

Biswaksen Patnaik

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SUMMARY

Human-computer interaction researcher specializing in real-time, multimodal systems for embodied and social interaction. Build and evaluate end-to-end systems that integrate gesture, speech, and contextual signals to enable responsive system behavior in real-world environments. Experience designing and conducting empirical studies to understand how users interact with and guide intelligent systems.

Research interests include human-AI interaction, human-in-the-loop systems, user behavior modeling, and interactive systems operating under real-world constraints.

EDUCATION

University of Maryland

Ph.D. in Computer Science

College Park, MD

2019 – Present

Research: Human-Centered Physical AI for Embodied Sensemaking and Interaction

Advisors: Dr. Niklas Elmqvist and Dr. Huaishu Peng

University of Maryland

M.S. in Human-Computer Interaction

College Park, MD

2017 – 2019

Research: Olfactory Analytics: Exploring the design space of smell for data visualization

National Institute of Technology

B.Tech. in Industrial Design

Rourkela, India

2012 – 2016

EXPERIENCE

Doctoral Researcher

University of Maryland

Aug. 2019 – Present

College Park, MD

- Design, build, and evaluate real-time interactive systems integrating multimodal input and LLM-based pipelines to support user-facing tools and creative workflows in time-sensitive environments.
- Develop research systems including *Datamancer* (multi-display data interaction), *VisTorch* (situated visualization for in-context exploration), and *StageAI* (real-time, context-aware AI assistant), advancing human-in-the-loop interaction across spatial and multi-device environments.
- Build multimodal interaction pipelines combining gesture, speech, and contextual signals with LLMs, studying how AI systems interpret context, generate outputs, and integrate into ongoing user workflows without disrupting interaction.
- Design and conduct empirical studies to evaluate usability, predictability, and user control in AI-assisted systems, generating insights for interactive data systems and real-time collaborative analytics.

Research Intern

Fujitsu Research of America

Jun. 2025 – Aug. 2025

Pittsburgh, PA

- Prototyped real-time multimodal interaction pipelines combining gesture, speech, and contextual signals with LLMs to support AI-assisted interface generation and modification.
- Designed and evaluated human-in-the-loop adaptive systems, examining how users guide and interpret generative system behavior through implicit and explicit interaction.
- Built end-to-end systems integrating multimodal input and generative models to support dynamic creation and modification of web-based interfaces in real time.

Visiting Scholar

Center for Anytime Anywhere Analytics, Aarhus University

Jul. 2024 – Aug. 2024

Aarhus, Denmark

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

Visiting Scholar

Sussex Computer Human Interaction Lab, University of Sussex

Jun. 2019 – Aug. 2019

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. Klokmoose, 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: LLM Systems, Retrieval-Augmented Generation (RAG), Embeddings & Vector search (FAISS, Chroma), PyTorch, LoRA / PEFT, LLM evaluation, human-in-the-loop systems

Systems / Development: FastAPI, REST APIs, WebSockets, Real-time systems, Multithreading & multiprocessing

Frontend / Visualization: React, D3.js, A-Frame, Unity, HTML/CSS, Matplotlib, Tableau

Design: Interaction Design, Product Design, Figma

Research: UX Research, Usability Testing, 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)