Xun Qian

HCI Researcher | AR/VR/MR Developer | Deep Learning Developer

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Education

Purdue University *West Lafayette, IN*

Ph.D. student in Mechanical Engineering, GPA: 3.62/4.0, Research Assistant at *C Design Lab* *Aug. 2018 - Present*

Cornell University *Ithaca, NY*

M.Eng. in Mechanical Engineering, GPA: 3.67/4.0 *Aug. 2016 - May. 2017*

University of Science and Technology Beijing (USTB) *Beijing, China*

B.S. in Mechanical Engineering, GPA: 3.83/4.0 *Sep. 2012 - Jun. 2016*

- Exchange student in Mechanical Engineering at University of California, Berkeley; Aug. 2015 - Dec. 2015; GPA: 3.85/4.0

Research Experience

AR Authoring Tools and Interactive Systems

GesturAR: An Authoring System for Creating Freehand Interactive Augmented Reality Applications [C.1] *West Lafayette, IN*

Co-Lead Author *Published in UIST 2021*

- Proposed a workflow for customizing freehand interactive AR experiences through in-situ gesture demonstration and visual programming.
- Designed an interaction model that mapped the gestural inputs to the virtual content behaviors with *4* different interaction modes.
- Built a CNN for gesture classification and a Siamese one-shot learning network for gesture comparison using *PyTorch* and *Unity Barracuda*.
- Developed an AR interface for performing hand gestures and defining virtual content reactions using *Unity3D* and *MRTK* on Hololens2.

CAPturAR: An Augmented Reality Tool for Authoring Human-Involved Context-Aware Applications [C.4] *West Lafayette, IN*

Co-Lead Author *Published in UIST 2020*

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

User Experience in AR

AdapTutAR: An Adaptive Tutoring System for Machine Tasks in Augmented Reality [C.2] *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.
- Trained 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 embodily recording the tutoring elements and adaptively showing/hiding them using *Unity3D*.
- Evaluated the effectiveness of the system by comparing the learning outcome with a non-adaptive baseline through a *24*-user systematic study.

An Exploratory Study of Augmented Reality Presence for Tutoring Machine Tasks [C.5] *West Lafayette, IN*

Co-Author *Published in CHI 2020*

- Conducted a *32*-user systematic study to evaluate the effectiveness of animated human avatars in AR machine task tutorials.
- Designed a mock-up machine with *9* types of machine interfaces and *4* machine tasks with *36* steps to mimic the real-life machine operations.
- Implemented an authoring interface to create AR tutorials with avatars and content animations through embodied demonstration using *Unity3D*.
- Distilled design recommendations and insights for AR machine task tutoring system design from the quantitative and qualitative results.

GhostAR: A Time-Space Editor for Embodied Authoring of Human-Robot Collaborative (HRC) Tasks with Augmented Reality [C.7]

West Lafayette, IN

CO-AUTHOR · *Published in UIST 2019*

- Proposed a workflow for authoring HRC tasks by sequentially role-playing the human and robot parts using AR avatars as spatial references.
- Designed a collaborative model for spatio-temporally mapping the real-time human actions to the authored robot reactions.
- Developed an AR interface for avatar recording and edit, robot manipulation, and human-robot collaborative task creation using *Unity3D*.
- Constructed the ROS-AR communication for realistic robot behavior simulation in AR using *customized URDF* and *ROS Sharp*.

Vipo: Spatial-Visual Programming with Functions for Robot-IoT Workflows [C.6]

West Lafayette, IN

CO-AUTHOR · *Published in CHI 2020*

- Designed an RDF-based protocol to enable the rapid registration of the robots and IoTs and the function-oriented robot-IoT task programming.
- Developed a bi-directional robot-IoT communication system for task deployment and real-time visual feedback using *ROS*.

Design and Prototyping Projects

LightPaintAR: Assist Light Painting Photography with Augmented Reality [C.3]

West Lafayette, IN

CO-AUTHOR · *Published in CHI 2021 LBW*

- Developed an assist light painting system to facilitate the accurate 3D light source movements by spatially referring to the pre-sketched AR traces.
- Designed an AR interface for in-situ sketching and editing the AR traces using *Unity3D* and *MRTK* on Hololens2.

High-Precision Alignment Tool for E-beam Lens Assembly

Ithaca, NY

ME CO-OP · *Aug. 2016 - May. 2017*

- Developed an automatic alignment prototype for e-beam lens assembly using *Hall Effect sensors* and *electromagnetic actuators*.
- Designed and assembled a test apparatus for friction model calibration using the *diffraction grating method*.
- Achieved $1\mu m$ resolution by tuning the PD control system.

E-Crane Camera System Development

Beijing, China

ME INTERN · *Jun. 2016 - Aug. 2016*

- Designed and fabricated an adjustable lens encoder mount prototype that could adapt to *4* broadly used lenses using *Solidworks* and *machine tools*.
- Increased the rotational resolution to *0.1*-degree by re-designing the arm encoder mount to eliminate the gear engagement malfunction.
- Contributed to the installation and commissioning of the e-crane prototype which was exhibited in *BIRTV 2017 EXPO*.

Teaching Experience

Product and Process Design (ME553)

West Lafayette, IN

TEACHING ASSISTANT · *Fall 2019, Spring 2020*

- Restructured the course contents into multiple online modules to improve the overall teaching effectiveness.
- Guided *6+* groups (*40+* graduate students) regarding the product opportunity identification and the value proposition of the course project.
- Achieved the highest course rating score *(4.6/5.0)* in the Fall 2019 semester.

Computer Aided Design and Prototyping (ME444)

West Lafayette, IN

TEACHING ASSISTANT · *Spring 2019*

- Coached *60+* undergraduate students with 3D prototyping skills using PTC Creo during the lab sessions.
- Designed a racing car guided project aiming to improve students' innovative thinking and the capability of design-from-scratch.
- Organized a toy fair with *100+* participants at the end of the semester.

Technical Skills

AR/VR Development	Unity3D, MRTK, ARCore, ARKit, Vuforia, OpenGL; Hololens2, Oculus Rift/Quest
Machine Learning	Tensorflow, PyTorch; Object Detection, Human Skeleton Detection, Semantic Segmentation, CNN, PCA, SVM
Computer Vision	OpenCV; Image Processing, Feature Extraction, Scene Reconstruction, Camera Calibration
Design and Prototyping	ROS, Arduino, 3D Printing, Laser Cutting, Machine Tools, CNC Machining, Solidworks, Creo, AutoCAD
Programming	Python, C#, C/C++, Matlab

Honors and Awards

Nov. 2021	**Special Recognition for Outstanding Review,** The ACM Conference on Human Factors in Computing Systems (CHI 2022)	*West Lafayette, IN*
Oct. 2021	**Honorable Mention,** The ACM Symposium on User Interface Software and Technology (UIST 2021)	*West Lafayette, IN*
Jun. 2015	**Third Place,** Beijing Collegiate Autonomous Racing Vehicle Competition	*Beijing, China*

Academic Service

Reviewer   IEEE VR 2022, CHI 2022, TEI 2022, SUI 2021, DIS 2021, CHI LBW 2020 and 2021, UIST 2021

Publications

[C.1] 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 34rd Annual ACM Symposium on User Interface Software and Technology **(UIST 2021)**. DOI: https://doi.org/10.1145/3472749.3474769

[C.2] 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.3] Tianyi Wang, **Xun Qian**, Fengming He, and Karthik Ramani. 2021. "LightPaintAR: Assist Light Painting Photography with Augmented Reality." In Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems **(CHI EA 2021)**. DOI: https://doi.org/10.1145/3411763.3451672

[C.4] 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.5] 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.6] 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.7] 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