, pandas, scikit-learn

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*

- Boosted service reliability to four 9s and enhanced API performance, ensuring robust user experiences. Modernized UI for filtering in SharePoint lists using React.
- Collaborated cross-functionally with design and PM teams and geographically distributed development teams.

Research Projects

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 6 two-hour-long design workshops with 6 undergraduates over a semester to explore novel design ideas across the OSINT cycle of planning, collection, processing, analysis, and dissemination.
- Applied a matchmaking process using generative AI probes to develop prompt libraries for relevant tasks and test collaboration features for evaluating LLM output as a team.

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

- Applied Design-Based Research to aid 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, Survey, Log analysis* **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.

Document Image Processing and Pattern Recognition | *Classifier Combination, Correlation* **2016 – 2018**

- Improved accuracy of handwritten numeral recognition through a combination of CNN models with different hyperparameters based on correlation analysis of confidence scores.
- Applied a wide range of classifier combination methodologies on three texture and shape-based features to improve the accuracy of handwritten Indian script recognition.
- Evaluated one-class classifiers to address challenges involved in text detection in natural scenes, including wide variation in font and size of text and highly complex background.
- Explored the correlation between facial expression and sentiment conveyed over text during a textual conversation by creating dataset and implementing emotion recognition from facial expression and sentiment analysis of text.

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. arXiv:2401.00928 **(Forthcoming at 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)**

A. Mukhopadhyay, S. Kumar, S. R. Chowdhury, N. Chakraborty, A. F. Mollah, S. Basu, and R. Sarkar. Multi-Lingual Scene Text Detection Using One-Class Classifier. International Journal of Computer Vision and Image Processing (IJCVIP) 9, no. 2 (2019): 48-65. https://doi.org/10.4018/IJCVIP.2019040104

A. Mukhopadhyay, P. Singh, R. Sarkar, and M. Nasipuri. A study of different classifier combination approaches for handwritten Indic Script Recognition. Journal of Imaging 4, no. 2 (2018): 39. https://doi.org/10.3390/jimaging4020039

Selected Workshop Papers and Posters

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