Biswaksen Patnaik

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Summary

Human-centered AI researcher building real-time, multimodal interactive systems for embodied and spatial interaction. My work focuses on designing and evaluating human-in-the-loop systems that support sensemaking in collaborative, real-world environments.

Education

University of Maryland College Park, MD
Ph.D. in Computer Science *2019 – Present*
Research: Human-Centered Physical AI for Embodied Sensemaking and Interaction
Advisors: Dr. Niklas Elmqvist and Dr. Huaishu Peng

University of Maryland College Park, MD
M.S. in Human-Computer Interaction *2017 – 2019*
Research: Olfactory Analytics: Exploring the design space of smell for data visualization

National Institute of Technology Rourkela, India
B.Tech. in Industrial Design *2012 – 2016*

Experience

Doctoral Researcher Aug. 2019 – Present
University of Maryland *College Park, MD*

- Design, develop, and evaluate end-to-end interactive systems for human-centered AI, integrating multimodal sensing, LLM-based pipelines, and adaptive interfaces to support spatial interaction in ad-hoc, collaborative, and time-sensitive environments; grounded in rapid prototyping and iterative validation in real-world settings.
- Lead design and implementation of research systems including *Datamancer* (bimanual gesture interaction across distributed displays), *VisTorch* (handheld projection for situated analytics), and *StageAI* (agentic AI system for real-time support during live presentations), advancing real-time, human-in-the-loop interaction across spatial and multi-device ecosystems, resulting in peer-reviewed CHI publications.
- Design and conduct empirical user studies with users and domain experts to evaluate usability, predictability, and human control in interactive systems, generating insights that inform the design of real-time, collaborative interaction techniques.

Research Intern Jun. 2025 – Aug. 2025
Fujitsu Research of America *Pittsburgh, PA*

- Prototyped multimodal interaction pipelines combining gesture, speech, and contextual signals to support real-time AI-assisted interface generation and modification.
- Designed and evaluated human-in-the-loop adaptive systems, examining implicit and explicit interaction cues to support user control and understanding of generative system behavior.
- Built end-to-end prototype systems integrating multimodal input with generative models to support creation and modification of web-based user interfaces.

Visiting Scholar Jul. 2024 – Aug. 2024
Center for Anytime Anywhere Analytics, Aarhus University *Aarhus, Denmark*

- Developed and evaluated bimanual gesture interaction techniques for multi-display environments, enabling cross-device data manipulation and spatial organization of analytical workflows.
- Designed and prototyped a wearable interaction system supporting embodied, cross-device analytics, integrating on-device sensing and real-time gesture input across heterogeneous displays.

Visiting Scholar Jun. 2019 – Aug. 2019
Sussex Computer Human Interaction Lab, University of Sussex *Brighton, UK*

- Explored mid-air haptic interaction techniques using ultrasonic feedback, developing haptic encoding strategies (e.g., patterns, intensities, temporal cues) for non-visual data representation and accessible interaction.
- Prototyped and evaluated cross-modal interaction techniques integrating mid-air haptics with visualization, examining how haptic cues support data interpretation in immersive analytics settings.

Research Intern May 2018 – Aug. 2018

Human-Computer Interaction Group, Hasso Plattner Institute *Potsdam, Germany*

- Explored haptic rendering techniques across different body locations to understand perception and inform the design of assistive interaction techniques.
- Designed and prototyped a low-cost, capstan-based force-feedback mechanism with low backlash, integrating sensing and actuation to support accessible haptic interaction for visually impaired users.

Research Intern Feb. 2017 – May 2017

Wearable Computer Lab, University of South Australia *Adelaide, Australia*

- Investigated shape-changing and physically adaptive interfaces for collaborative interaction, developing a functional prototype to examine how physical form influences dynamic affordances in user interfaces.

Research Intern May 2015 – Jul. 2015

Keio-NUS CUTE Center, National University of Singapore *Singapore*

- Designed and prototyped user interfaces for digital taste stimulation systems, and conducted user studies examining how visual, electrical, and olfactory cues influence taste perception across diverse user groups.

Selected Publications

- **Biswaksen Patnaik**, Marcel Borowski, Huaishu Peng, Clemens N. Klokmose, Niklas Elmqvist. *Datamancer: Bimanual Gesture Interaction in Multi-Display Ubiquitous Analytics Environments.* CHI 2025.
- **Biswaksen Patnaik**, Huaishu Peng, Niklas Elmqvist. *VisTorch: Interacting with Situated Visualizations using Handheld Projectors.* CHI 2024.
- **Biswaksen Patnaik**, Huaishu Peng, Niklas Elmqvist. *Sensemaking Sans Power: Interactive Data Visualization Using Color-Changing Ink.* IEEE TVCG 2023.
- Pramod Chundury, **Biswaksen Patnaik**, Yasmin Reyazuddin, Christine Tang, Jonathan Lazar, Niklas Elmqvist. *Towards Understanding Sensory Substitution for Accessible Visualization: An Interview Study.* IEEE TVCG 2022.
- Andrea Batch, **Biswaksen Patnaik**, Moses Akazue, Niklas Elmqvist. *Scents and Sensibility: Evaluating Information Olfactation.* CHI 2020.
- **Biswaksen Patnaik**, Andrea Batch, Niklas Elmqvist. *Information Olfactation: Harnessing Scent to Convey Data.* IEEE TVCG 2018.

Technical Skills

Programming: Python, JavaScript
ML / AI: PyTorch, LoRA / PEFT, LLM APIs, Retrieval-based systems (RAG), Embeddings & vector search (FAISS, Chroma), LlamaIndex, Human-in-the-loop AI systems
Systems / Development: FastAPI, REST APIs, WebSockets, Real-time systems, Multithreading & multiprocessing
Frontend / Visualization: React, D3.js, A-Frame, Unity, HTML/CSS, Figma, Matplotlib, Tableau
Research: UX Research, Human Factors, Qualitative, Quantitative, and Mixed-methods Evaluation
Hardware / Prototyping: Raspberry Pi, Arduino, EdgeAI (Jetson), 3D printing, Rapid prototyping, Fusion 360

Awards, Service, & Teaching

- Reviewer, ACM CHI (2024, 2025)
- Subcommittee Assistant, Developing Novel Devices: Hardware, Materials & Fabrication (CHI 2026)
- Dean's Fellowship, Department of Computer Science, University of Maryland (2019 – 2021)
- HCIM Student Travel Award, University of Maryland (2018)
- Volunteer, Human-Computer Interaction Lab Symposium, University of Maryland (2019)
- Teaching Assistant (UMD): CMSC434 Human-Computer Interaction (Fall 2024 – Spring 2026); CMSC425 Game Programming (Spring 2024); INST362 User-Centered Design (Fall 2018)