



Designing Interactive Multimodal Information Retrieval and Access for Heads Up Computing (DIMIRA-HUC)

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Abstract

The advancement of wearable intelligent systems presents a unique opportunity to transform how humans interact with digital content. This workshop explores the design of Interactive Multimodal Information Retrieval and Access systems specifically tailored for Heads-Up Computing environments. By leveraging multimodal inputs, such as voice, gaze, and gesture, these systems enable real-time, hands-free access to digital information, facilitating seamless and efficient interaction. The goal is to support tasks requiring rapid information access in dynamic environments while ensuring users remain "heads-up" and engaged with the real world. This half-day workshop will share research outcomes and best practices, foster community building, and facilitate discussions on key challenges. By bringing together researchers and practitioners, it aims to drive further advancements in both research and practical applications within this rapidly evolving field.

CCS Concepts

• **Human-centered computing**; • **Ubiquitous and mobile computing**; **Mixed / Augmented reality**; **Virtual reality**; • **Information systems**; • **Search interfaces**;

Keywords

Multimodal Interaction Design, Conversational Search, Interactive Information Retrieval, Seeking and Access, User Search Behavior, Heads-up Computing, Generative AI

ACM Reference Format:

Haiming Liu, Shengdong Zhao, Silang Wang, Preben Hansen, Ian Oakley, and Khanh-Duy Le. 2025. Designing Interactive Multimodal Information

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CHIIR '25, Melbourne, VIC, Australia

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ACM ISBN 979-8-4007-1290-6/2025/03

<https://doi.org/10.1145/3698204.3716482>

Retrieval and Access for Heads Up Computing (DIMIRA-HUC). In *2025 ACM SIGIR Conference on Human Information Interaction and Retrieval (CHIIR '25)*, March 24–28, 2025, Melbourne, VIC, Australia. ACM, New York, NY, USA, 3 pages. <https://doi.org/10.1145/3698204.3716482>

1 Introduction

In recent years, heads-up computing has emerged as a promising paradigm, shifting the focus from traditional device-centric interactions to more fluid, context-aware systems that align with natural human behaviors [12]. The primary goal of heads-up computing is to preserve users' situational awareness, enabling interaction with digital systems without diverting attention from their physical surroundings. As an emerging field, heads-up computing presents both opportunities and challenges [11]. Adapting to this new interaction paradigm requires rethinking the design of search and generative AI technologies, which differ significantly from traditional interfaces for computers and mobile screens [9]. This workshop explores the design of interactive multimodal systems that support information retrieval and access in such environments, leveraging the unique advantages of wearable and immersive technologies.

1.1 Multimodal Interaction in Information Retrieval and Access:

The evolution of information retrieval and Access in the heads-up computing paradigm hinges on the integration of multiple modalities. Unlike traditional methods where users must engage through a single interface (e.g., typing on a screen), multimodal systems combine voice commands, gestures, and gaze tracking to allow users to query and access information. This enables a more natural and intuitive interaction style, essential for heads-up devices, where users may be engaged in other physical tasks (e.g., walking, driving, etc.).

1.2 Designing for Multimodal Interactive Retrieval and Access:

The design of a system for interactive retrieval and access must focus on immediacy and relevance. Wearable systems, such as augmented reality (AR) glasses and virtual reality (VR) headsets

must provide real-time results based on multimodal queries without overwhelming the user. The design should emphasize the following:

Context-awareness: The system should recognize and adapt to user environments and activities when forming the users' information needs, prioritizing information based on relevance and user attention levels.

Feedback loops: Users should be able to refine and filter queries and results interactively using natural input modalities, such as hand gestures, gaze, voice, etc.

Seamless interaction: The retrieval process must minimize disruptions, allowing users to remain immersed in their tasks without breaking focus to interact with the device.

1.3 Challenges and Opportunities:

Designing such information retrieval and access systems for heads-up computing presents several challenges:

Privacy and security: Given the always-on nature of multimodal systems, maintaining user privacy, and securing sensitive data is paramount.

Cognitive load: The system must balance delivering timely information without overwhelming users, particularly when multiple input modalities are simultaneously engaged.

Adaptability: The system should be able to adjust to varying levels of user engagement and environmental complexity, ensuring robust performance in different contexts (e.g., low-light conditions, noisy environments).

However, the opportunities are vast. A successful multimodal information retrieval and access system can:

Enhance productivity by allowing users to multitask efficiently in workspaces and public environments.

Improve accessibility for users with physical impairments, enabling them to retrieve information in a hands-free, seamless manner.

Advance user experience in sectors such as healthcare, manufacturing, and education by providing instant, context-relevant information.

2 The workshop

The workshop will be a half-day symposium featuring invited talks and focused group discussions.

2.1 The Workshop Schedule

00:00-00:15 Workshop opening and welcome (15 mins)
 00:15-01:00 Keynote talk (45 mins)
 01:00-01:30 Invited talks x 2 (30 mins)
 01:30-02:00 Coffee break (30 mins)
 02:00-02:30 Invited talks x 2 (30 mins)
 02:30-03:55 CHI SIG Style Discussion
 03:55-04:00 Workshop closing and moving forward.

2.2 The Workshop Significance and Relevant to CHIIR

This workshop builds on the co-organizers' ongoing and past research and innovation projects, aiming to cultivate a larger community and drive progress in this research agenda. Liu has been conducting CHIIR-related research and organizing activities in this

field for over a decade [1-6, 8-9]. In collaboration with Oakley, Wang, Le, and Zhao, Liu has worked on developing information retrieval and access technologies for a new interaction paradigm known as Heads-Up Computing (HUC) [9, 11], which was proposed and defined by Zhao et al. [12]. Preben has also made significant contributions, publishing a substantial body of impactful research on CHIIR-related topics. In recent years, his work has focused on designing information access systems for augmented reality (AR) and virtual reality (VR) scenarios [7, 10].

All organizers have extensive experience in running workshops and conferences, and this proposed workshop aligns well with the CHIIR community's focus. While some CHIIR researchers are exploring information retrieval and access systems within the heads-up computing paradigm, there is currently no dedicated platform for sharing knowledge, experiences, and best practices. This workshop seeks to bridge that gap by fostering collaboration and advancing the research agenda in a systematic and meaningful way.

2.3 The Expected Workshop Outcome

The workshop summary is expected to be published in the adjunct proceedings and reported in SIGIR Forum and Communications of the ACM. Following the workshop, we plan to establish a Special Interest Group (SIG) at CHI 2025. Additionally, we aim to organize a special issue in a relevant journal, such as the International Journal of Human-Computer Studies or another CHI or information retrieval journal.

3 workshop organisers

Haiming Liu is an Associate Professor in Interactive User-Centered Information Access at the University of Southampton, UK. She has published extensively in leading venues across the Information Science, Information Retrieval, and Human-Computer Interaction communities, including SIGIR, ECIR, CHIIR, ICMR, and UMAP. Her expertise in interactive multimedia and multimodal search is a key component of intelligence for Heads-Up Computing, and she is deeply committed to designing information retrieval and access technologies for this emerging interaction paradigm. Haiming has held numerous leadership roles in conference organization, including Program Chair, Workshop Chair, Tutorial Chair, and PhD Symposium Chair. With her experience in successfully organizing three previous workshops, she is well-positioned to lead this workshop to success.

Shengdong Zhao is a professor in the School of Creative Media and Computer Science Department at the City University of Hong Kong (CityU). With an extensive background in creating interface tools and applications, he regularly shares his research at leading HCI conferences and journals, including CHI, UbiComp, UIST, and CSCW. Presently, Dr. Zhao's research is centered on the development of the next interaction paradigm, referred to as "Heads-up Computing." This endeavor aims to facilitate wearable personal assistants that provide timely, context-sensitive assistance in various environments. In 2017, he consulted for the Huawei Consumer Business Group. Beyond his research, Dr. Zhao actively contributes to the HCI community, often being part of program

committees for notable HCI conferences and having chaired the paper committee for the ACM SIGCHI conferences in 2019 and 2020.

Ian Oakley is a tenured full professor at the School of Electrical Engineering at KAIST. Over the past two decades he has amassed a substantial portfolio of research in wearable and interactive technology and is a regular author at key venues in the area, such as ACM CHI, UIST and IMWUT. Currently he is interested in designing input and interactions for smart glass systems that reflect the unique form factors and use-contexts of these systems: miniaturized, handheld, wearable, ubiquitous and operated when mobile, distracted, busy or multi-tasking. In addition to his work as a researcher and author, he regularly serves as a program committee member or chair for a wide range of top HCI venues including CHI, UIST, IMWUT and TEI.

Silang Wang is a year four Computer Engineering undergraduate student at the National University of Singapore (NUS). His research interests focus on supporting human-centered multimodal interaction in daily tasks like information retrieval, specifically to enhance user experience. Passionate about interdisciplinary research and collaboration, Silang has participated in and won awards at multiple international hackathons, such as the Huawei Smartglasses Development Bootcamp and the International Building Design Competition, where he worked alongside architects, industrial designers, and engineers to balance art and analytics in his projects. He has published two papers on user interaction behavior with novel messaging and information retrieval systems on AR smart glasses in IMWUT and MobileHCI. In addition to his academic pursuits, he is also interested in entrepreneurial endeavors, cinematography and music.

Preben Hanson is a Docent and Associate Professor in Human-Computer Interaction and Information Seeking at Stockholm University, Department of Computer and Systems Sciences. He is the Director of Internationalization of Research and Higher Education at DSV. He is also an Honorary Research Fellow at University of Illinois, Urbana-Champaign and Visiting Professor at Peking University. He has authored more than 190 academic peer-reviewed articles in international journals and conferences. He has served as conference Chair in around 15 conferences like ACM and iConference. He also serves as the editorial board member: ACM Responsible Computing (ARC), International Journal of Information and Learning Sciences and International and Journal of Data and Information Management (DIM).

Khanh-Duy Le, shortly called Duy Le or Duy, is currently a senior researcher & lecturer (equivalent to Assistant Professor) at the Faculty of Information Technology, University of Science – Vietnam National University Ho Chi Minh City (VNUHCM). He is the founder and currently leading the Human-Computer Interaction & User Experience research group, the very first of this kind at University of Science as well as in the VNU-HCM system. He is also concurrently Deputy Head of the Intelligent Systems Lab of the faculty. He obtained a PhD degree in human-computer interaction from Chalmers University of Technology, Sweden. Before that, he completed his Master of Engineering degree specialized in Multimedia from Télécom ParisTech, France. Prior to rejoining academia in Vietnam in mid-2022, he was a research scientist in the User Experience research team of ABB Research in Västerås, Sweden. He also had a time working in the Human-Machine interface group of Technicolor Research & Innovation, France. His main

research interest lies on virtual & mixed reality, collaborative and telepresence systems as well as their applications to address user experience challenges in education, training, healthcare, problem solving and information searching. Besides academic research, he is also strongly pushing for dissemination of HCI research into industry through knowledge and technological transfer collaboration.

Acknowledgments

This research activity is partially funded by the AugmentAERO project (Applying AI and AR Technology to the Aerospace Market), supported by Innovate UK (Project No. 10105198).

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