Shakiba Davari

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Research Interest

Intelligent Augmented Reality (AR) Interface Design: My research interest lies in connecting my past research experience in applied machine learning (ML) and my current passion for AR interfaces. I am a 3D interaction/interface designer focusing on intelligent AR interfaces. I concentrate on different aspects of detecting AR users' context and utilizing it to adapt their AR interface. Such context-aware interfaces mitigate the existing challenges of AR, such as real-world occlusion and social intrusiveness, while providing more reliable and efficient information access and interaction in AR.

Education

Ph.D., Computer Science *Expected graduation: Aug 2024* **Virginia Tech (2018-Present)**

MSc., Computer Science

Specialization: Human-Computer Interaction *(Degree received)* **Virginia Tech (2018-2020)**

Specialization: Computational Perception and Robotics **Georgia Tech (2017-2018)**

BSc., Computer Engineering *(Degree received)* **Shahid Beheshti University(SBU), Iran(2010-2014)**

Research Experience

Graduate Research Assistant **Virginia Tech (2018-Present)**

Advisor: Doug A. Bowman

Conceptual Framework Research

I applied a methodical approach based on a) consideration of end goals, features, and challenges of AR, and b) in-depth review and analysis of existing AR interfaces, input modalities, context frameworks, and taxonomies to:

- I proposed a taxonomy of the design dimensions and adaptations of AR interfaces [1].
- I proposed a taxonomy of context tailored for capturing and inferring the intricacies and features crucial to effective intelligent AR interfaces [2, 7].
- I developed a framework for context-aware inference and adaptation towards intelligent AR interfaces [2, 7].
- I proposed a methodology to classify AR interfaces and utilized it to introduce Glanceable AR [8, 9].
- I proposed a guideline for evaluating and comparing AR input modalities and am currently conducting a survey on the natural AR input modalities according to this guideline [3].

Socially Intelligent AR Interfaces

- I designed and developed a socially intelligent AR interface for HoloLens devices, incorporating face and speech recognition to adapt the content and display of the information to the context.
- I designed an experiment to evaluate the effect of AR interfaces and context-awareness on the user experience and information access efficiency compared to mobile phones.
- I conducted a user study on 36 participants, published the results, and presented them at IEEE VR 2022 [6].

Teamwork

- I designed Drill-AR for HoloLens devices to speed up drilling tasks at the Boeing Aircraft Company assembly line.
- I designed and implemented a prototype for an AR Operating System Interface.
- I participated in various teams in the annual 3DUI Contest at the IEEE VR conference.
  - I designed 3D Interaction techniques and communicated our findings through publications, receiving the Best 3DUI award for two consecutive years.
  - I led a team of 10 graduate and undergraduate students to design an immersive VR experience using passive haptics and everyday proxy objects.

Tools: Python, OpenCV, DNNs, Flask web app development, Unity Game Engine, Photon, MRTK

Research Scientist Intern **Adobe Inc. (2022 May-Aug)**

- I designed and developed 16 different AR interfaces for content navigation on iOS devices and explored their effectiveness in multiple contexts through a preliminary survey.
- I implemented the most promising candidate interfaces on HoloLens devices.
- I conducted a user study on 24 participants to collect quantitative and qualitative data for evaluating two different AR content placement strategies in four contexts.
- I performed various statistical significance analyses, such as non-parametric ART-ANOVA, on the study data and

detailed the results in a manuscript intended for publication *[4]*.

Tools: Apple ARKit, Swift, Adobe Aero, Unity Game Engine, MRTK, JMP

Research Intern — **Microsoft Inc. (2021 May-Aug)**

- I designed and developed a new tool to leverage the potential of virtual monitors for assisting low-vision users.
- I designed and conducted a user study on 21 low-vision participants.
- I derived valuable design guidelines for enhancing the hardware and software aspects of virtual monitors tailored to the needs of the low-vision population [5]. *Tools: Unity Game Engine*

Researcher — **Stanford University (2017-2018)**

- I designed and developed driving simulation scenarios to gather driver data across diverse situations in a project Investigating the effect of leveraging human actions in autonomous cars.
- I investigated various algorithms to automate the flight path of Unmanned Aerial Vehicles (UAVs) for efficient image capture within dynamic construction sites. *Tools: SimVista, SimCreator, Python2, OpenCV, Pymunck*

Researcher — **University of Toronto (2015-2016)**

- I combined various ML classification models to develop a robust system that categorizes construction site images into one of the five construction progress stages states indicative of the construction progress *[10].*
- I automated web crawling and the extraction of reliable data from target websites for an online assistive technology rating system for caregivers. *Tools: Python2, OpenCV, Selenium, Apache Nutch*

Selected Honors & Awards

Invited Talk: "Context Aware Inference and Adaptation in Intelligent AR Interfaces"	[PERCxR @ISMAR 2022]
Best 3DUI Award	[IEEEVR 2020 & IEEEVR 2021]
Departmental Service Award	[CS Department @Virginia Tech 2020]
Grace Hopper Celebration of Women in Computing Scholarship	[Virginia Tech 2022] – [Virginia Tech 2021]
Inclusion, Diversity, and Accessibility Scholarship	[IEEEVR 2022]
ACM Capital Region Celebration of Women in Computing Scholarship	[Virginia Tech 2020]
Tapia Celebration of Diversity in Computing Scholarship	[Tapia Foundation 2020] – [Virginia Tech 2019] – [Georgia Tech-2017]

Selected Service Activities

Workshop Co-organizer	[1st Workshop on Intelligent XR: Harnessing AI for Next-Generation XR User Experiences (iXR), ISMAR 2024]
Poster Chair	[ACM Spatial User Interaction (SUI) 2024]
Reviewer	[CHI 2021 & 2023] – [IEEEVR 2021 & 2022] – [ISMAR 2020 & 2021 & 2022] – [UIST 2022] – [AutomotiveUI 2020]
Leadership Roles	[Virginia Tech Graduate Student Council 2019-2020] – [Iranian Society at Virginia Tech 2018 to 2021]
Mentoring and Advising	[Danny Stover 2022-2023] – [Alexander Giovanelli 2021-2022] – [Daniel Manesh 2021-2022]

Publications

[1] A Taxonomy of Design Dimensions and Adaptations in AR, S. Davari, DA Bowman, IEEE Transactions on Visualization and Computer Graphics(TVCG) 2024 (In-preparation)

[2] Intelligent AR: A Taxonomy of Context and a Framework for Context-Aware Inference and Adaptation, S. Davari, DA. Bowman, *IEEE CG&A* Special Issue on Next-generation Mixed-Reality User Experiences (In-preparation)

[3] An AR Input Modality Evaluation Guideline and A Survey on the Natural Input Modalities in Augmented Reality, S. Davari, Logan Lane, DA. Bowman, IEEE TVCG 2024 (In-preparation)

[4] Exploring Content Placement Strategies for Context-Aware Augmented Reality, S. Davari, DA Bowman, S. Petrangili, J. Hofswell (under-review)

[5] Virtual monitors vs. physical monitors: an empirical comparison for productivity work, L. Pavanatto, S. Davari, C. Badea, R. Stoackley, DA. Bowman, Frontiers in Virtual Reality 2023, Vol 4, 1215820

[6] Validating the Benefits of Glanceable and Context-Aware Augmented Reality for Everyday Information Access Tasks, S. Davari, F. Lu, DA. Bowman, IEEE VR 2022, New Zealand, pp. 436-444

[7] [DC] Context-Aware Inference and Adaptation in AR, S. Davari, IEEE VR 2022, New Zealand, pp. 938-939

[8] Occlusion Management Techniques for Everyday Glanceable AR Interfaces, S. Davari, F. Lu, and DA. Bowman, Workshop on Everyday VR (WEVR) @ IEEE VR 2020, USA, pp. 324-330

[9] Glanceable AR: Evaluating Information Access Methods for Head-Worn Augmented Reality, F. Lu, S. Davari, L. Lisle, Y. Li, DA. Bowman, IEEE VR 2020, Atlanta, GA, USA. pp. 930-938

[10] Automated computer vision-based detection of components of under-construction indoor partitions, H. Hamledari, B. McCabe, S. Davari, Automation in Construction 2017, Vol 74, pp. 78-94