Yu-Chun Ku

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EDUCATION

Johns Hopkins University, Baltimore, MD **Sep. 2022 – June 2024**

Master of Science in Robotics

National Taiwan Normal University, Taipei, Taiwan **Sep. 2016 – June 2020**

Bachelor of Mechatronic Engineering

PROFESSIONAL EXPERIENCE

R&D Engineer **May. 2025 – Present**

Medivis — Multimodal AI, Medical Imaging AI *New York, NY, USA*

- Developing a pre-operative 3D MRI-to-CT translation pipeline and an intra-operative fluoroscopic reconstruction framework to generate synthetic CT volumes and vertebra-level 3D models for surgical planning.
- Building the Medivis AI Assistant (MAIA) for medical imaging and surgical support by integrating OpenAI and Google Gemini APIs with a C# .NET backend for scalable model orchestration and deployment.

Research Assistant **Sep. 2023 – Apr. 2025**

Johns Hopkins University — Robot Learning, AR/VR, Digital Twins *Baltimore, MD, USA*

- Designed scalable digital twin platforms for surgical simulation, workflow modeling, and data generation in learning-based control.
- Developed imitation learning pipelines from egocentric demonstrations to train task policies and evaluate sim-to-real transfer.
- Created a virtual reality clinical training system using Neuralangelo-based surface reconstruction to create immersive training environments for healthcare professionals.
- Engineered mixed reality guidance tools for orthopedic navigation to achieve 5.26mm and 2.88° placement accuracy.

Full-Stack Software Engineer **Sep. 2020 – May. 2022**

DiJet Link Co., Ltd. — Web Applications, Data Management *Taipei, Taiwan*

- Built a web-based case management and underground water monitoring platform to improve workflow efficiency by 40%.
- Rebuilt database architecture to reduce query latency by 50% and integrated real-time analytics using time-series databases.
- Led UI/UX redesigns and collaborated across engineering teams to deploy secure, scalable web applications.

PUBLICATIONS

1. Y. Liu, **Y. Ku (co-first)**, J. Zhang, et al.: *dARt Vinci*: Egocentric Data Collection for Surgical Robot Learning at Scale. *The 2025 IEEE International Conference on Intelligent Robots and Systems (IROS).*

2. C. Gomez, L. Seenivasan, ..., **Y. Ku**, et al.: Explainable AI for Automated User-Specific Feedback in Surgical Skill Acquisition. *MICCAI HAIC Workshop 2025.* ***Best Paper/Presentation Award.***

3. A. Perez, H. Zhang, **Y. Ku**, et al.: Privacy-Preserving Operating Room Workflow Analysis using Digital Twins. *Medical Imaging with Deep Learning 2025 (MIDL).*

4. J. Wang, J. A. Barragan, H. Ishida, J. Guo, **Y. Ku**, et al.: A Digital Twin for Telesurgery under Intermittent Communication. *The 2025 International Symposium on Medical Robotics (ISML).*

5. A. H. Moser, C. Kim, ..., **Y. Ku**, et al.: Mixed Reality in Nursing Practice: A Mixed Methods Systematic Review. *Journal of clinical nursing.*

6. H. Shu, L. Seenivasan, ..., **Y. Ku**, et al.: DualVision ArthroNav: Investigating Opportunities to Enhance Localization and Reconstruction in Image-based Arthroscopy Navigation via External Cameras. *The 16th International Conference on Information Processing in Computer-Assisted Interventions (IPCAI).*

7. H. Zhang, B. D. 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.*

8. **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 (ISMAR).*

RESEARCH EXPERIENCE

BrainBot - Big Brain with XLeRobot — Oct. 2025

Embodied AI, Robot Learning — *Seeed 2025 Embodied AI Hackathon* — *Mountain View, CA*

- Designed a modular, robot-agnostic teleoperation and learning platform supporting multi-device control, wireless operation, demonstration data collection, real-time inference, and visualization.
- Built a Meta Quest 3 Unity application for VR teleoperation to capture 3D motions and stream actions to multiple robot arms, with real-time robot state and multi-camera visualization.
- Developed a full data-collection pipeline for both real-world robots and simulation in NVIDIA Isaac Lab, and trained policies using the NVIDIA GR00T model.

Multi-Agent Parkinson's Disease Monitoring System — Mar. 2025

LLMs, Multimodal Sensing, Multi-Agent — *Healthcare Hackathon with AI 2025 (H2AI25)* — *Georgetown University*

- Designed a multi-agent system combining LLMs and computer vision to analyze multimodal data of Parkinson's disease
- Developed gesture recognition pipelines using MediaPipe for real-time tracking of hand tremors, posture, and gait
- Built task-specific analysis agents (motor, speech, mood, cognition) and a meta-analyst agent for longitudinal synthesis
- Won the **Best in Technical Innovation Award** and **Neuro AI Innovation Award**

Mixed Reality Platform for Scalable Robotic Data Generation — Dec. 2024 – Feb. 2025

Isaac Sim, Unity3D, Robotics — **Advisor:** Prof. Mehran Armand & Prof. Peter Kazanzides — *Johns Hopkins University*

- Designed an MR platform to enable teleoperation and scalable and high-quality ego-centric robotic data generation
- Integrated with NVIDIA Isaac Sim for realistic physics-based simulations and high-fidelity dataset creation
- Leveraged hand-tracking and inverse kinematics to enable real-time robot control and movement visualization
- Conducted a user study (12 participants, 10 tasks) comparing the MR platform to a real robot, showing a 41% increase in data throughput and a 10% reduction in experiment time.
- Findings submitted for review to **PUBLICATIONS #1**

Teleoperation with Communication Loss on da Vinci Surgical System — Sep. 2024 – Nov. 2024

dVRK, ROS, Python — **Advisor:** Prof. Peter Kazanzides — *Johns Hopkins University*

- Developed a digital twin framework for the da Vinci surgical robot to maintain teleoperation functionality during communication loss using a virtual environment in the AMBF simulator
- Conducted a user study with 8 participants performing the peg transfer task 2 experimental conditions (baseline and replay), analyzing NASA TLX results to show reduced frustration and smoother task performance
- Revealed that the replay strategy reduced task completion time by 23% and improved workflow recovery
- Publish findings in **PUBLICATIONS #4**

High-Fidelity Virtual Reality Clinical Training System — June 2024 – Dec. 2024

Unity3D, C#, Neuralangelo — **Advisor:** Prof. Vinciya Pandian & Prof. Mathias Unberath — *Johns Hopkins University*

- Developed a standalone VR system to simulate the central line dressing change procedure for clinical training
- Generated digital twin assets of medical environments and instruments using neural surface reconstruction techniques
- Implemented a sequential control mechanism to guide users through each procedural step accurately
- Designed a user study with healthcare professionals to evaluate the training effectiveness of the VR environment

Mixed Reality-Assisted Trajectory Planning and Guidance System — June 2024 – Aug. 2024

Optical Tracking, 3D Printing — **Advisor:** Prof. Mathias Unberath — *Johns Hopkins University*

- Developed an MR system on HoloLens 2 for percutaneous orthopedic K-wire placement, achieving an average placement accuracy of 5.26 mm and 2.88°
- Integrated real-time instrument tracking and spatial alignment to minimize errors and improve insertion accuracy
- Collaborated with 2 experienced surgeons to evaluate system performance using custom 3D-printed phantom models
- Published findings in **PUBLICATIONS #7**

Evaluating Effectiveness of Visualization Techniques in Mixed Reality — Sep. 2023 – Mar. 2024

User Study Design — **Advisor:** Prof. Alejandro Martin-Gomez — *Johns Hopkins University*

- Explored visualization methods to enhance localization of out-of-view objects on HoloLens 2, using Just Noticeable Difference (JND) to quantify perceptual thresholds
- Designed a user study with 24 participants, testing 3 MR techniques (3D Arrow, 3D Radar, EyeSee360) in 2 user interface modalities (dynamic, static)
- Revealed 3D Arrow as the most effective for rapid object identification, while 3D Radar and EyeSee360 offered distinct advantages in spatial encoding and panoramic awareness
- Published findings in **PUBLICATIONS #8**