Xincheng Huang – Curriculum Vitae

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RESEARCH INTERESTS

My research interests are in Human-Computer Interaction. In particular I am interested in enabling novel interactive techniques in virtual and augmented Reality with technologies such as sensing and computer vision.

EDUCATION

University of British Columbia, Vancouver, BC — Sept 2021 – present
Ph.D. in Computer Science
Advisor: Dr. Robert Xiao

University of Michigan, Ann Arbor, MI — Aug 2019 – April 2021
M.S. in Computer Science and Engineering
Advisors: Dr. Nikola Banovic and Dr. Alanson Sample

New York University Shanghai, Shanghai, China — Aug 2015 – May 2019
B.S. in Computer Science, B.S. in Interactive Media Arts
Graduated with Magna Cum Laude

RESEARCH EXPERIENCE

Graduate Research Assistant — Sept 2021 - present
X Lab, University of British Columbia, Vancouver, BC. Advisor: Dr. Robert Xiao
Researching systems and interactive techniques to enable and improve remote shared experience in AR/VR, such as establishing remote shared mixed reality workspace (C1) and enabling virtual reality telepresence over 5G (C2).

Research Assistant — Mar 2020 – April 2021
Computational HCI Lab, University of Michigan, Ann Arbor, MI. Advisors: Dr. Nikola Banovic and Dr. Alanson Sample
Researched a constructive assembly guidance system which infers the structures of assemblies from user behaviors sensed by UHF-RFIDs. The result of our work (J1) was accepted to IMWUT, Dec 2022.

Research Assistant — Jan 2020 – April 2020, Jan 2021 – April 2021
Secure Cloud Manufacturing Group, University of Michigan, Ann Arbor, MI
Created an educational Virtual Manufacture Space in VR for the Detroit Area Pre-college Engineering Program (DAPCEP). Two versions of the project, based on Virtual Reality and WebGL respectively, were presented on DAPCEP 2020 and DAPCEP 2021.

TEACHING EXPERIENCE

Graduate Teaching Assistant — Sept 2022 – present
University of British Columbia, Vancouver, BC
CPSC 554X – Machine Learning and Signal Processing. Main duties: grade assignments and respond to student's questions.

Learning Assistant Feb 2019 – May 2019

New York University Shanghai

CSCI-SHU 101 Introduction to Computer Science. Main duties: hold office hours and conduct review sessions. Was awarded the "Excellent Tutoring" award and "Most Appointed Tutor" award for the semester.

RESEARCH PROJECTS

Shared Mixed Reality Workspace in Remote Communication with MR HMDs April 2022 – present

Research Project I conducted as the first author, advised by Dr. Robert Xiao

This project creates a lightweight shared mixed reality workspace that supports 2.5D physical tasks and 3D virtual tasks for remote users with Microsoft HoloLens 2 mixed reality headsets – Merged users' selected physical surfaces captured by the HoloLens' front camera with color-channel background-subtraction – Stabilized the video feeds with holographic projection – Created a virtual workspace that synchronized two remote users' spatial awareness by using the shared physical surfaces as spatial anchors – Bridged the physical workspace and the virtual workspace by enabling virtual object creation from planar physical objects such as hand-drawn patterns and shapes cut from paper – The paper for this project (C1) is in the revise and resubmission phase at *CHI 2023*. [Webpage][Video]

5G Telepresence in VR with 360 video streaming Oct 2021 - present

Research project I conducted as the first author, advised by Dr. Robert Xiao, sponsored by Rogers communications

This project enables telepresence communication in virtual reality – Captured a real-time 6K 360 video and streamed it with 5G connection to a virtual reality headset – Employed foveated compression additional to the common H.264 to save bandwidth – Investigated how much foveated compression improves the in field-of-view (FoV) bitrates by measuring the Peak-Signal-to-Noise-Ratio (PSNR) in the VR headset's field-of-view (FoV) as well as conducting a Just-Noticeable-Difference (JND) user test on the visual quality – Evaluated the implication of using a low-latency network on head-foveated high-resolution video streaming by conducting another JND user test on the video artifacts at the peripheral of the VR FoV – Our results suggest that our head-foveated rendering can save video bitrates up to 65% and the low-latency brought by 5G can reduce the necessity for viewport prediction. The paper for this project (C2) is under review at *Graphics Interface 2023*. [Webpage][Video]

StructureSense: Inferring Constructive Assembly Structures from User Behaviors Mar 2020 – April 2021

Research Project I conducted as the first author, advised by Dr. Nikola Banovic and Dr. Alanson Sample

Paper submitted to IMWUT 2022, Vol 2.

This project created a tangible constructive brick building system that enables interactive assembly guidance and rapid 3D model construction – Combined UHF-RFID sensing and Markov Chain Monte Carlo (MCMC) to enable real-time tracking of building processes that is generalizable to arbitrary constructive sets – Evaluated and demonstrated the potential of our system in applications such as education, interactive fabrication, and rapid 3D model prototyping with a building process guiding system and a structure authoring system. The paper for this project (J1) is accepted to *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol (IMWUT)* and will appear on Volume 6, Number 4, December 2022. [Webpage][Video][PDF]

Virtual Manufacture Space for Middle School Students Jan 2020 – Mar 2020, Jan 2021 – Mar 2021

Research Project for the Secure Cloud Manufacturing Team supervised by Dr. Kira Barton

This project was done as a part of the Detroit Area Pre-college Engineering Program (DAPCEP), which tries to provide educational opportunities for pre-college students – I was responsible for developing an educational Virtual Manufacturing Space in VR with OpenXR and Unity for middle school students to assemble simulated manufacture lines and learn basic manufacturing concepts – The project was presented at DAPCEP 2020 and DAPCEP 2021 (held remotely), in the form of virtual reality and WebGL, respectively. [Webpage][Video]

Telepresence with 3D PointCould Jan 2019 – May 2019

Undergraduate Thesis for Computer Science at NYUSH, advised by Dr. Olivier Marin and Prof. Michael Naimark

This thesis project (in a group of two) focuses on enabling telepresence communication by streaming 3D figures reconstructed with 3D point clouds. The main contribution of this project is a pipeline for constructing 3D images from depth cameras mounted to the frame of a desktop. The pipeline is assembled with methods including key-point selection (e.g. SIFT), feature description (e.g. FPFH), and registration refinement (e.g. Iterative Closest Points). [Webpage]

Immersive Strategies: A First-Person Perspective VR Chess Game Jan 2019 – May 2019

Undergraduate Thesis for Interactive Media Arts at NYUSH, advised by Prof. Alison De Fren

In this project I developed a first-person perspective chess game in VR with Unity and OpenXR. This project recreates the well-known human-sized chess playing experience in *Harry Potter: The Philosopher's Stone* in VR, where a player plays and commends the chess pieces from the perspective of a chess piece. As a part of this thesis, user tests were conducted to collect feedbacks for such an immersive gaming experience. [Webpage][Video]

PUBLICATIONS

C1* – **Xincheng Huang** and Robert Xiao. 2023. ShareSpace: Establishing Shared Mixed Reality Workspace in Remote Communication with Head-Mounted AR Displays, *in Revise and Resubmission (R&R) phase at CHI' 23*

C2* – **Xincheng Huang**, James Riddell, and Robert Xiao. 2023. Virtual Reality Telepresence over 5G: 360-Degree Video with Edge Compute Assisted Foveated Compression, *under review at Graphics Interface 2023*

J1 - **Xincheng Huang**, Keylonnie L Miller, Alanson P. Sample, and Nikola Banovic. 2022. StructureSense: Inferring Constructive Assembly Structures from User Behaviors. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 6, 4, Article 204 (December 2022), 25 pages, https://doi.org/10.1145/3570343

(* papers under review)

AWARDS

Latin Award, Magna Cum Laude, New York University Shanghai 2019

Awarded to top 15% of the graduated class

Dean's List for Academic Year, NYU Shanghai 2015 – 2016, 2016 – 2017, 2017 – 2018, 2018 - 2019

Awarded to top 30% for each academic year

MiniGame (MG) NetEase, Top 10 May – Aug 2018

Game development competition by NetEase, Inc. Reached Top 10 out of 200 participating teams

University Recognition Award, NYU Shanghai 2017 – 2018

College Social Common Welfare Contest, Gold Medal 2016

Common Welfare Contest by Shenzhen Social Common Welfare Foundation. Presented a second iteration of an ultra-sonic based assistive guidance tool for people with a low vision. Received grant of ~10000 USD

ENACTUS East China Social Entrepreneurship Contest, First Prize 2016

Participated as the technical consultant in the NYU Shanghai's Enactus team and developed an ultra-sonic based assistive guidance tool for people with a low vision.