

Xun Qian

HCI RESEARCHER | XR DEVELOPER

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Professional Experience

Research Scientist

Mountain View, CA

GOOGLE AR

May. 2023 - Present

- Developed interactive Extended Reality (XR) systems by integrating cutting-edge perceptive and generative AI technologies.
- Led the production of applications on Google AR platforms, collaborating with cross-functional teams to ensure seamless deployment.
- Conducted research at the intersection of human-AI interaction and Extended Reality (XR) within the Human-Computer Interaction (HCI) community.

Research Intern at Google AR

San Francisco, CA

INTERN HOST: DR. RUOFEI DU

Sep. 2022 - Dec. 2022

- Published ChatDirector: Enhancing Video Conferencing with Space-Aware Scene Rendering and Speech-Driven Layout Transition at CHI 2024.

Research Scientist Intern at Meta Reality Labs

Redmond, WA

INTERN MANAGER: DR. KASHYAP TODI

May. 2022 - Sep. 2022

- Published Fast-Forward Reality: Authoring Error-Free Context-Aware Policies with Real-Time Unit Tests in Extended Reality at CHI 2024.

Selected Research Experience (Lead Author)

ChatDirector: Enhancing Video Conferencing with Space-Aware Scene Rendering and Speech-Driven Layout Transition

Mountain View, CA

LEAD AUTHOR

Published in CHI 2024

- Developed an innovative web-based 3D video conferencing system that emulates the co-presence and fluidity of in-person meetings.
- Implemented a real-time pipeline for reconstructing 3D portrait avatars from RGB webcams, utilizing a lightweight **portrait depth estimation model** and an efficient RGB-D rendering technique with custom **WebGL shaders**.
- Designed a dynamic decision tree algorithm to automatically adjust scene layout and avatar poses based on participants' speech states, enhancing natural attention transitions.

Fast-Forward Reality: Authoring Error-Free Context-Aware Policies with Real-Time Unit Tests in Extended Reality

Redmond, WA

LEAD AUTHOR

Published in CHI 2024

- Proposed an author-test-refine workflow that enables end-users to validate and iterate context-aware policies (CAPs) at author-time by evaluating their performances via diverse simulated unit tests.
- Designed a computational approach for generating unit test cases that are personalized to each user and environment to effectively reveal potential run-time inaccuracies of the CAP.
- Implemented an XR based authoring interface that uses immersive visualizations to offer intuitive understandings of contexts presented in test cases, and direct operations to define and iterate the CAP using *Unity3D*.

ARnnotate: An Augmented Reality Interface for Collecting Custom Dataset of 3D Hand-Object Interaction Pose Estimation

West Lafayette, IN

LEAD AUTHOR

Published in UIST 2022

- Developed a novel AR based workflow for pervasive and continuous collection of custom hand-object pose estimation datasets.
- Implemented a **CenterPose object detection network** and an **OpenPose hand detection network** using *Tensorflow* on Linux.
- Designed an AR interface with front-end visual assistance and back-end computational processes that helps improve the quality of the datasets using *Unity3D* on *Oculus Quest 2*.

ScalAR: Authoring Semantically Adaptive Augmented Reality Experiences in Virtual Reality

West Lafayette, IN

LEAD AUTHOR

Published in CHI 2022

- Developed an AR/VR integrated workflow to define and validate semantically adaptive AR experiences in synthetically generated VR environments.
- Integrated a **3D semantic understanding network** and a **YOLO object detection network** for 3D object detection on *HoloLens 2*.
- Constructed an **SVM-based algorithm** that fits an AR designer's demonstrations as a semantic adaptation model used for deploying the experiences.
- Designed an AR interface for physical environment scanning, an immersive VR authoring studio for experience authoring, and an AR interface for experience deployment using *Unity3D* on *Oculus Quest 2*.

GesturAR: An Authoring System for Creating Freehand Interactive Augmented Reality Applications [Honorable Mention Award (Top 5%)]

West Lafayette, IN

CO-LEAD AUTHOR

Published in UIST 2021

- Developed an innovative workflow for customizing freehand interactive AR experiences through in-situ gesture demonstration and visual programming.
- Implemented a **CNN for gesture detection** and a **Siamese network for gesture comparison** using *PyTorch* and *Unity Barracuda*.
- Designed an interaction model that mapped the gestural inputs to the virtual content behaviors with 4 different interaction modes.
- Developed an AR interface for performing hand gestures and defining virtual content reactions using *Unity3D* on *HoloLens 2*.

AdapTutAR: An Adaptive Tutoring System for Machine Tasks in Augmented Reality

West Lafayette, IN

CO-LEAD AUTHOR

Published in CHI 2021

- Developed an AR machine task tutoring system that adjusted the visual presence of the tutoring elements to the user's learning progress.
- Integrated a **CNN for machine state recognition**, a **CNN for interaction detection**, and an **SVM for user state classification** using *Tensorflow*.
- Designed a **finite state machine** to dynamically adjust the level of details of the AR tutoring contents based on the detected states.
- Implemented an AR interface for embodying recording the tutoring elements and adaptively showing/hiding them using *Unity3D*.

CAPtutAR: An Augmented Reality Tool for Authoring Human-Involved Context-Aware Applications

West Lafayette, IN

CO-LEAD AUTHOR

Published in UIST 2020

- Proposed a novel system for personalizing human-involved context-aware applications (CAPs) in AR using the recorded daily activities.
- Designed a **3D human upperbody skeleton detection network** with fisheye images using *Tensorflow*.
- Developed an automatic dataset labelling application for the pose detection network using *Azure Kinect Body Tracking SDK*.
- Developed a multi-camera AR-HMD platform supporting the non-intrusive recording and detection of the human activities.
- Implemented a **Dynamic Time Warping algorithm** for comparing human activities in real-time.
- Built an AR interface for visualizing and selecting the recorded contexts, and creating CAPs through visual programming using *Unity3D*.

Technical Skills

XR Development Unity3D (6 years); Quest series, HoloLens 2

Deep Learning Tensorflow (7 years), PyTorch (3 years); Object Detection, Gesture Recognition, Human Pose Tracking

Vision and Graphics OpenGL, GLSL, HLSL; WebGL; OpenCV; Three.js

Programming Languages Python (8 years), C# (6 years), C++ (4 years), Javascript

Design and Prototyping Solidworks (10 years); ROS, Arduino; 3D Printing

Academic Service

Associate Chair CHI 2025, IEEE VR 2025

Reviewer CHI 2021-2024, UIST 2021-2024, CSCW, IEEE VR, ISMAR, DIS, TEI, SUI

Honors and Awards

ACM **Special Recognition for Outstanding Review**, CHI 2024, ISS 2023, UIST 2023, CHI 2023, CHI 2022

ACM **Honorable Mention**, CHI 2023, CHI 2023, UIST 2021

Education

Purdue University

West Lafayette, IN

PH.D. IN MECHANICAL ENGINEERING

Aug. 2018 - May. 2023

- Lead researcher in developing **AI-driven and context-aware XR systems**. Advisor: Dr. Karthik Ramani.
- Thesis: Explore the Design and Authoring of AI-Driven Context-Aware Augmented Reality Experiences

Publications

- [C.1]** **Xun Qian**, Feitong Tan, Yinda Zhang, Brian Moreno Collins, David Kim, Alex Olwal, Karthik Ramani, and Ruofei Du. 2024. ChatDirector: Enhancing Video Conferencing with Space-Aware Scene Rendering and Speech-Driven Layout Transition. In Proceedings of the CHI Conference on Human Factors in Computing Systems (**CHI 2024**). DOI: <https://doi.org/10.1145/3613904.3642110>
- [C.2]** **Xun Qian**, Tianyi Wang, Xuhai Xu, Tanya R. Jonker, and Kashyap Todi. 2024. Fast-Forward Reality: Authoring Error-Free Context-Aware Policies with Real-Time Unit Tests in Extended Reality. In Proceedings of the CHI Conference on Human Factors in Computing Systems (**CHI 2024**). DOI: <https://doi.org/10.1145/3613904.3642158>
- [C.3]** Rahul Jain*, Jingyu Shi*, Runlin Duan, Zhengzhe Zhu, **Xun Qian**, and Karthik Ramani. 2023. Ubi-TOUCH: Ubiquitous Tangible Object Utilization through Consistent Hand-object interaction in Augmented Reality. In Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology (**UIST 2023**). DOI: <https://doi.org/10.1145/3586183.3606793>
- [C.4]** Fengming He*, Xiyun Hu*, Jingyu Shi, **Xun Qian**, Tianyi Wang, and Karthik Ramani. 2023. Ubi Edge: Authoring Edge-Based Opportunistic Tangible User Interfaces in Augmented Reality. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (**CHI 2023**). DOI: <https://doi.org/10.1145/3544548.3580704>
- [C.5]** Ziyi Liu*, Zhengzhe Zhu*, Enze Jiang, Feichi Huang, Ana M Villanueva, **Xun Qian**, Tianyi Wang, and Karthik Ramani. 2023. InstruMentAR: Auto-Generation of Augmented Reality Tutorials for Operating Digital Instruments Through Recording Embodied Demonstration. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (**CHI 2023**). DOI: <https://doi.org/10.1145/3544548.3581442>
- [C.6]** Zhengzhe Zhu*, Ziyi Liu*, Youyou Zhang, Lijun Zhu, Joey Huang, Ana M Villanueva, **Xun Qian**, Kylie Pepler, and Karthik Ramani. 2023. LearnIoTVR: An End-to-End Virtual Reality Environment Providing Authentic Learning Experiences for Internet of Things. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (**CHI 2023**). DOI: <https://doi.org/10.1145/3544548.3581396>
- [C.7]** Xuhai Xu, Anna Yu, Tanya R. Jonker, Kashyap Todi, Feiyu Lu, **Xun Qian**, João Marcelo Evangelista Belo, Tianyi Wang, Michelle Li, Aran Mun, Te-Yen Wu, Junxiao Shen, Ting Zhang, Narine Kokhlikyan, Fulton Wang, Paul Sorenson, Sophie Kim, and Hrvoje Benko. 2023. XAIR: A Framework of Explainable AI in Augmented Reality. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (**CHI 2023**). DOI: <https://doi.org/10.1145/3544548.3581500>
- [C.8]** **Xun Qian***, Fengming He*, Xiyun Hu, Tianyi Wang, and Karthik Ramani. 2022. ARnnotate: An Augmented Reality Interface for Collecting Custom Dataset of 3D Hand-Object Interaction Pose Estimation. In Proceedings of the 35th Annual ACM Symposium on User Interface Software and Technology (**UIST 2022**). DOI: <https://doi.org/10.1145/3526113.3545663>
- [C.9]** Zhengzhe Zhu*, Ziyi Liu*, Tianyi Wang, Youyou Zhang, **Xun Qian**, Pashin Farsak Raja, Ana M Villanueva, and Karthik Ramani. 2022. MechARspace: An Authoring System Enabling Bidirectional Binding of AR with Toys in Real-time. In Proceedings of the 35th Annual ACM Symposium on User Interface Software and Technology (**UIST 2022**). DOI: <https://doi.org/10.1145/3526113.3545668>
- [C.10]** **Xun Qian**, Fengming He, Xiyun Hu, Tianyi Wang, Ananya Ipsita, and Karthik Ramani. 2022. ScalAR: Authoring Semantically Adaptive Augmented Reality Experiences in Virtual Reality. In Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems (**CHI 2022**). DOI: <https://doi.org/10.1145/3491102.3517665>
- [C.11]** Tianyi Wang*, **Xun Qian***, Fengming He, Xiyun Hu, Yuanzhi Cao, and Karthik Ramani. 2021. GesturAR: An Authoring System for Creating Freehand Interactive Augmented Reality Applications. In Proceedings of the 34th Annual ACM Symposium on User Interface Software and Technology (**UIST 2021**). DOI: <https://doi.org/10.1145/3472749.3474769>
- [C.12]** Subramanian Chidambaram, Hank Huang, Fengming He, **Xun Qian**, Ana M Villanueva, Thomas S Redick, Wolfgang Stuerzlinger, and Karthik Ramani. 2021. ProcessAR: An augmented reality-based tool to create in-situ procedural 2D/3D AR Instructions. In Designing Interactive Systems Conference 2021 (**DIS 2021**). DOI: <https://doi.org/10.1145/3461778.3462126>
- [C.13]** Gaoping Huang*, **Xun Qian***, Tianyi Wang, Fagun Patel, Maitreya Sreeram, Yuanzhi Cao, Karthik Ramani, and Alexander J. Quinn. 2021. AdapTutAR: An Adaptive Tutoring System for Machine Tasks in Augmented Reality. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (**CHI 2021**). DOI: <https://doi.org/10.1145/3411764.3445283>

- [C.14] Tianyi Wang*, **Xun Qian***, Fengming He, Xiyun Hu, Ke Huo, Yuanzhi Cao, and Karthik Ramani. 2020. CAPturAR: An Augmented Reality Tool for Authoring Human-Involved Context-Aware Applications. In Proceedings of the 33rd Annual ACM Symposium on User Interface Software and Technology (**UIST 2020**). DOI: <https://doi.org/10.1145/3379337.3415815>
- [C.15] Yuanzhi Cao, **Xun Qian**, Tianyi Wang, Rachel Lee, Ke Huo, and Karthik Ramani. 2020. An Exploratory Study of Augmented Reality Presence for Tutoring Machine Tasks. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (**CHI 2020**). DOI: <https://doi.org/10.1145/3313831.3376688>
- [C.16] Gaoping Huang, Pawan S. Rao, Meng-Han Wu, **Xun Qian**, Shimon Y. Nof, Karthik Ramani, and Alexander J. Quinn. 2020. Vipo: Spatial-Visual Programming with Functions for Robot-IoT Workflows. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (**CHI 2020**). DOI: <https://doi.org/10.1145/3313831.3376670>
- [C.17] Yuanzhi Cao*, Tianyi Wang*, **Xun Qian**, Pawan S. Rao, Manav Wadhawan, Ke Huo, and Karthik Ramani. 2019. GhostAR: A Time-space Editor for Embodied Authoring of Human-Robot Collaborative Task with Augmented Reality. In Proceedings of the 32nd Annual ACM Symposium on User Interface Software and Technology (**UIST 2019**). DOI: <https://doi.org/10.1145/3332165.3347902>

Patents

- [P.1] Karthik Ramani, **Xun Qian**, Tianyi Wang, Fengming He. 2024. Augmented reality system and method for collecting custom datasets for 3d hand-object interaction pose estimation. U.S. Patent Application No. 18/480,134.
- [P.2] **Xun Qian**, Kashyap Todi, Tanya Renee Jonker, Tianyi Wang, Anna Camilla Martinez, Felix Izarra, Ting Zhang, Ruta Parimal Desai, Yan Xu, Frances Cin-yea Lai, Tianyi Yang. 2024. Authoring context aware policies with real-time feedforward validation in extended reality. U.S. Patent Application No. 18/463,030.
- [P.3] Karthik Ramani, Tianyi Wang, **Xun Qian**, Fengming He. 2023. System and Method for Authoring Freehand Interactive Augmented Reality Applications. U.S. Patent Application No. 17/814,965.
- [P.4] Karthik Ramani, Gaoping Huang, Alexander J. Quinn, Yuanzhi Cao, Tianyi Wang, and **Xun Qian**. 2022. Adaptive Tutoring System for Machine Tasks in Augmented Reality. U.S. Patent Application No. 17/517,949.
- [P.5] Karthik Ramani, Tianyi Wang, and **Xun Qian**. 2021. System and Method for Authoring Human-Involved Context-Aware Applications. U.S. Patent Application No. 17/363,365.