

YU-CHUN KU

✉ yku4@jhu.edu 📞 +1 667-379-4654

EDUCATION

Johns Hopkins University, Baltimore, MD

Sept. 2022 – June 2024

Master of Science in Robotics

- **Selected Coursework:** Augmented Reality, Robot System Programming, Robot Device Kinematics Dynamics and Control, Algorithms for Sensor-based Robotics, Computer Integrated Surgery

National Taiwan Normal University, Taipei, Taiwan

Sept. 2016 – June 2020

Bachelor of Mechatronic Engineering

- **Coursework:** Artificial Intelligence, Machine Learning, Intelligent Automation and Robot, Automatic Control Engineering

SELECTED EXPERIENCE

Room-Scale Digital Twin Simulation for Synthetic Data Generation

Aug. 2024 – Present

Advisor: Prof. Mathias Unberath

ARCADE Lab, Johns Hopkins University

- Reconstructing object-level 3D digital twins and rendering novel views using a state-of-the-art reconstruction pipeline
- Extracting visual and geometric features from sequential video frames using off-the-shelf foundation models
- Generating richly annotated, photorealistic synthetic datasets using digital twin for surgical phase detection algorithms

High-Fidelity Virtual Reality Clinical Training System

June 2024 – Present

Advisor: Prof. Mathias Unberath & Prof. Vinciya Pandian

ARCADE Lab, Johns Hopkins University

- Developed a standalone VR training simulator using Unity3D to simulate the central line dressing change procedure
- Created digital twin assets of medical environments and instruments using neural surface reconstruction
- Designed a user study with healthcare professionals to assess the effectiveness of digital twin environments

Mixed Reality-Assisted Trajectory Planning and Guidance System

June 2024 – Aug. 2024

Advisor: Prof. Mathias Unberath & Prof. Russell H. Taylor

ARCADE Lab, Johns Hopkins University

- Developed a mixed reality navigation system to improve orthopedic wire placement accuracy
- Using HoloLens 2 for real-time surgical instruments tracking and wire spatial alignment visualization
- Integrated patient CT scans with NDI optical tracking to enhance pre-operative trajectory planning
- Achieved significant reduction in wire placement errors, with endpoint error of 5.26 mm and rotational error of 2.57°
- This work result in **PUBLICATIONS #2**

Augmented Reality-Enhanced Surgical Microscopes for Spinal Procedures

Jan. 2024 – May 2024

Advisor: Prof. Russell H. Taylor & Prof. Alejandro Martin-Gomez

Johns Hopkins University

- Developed an AR system using for real-time 3D anatomical visualization in Minimally Invasive Spinal Surgery.
- Implemented real-time anatomy tracking and registration to digital twin using NDI tracking system.
- Created a Unity plugin that enabled real-time marker-based detection and pose estimation using OpenCV

Evaluating Effectiveness of Visualization Techniques in Mixed Reality

Sept. 2023 – Mar. 2024

Advisor: Prof. Alejandro Martin-Gomez

Johns Hopkins University

- Investigated the effectiveness of visualization techniques for out-of-view objects localization using HoloLens 2
- Developed test scenarios and user studies that provide insights on user interaction and cognitive workload
- Conducted in-depth analyses to determine the Just Noticeable Difference (JND) among visualization techniques
- This work result in **PUBLICATIONS #1**

PUBLICATIONS

1. **Y. Ku**, et al.: [Evaluating the Effectiveness of Visual Guidance for Out-of-View Object Localization using Mixed Reality Head-Mounted Displays](#). *Present as poster in The 23rd IEEE International Symposium on Mixed and Augmented Reality*.
2. H. Zhang, B. Kileen, **Y. Ku**, et al.: [StraightTrack: A Mixed Reality Navigation System for Percutaneous K-wire Insertion](#). *Wiley Health Technology Letters, 2024. Special Issue: MICCAI AE-CAI 2024*.

WORKING & TEACHING EXPERIENCE

Johns Hopkins University

Aug. 2023 – May 2024

Teaching Assistant, Augmented Reality

- Guided teams through advanced AR projects such as the development of a campus tour navigation system on mobile devices and surgical guidance interfaces for continuum manipulators

DiJet Link Co., Ltd.

Sept. 2020 – May 2022

Full-Stack Software Engineer

- Led the development of case management and reporting web platforms, phasing out paper-based systems by using PostgreSQL and Laravel PHP
- Designed and maintained robust databases, optimizing data schemas and reducing redundancies to enhance reporting and data processing workflows
- Developed dynamic front-end interfaces using Vue.js, improving user experience with reactive components and efficient two-way data binding
- Built a Node.js web system for monitoring underground water levels, incorporating time series data management and Python algorithms for precise data analysis

Technical Skills

- **Programming Languages:** C/C++, C#, Python, MATLAB, JavaScript
- **Frameworks/Tools:** ROS, Unity3D, Git, Node.js, React.js, PostgreSQL, TensorFlow/PyTorch