Han Zhang

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EDUCATION

The Johns Hopkins University   Aug . 2022 – Dec. 2023

Master of Science; Biomedical Engineering

- GPA: 3.80 / 4.0

Relevant course: Deep Learning, Computer Vision, Augmented Reality, Computer Integrated Surgery I&II, Medical Robot Design, Haptic Interface Design, Robot Device Kinematics Dynamics and Control, Algorithms for Sensor-based Robotics

University of California, Davis   Sept . 2018 – Jun. 2022

Bachelor of Science; Biomedical Engineering with Honors

- GPA: 3.79 / 4.0

Relevant course: Data Structure, Biomedical Signal and Control, Biomedical Imaging System, Clinical Application of Biomedical Device Design, Biotransport Phenomena, Neuroengineering

RESEARCH EXPERIENCES

Spatial Planning for Medical Environment in Virtual Reality Digital Twin   July. 2023 – Present

Advisor: Prof. Mathias Unberath   *ARCADE Lab, Johns Hopkins University*

- Created NeRF-based digital twin to improve spatial planning ability in operation room.
- Implemented the manipulation of the surgical digital twin and user interaction in the VR environment.
- Designed and conducted the user study to investigate the mental impact of planning in different quality reconstructions.

Autonomous X-ray Image Acquisition and Interpretation System   July. 2023 – Present

Advisor: Prof. Mathias Unberath   *ARCADE Lab, Johns Hopkins University*

- Participated in building an autonomous system to reduce operating time and excess X-ray acquisition for percutaneous fracture fixation.
- Developed an argument reality-based virtual indicator interface to provide real time wire insertion guidance based on preoperative CT scan and intraoperative X-ray shot.
- Designed and fabricated an AR-compatible drill attachment for IR tracking by using rapid prototyping.

Fostering Empathy and Engagement among Surgical Teams through Virtual Reality   Jun. 2023 – Sept. 2023

Advisor: Prof. Mathias Unberath   *ARCADE Lab, Johns Hopkins University*

- Developed a multiplayer VR simulator to investigate the cooperation and engagement in surgical teamwork.
- Designed and conducted a user study demonstrating that exposure to surgical workflows can significantly benefit non-surgical team members.

Recreating Pelvic Trauma Surgery in Virtual Reality   Jan. 2023 – Jun. 2023

Advisor: Prof. Russell H. Taylor & Prof. Mathias Unberath   *ARCADE Lab, Johns Hopkins University*

- Led the development of a multiplayer VR simulator for pelvic trauma surgery with C-arm fluoroscopy for orthopedic surgeons training.
- Created the interactive VR environment, surgical asset, tool-to-tissue modeling and training curriculum.

Learning Assessment in XR Using Eye Tracking   Feb. 2023 - Jun. 2023

Advisor: Prof. Ehsan Azimi   ·   *Department of Computer Science, Johns Hopkins University*

- Developed an eye gaze-based evaluation system for trainee surgical skills using Microsoft Hololens2.
- Responsible for implementing Unity scene, study design and data collection.

Surgical Phase Recognition from X-ray Image   Jan. 2023 – Mar. 2023

Advisor: Prof. Mathias Unberath   *ARCADE Lab, Johns Hopkins University*

- Participated in creating a surgical phase recognition model for X-ray-guided percutaneous pelvic fracture fixation based on AI-generated X-ray.
- Conducted the cadaver study to analysis to verify the model effectiveness.
- Created the 3D models of the surgical tools for realistic X-ray simulation.

3D Hapkit: 3-degree-of-freedom (DOF) Haptic Device using a Delta Parallel Mechanism   Jun. 2022 - Dec. 2022

Advisor: Prof. Jeremy Brown   *Haptics and Medical Robotics Laboratory, Johns Hopkins University*

- Developed a 3-DOF kinesthetic haptic device for higher educational training by rapid prototyping.
- Created a virtual environment for rendering haptic interaction with virtual objects.

Radiolucent Hand and Wrist Fixation Device Senior Capstone Project   Sept. 2021- Jun. 2022

Advisor: [Prof. Robert M. Szabo](#)   *Department of Orthopedics, UC Davis Health*
- Designed and fabricated a device that stabilized patients' upper extremities during C-arm fluoroscopy to prevent surgeons' hands from radiation exposure.

Low-Cost Microfluidic Device for Single-Cell Isolation and Cloning   Sept. 2021- Jun. 2022
Advisor: [Prof. Marc T. Facciotti](#)   *BioInnovation Group at University of California, Davis*
- Recruited and Lead 10 people to create cost-effective microfluidic chips for high throughput single cell isolation and culturing to analyze cell heterogeneity.
- Achieved the single cell capture and increased the rate to 35% at 1/100th the upfront cost using 3D printing techniques.

Automated Microscopy Drug Screening System for Cardiotoxicity Identification   Jan. 2021- Jun. 2022
Advisor: [Prof. Ye Chen-Izu](#)   *Cardiac Signaling Laboratory at University of California, Davis*
- Designed an innovative cell-in-gel chamber with electric field stimulation.
- Analyzed the flow and drug distribution of cell-in-gel chamber in SolidWorks and fabricated by PDMS.
- Developed multiple adjustable stages used for Olympus Confocal Microscope by rapid prototyping.

PUBLICATIONS
- **H. Zhang** & B. D. Killeen **(co-first authors)**, L. Wang, Z. Liu, R.H. Taylor, G. Osgood, and M. Unberath, Stand in My Shoes: Fostering Empathy and Engagement among Surgical Teams through Virtual Reality. *The 15th International Conference on Information Processing in Computer-Assisted Interventions*. In Review.
- C. Kleinbeck, **H. Zhang**, B. D. Killeen, D. Roth, M. Unberath, Optimizing Complex Medical Environments and Scenarios via Immersive Neural Rendering-based Digital Twins. *The 15th International Conference on Information Processing in Computer-Assisted Interventions*. In preparation.
- B. D. Killeen, **H. Zhang**, J. Mangulabnan, M. Armand, R.H. Taylor, G. Osgood, and M. Unberath, Pelphix: Surgical Phase Recognition from X-ray Images in Percutaneous Pelvic Fixation. *The 26th International Conference on Medical Image Computing and Computer-Assisted Intervention. https://doi.org/10.1007/978-3-031-43996-4_13*
- **H. Zhang**, J. U. Bartels and J. D. Brown, 3D Hapkit: A Low-Cost, Open-Source, 3-DOF Haptic Device Based on the Delta Parallel Mechanism. *2023 IEEE World Haptics Conference*, July 10-13, Delft, Netherlands。

PRESENTATAION & DEMOS
- IEEE World Haptics 2023 Conference, Delft, Netherlands   July 2023
  "3D Hapkit: 3-degree-of-freedom (DOF) Haptic Device using a Delta Parallel Mechanism"
- Johns Hopkins University LCSR Day, Baltimore, USA   April 2023
  "PelvisVR: Recreating Pelvic Trauma Surgery in Virtual Reality "
- 2022 UC Davis College of Engineering Design Showcase, Davis, USA   June 2022
  "THF:Radiolucent Hand and Wrist Fixation Device For Intraoperative Fluoroscopy"

ACTIVITIES
Teaching Assistant, *Whiting School of Engineering, Johns Hopkins University*   Aug. 2023 - Present
- Haptic Interface Design for Human-Robot Interaction (EN 530.491/691).
- Intro to Augmented Reality (EN 601.454/654).

Team Leader in Microfluidics, *BioInnovation Group at University of California, Davis*   Sept. 2021 - Jun. 2022

AWARDS
- Best Project Award *in Computer Integrated Surgery II, Johns Hopkins University*   May 2023
- Best Project Award *in Haptic Interface Design, Johns Hopkins University*   Dec. 2022
- Excellence in Manufacturing Award *at Senior Design, University of California, Davis*   Jun. 2022
- Dean's Honor List, *College of Engineering, University of California, Davis*   Oct. 2021

AWARDS
- **Programming Languages**: Python, MATLAB, C#, C++
- **Tools**: Unity, ROS, Arduino IDE, 3D Slicer, LaTeX, PyTorch, Git, Simulink
- **CAD Software**: Blender, Solidworks, 3DS Max
- **Manufacturing**: 3D Printing, CNC, Laser Cutting, Drilling, Welding
- **Wet Lab**: Cell Culture, 3D Bioprinting, Microscopy