

Yihao Liu

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Education

01/2021 – Present **Doctor of Philosophy in Computer Science**, Johns Hopkins University, Baltimore, MD | 3.95/4.00
01/2021 – Present **Master of Science in Computer Science**, Johns Hopkins University, Baltimore, MD | 3.67/4.00
09/2019 – 12/2021 **Master of Science in Robotics**, Johns Hopkins University, Baltimore, MD | 3.89/4.00
09/2015 – 06/2019 **Bachelor of Applied Science in Electrical Engineering, Minor in Computer Science**,
University of British Columbia, Kelowna, BC | 168 Earned Credits, 90.7/100

Recent Publications

Bold font indicates serving as **first** or **corresponding author**.

11. **Liu, Y.**, & Armand, M. (2024). A Roadmap Towards Automated and Regulated Robotic Systems. *arXiv preprint arXiv:2403.14049*.
10. **Liu, Y.**, Zhang, J., Diaz-Pinto, A., Li, H., Martin-Gomez, A., Kheradmand, A., & Armand, M. (2024, April). Segment any medical model extended. In *Medical Imaging 2024: Image Processing* (Vol. 12926, pp. 411-422). SPIE.
9. Ai, L., **Liu, Y.**, Armand, M., Kheradmand, A., & Martin-Gomez, A. (2024). On the fly robotic-assisted medical instrument planning and execution using mixed reality. *The 2024 IEEE International Conference on Robotics and Automation (ICRA2024)*. Accepted.
8. **Liu, Y.**, Zhang, J., She, Z., Kheradmand, A., & Armand, M. (2024). Gbec: geometry-based hand-eye calibration. *The 2024 IEEE International Conference on Robotics and Automation (ICRA2024)*. Accepted.
7. Zhang, J., Zhang, Z., **Liu, Y.**, Chen, Y., Kheradmand, A., & Armand, M. (2024). Realtime robust shape estimation of deformable linear object. *The 2024 IEEE International Conference on Robotics and Automation (ICRA2024)*. Accepted.
6. **Liu, Y.**, Tian, J., Martin-Gomez, A., Arshad, Q., Armand, M., & Kheradmand, A. (2024). Autokinesis reveals a threshold for perception of visual motion. *Neuroscience*.
5. **Liu, Y.**, Kheradmand, A., & Armand, M. (2023). Toward process controlled medical robotic system. *arXiv preprint arXiv:2308.05809*. Under review.
4. Li, H., Yan, W., Liu, D., Qian, L., Yang, Y., Liu, Y., Zhao, Z., Ding, H., & Wang, G. (2023). Evd surgical guidance with retro-reflective tool tracking and spatial reconstruction using head-mounted augmented reality device. *arXiv preprint arXiv:2306.15490*.
3. **Liu, Y.**, Zhang, J., She, Z., Kheradmand, A., & Armand, M. (2023). Samm (segment any medical model): a 3d slicer integration to sam. *arXiv preprint arXiv:2304.05622*.
2. **Liu, Y.**, Liu, S. J., Sefati, S., Jing, T., Kheradmand, A., & Armand, M. (2022, March). Inside-out tracking and projection mapping for robot-assisted transcranial magnetic stimulation. In *Optical Architectures for Displays and Sensing in Augmented, Virtual, and Mixed Reality (AR, VR, MR) III* (Vol. 11931, pp. 57-70). SPIE.
1. **Liu, Y.**, Azimi, E., Davé, N., Qiu, C., Yang, R., & Kazanzides, P. (2021, May). Augmented reality assisted orbital floor reconstruction. In *2021 IEEE International Conference on Intelligent Reality (ICIR)* (pp. 25-30). IEEE.

Past Publications

- Liu, H., Zhao, C., Liu, Y., Dong, H., Ge, J., & Liu, Z. (2022). Enhanced magnetic imaging for industrial metal workpiece detection through the combination of electromagnetic induction and magnetic anomalies. *IEEE Transactions on Instrumentation and Measurement*, 71, 1-9.
- Liu, H., Bin, J., Liu, Y., Dong, H., Liu, Z., Mrad, N., & Blasch, E. (2021). SGCast: a new forecasting framework for multilocation geomagnetic data with missing traces based on matrix factorization. *IEEE Transactions on Instrumentation and Measurement*, 70, 1-11.

- Zhao, P., Shiraz, M. H. A., Zhu, H., Liu, Y., Tao, L., & Liu, J. (2019). Hierarchically porous carbon from waste coffee grounds for high-performance Li–Se batteries. *Electrochimica Acta*, 325, 134931.
- **Liu, Y.**, Liu, S., Liu, H., Mandache, C., & Liu, Z. (2019). Pulsed eddy current data analysis for the characterization of the second-layer discontinuities. *Journal of Nondestructive Evaluation*, 38, 1-8.
- Liu, H., Liu, Z., Liu, S., Liu, Y., Bin, J., Shi, F., & Dong, H. (2018). A nonlinear regression application via machine learning techniques for geomagnetic data reconstruction processing. *IEEE Transactions on Geoscience and Remote Sensing*, 57(1), 128-140.
- Liu, H., Liu, Y., Liu, S., Liu, Z., Ge, J., Song, H., ... & Dong, H. (2018, May). What can machine learning do for geomagnetic data processing? A reconstruction application. In *2018 IEEE International Instrumentation and Measurement Technology Conference (I2MTC)* (pp. 1-6). IEEE.
- Shi, F., Liu, Y., Liu, Z., & Li, E. (2018). Prediction of pipe performance with stacking ensemble learning based approaches. *Journal of Intelligent & Fuzzy Systems*, 34(6), 3845-3855.
- Bin, J., Tang, S., Liu, Y., Wang, G., Gardiner, B., Liu, Z., & Li, E. (2017, September). Regression model for appraisal of real estate using recurrent neural network and boosting tree. In *2017 2nd IEEE international conference on computational intelligence and applications (ICCIA)* (pp. 209-213). IEEE.

Projects

AI-Assisted Patient Navigation using Mixed Reality | RAG, LangChain, Unity, Quest 3

- Built a virtual assistant for health providers and patients, enabling patient navigation using AI-embodied Mixed Reality (MR).
- Developed a device-agnostic, multi-agent, and MR-enabled system that provides remote clinical access, intuitive visualization, expert knowledge management, and online decision-making.
- Built web scrapping components for actual local health provider data and expert knowledge.

Expert Knowledge Generation on Surgical Procedures | Python, Llama 2, PEFT

- Curating datasets from surgical textbooks and fine-tuning on Llama 2.
- Obtaining benchmarks from surgeons and evaluation agents.

Intelligent Automation in Medical and Surgical Robotics | Python, ROS, C++

- Conducted theoretical modeling of automata in medical and surgical scenes.
- Developed libraries supporting the integration of the automata models to executable robotic systems [\[request demo\]](#)
- Identified and proposed research directions in end-to-end pipelines for automated tasks.

Robot [\[link\]](#) and AR [\[link\]](#) -Assisted Transcranial Magnetic Stimulation (TMS) | C++, Python, C#, Matlab, ROS, Unity, Vtk

- Completed a prototype of robotic TMS and used it for preliminary internal clinical trials and neuroscience studies.
- Developed neuro-navigation system for TMS targets planning and medical image viewing.
- Developed robotic systems and integrated [\[request demo\]](#) hardware with functional modules for Kuka LBR7 iiwa controlling [\[repo\]](#), hand-eye calibration [\[2,8\]](#), tool calibration [\[2\]](#), dynamics modeling [\[7\]](#), user interface, and networking [\[repo, repo\]](#).
- Developed AR systems [\[2,9\]](#) providing collision detection cues and capable of ergonomic planning and execution.
- Wrote academic publications [\[2,5,7-9\]](#) and patent applications, and presented in conferences.

Autokinetic Effect of Human Subjects [\[link\]](#) | C++, Python, 3D Slicer, ROS

- Developed subject testing systems [\[repos\]](#) and integrated hardware for functions including visual stimuli generation, eye tracking, hand tracking and data logging, with modules including user interface, and experiment workflow controller.
- Interacted with patients and healthy subjects in preliminary clinical trials. Recorded [\[demo\]](#) and analyzed data [\[request repo\]](#)
- Wrote a journal paper [\[6\]](#) and presented in Society for Neuroscience Conference 2023 [\[SfN23 page# 404\]](#) [\[request slides\]](#)

Robot [\[link\]](#) and AR [\[link\]](#) -Assisted Femoroplasty | C++, Python, C#, Unity 3D Slicer, ROS

- Improved hand-eye calibration results [\[8\]](#), and built a customized robotic manipulating system with AR capabilities [\[5,8,9\]](#).

3D Slicer Integration to Segment Anything Model [\[link\]](#) | 3D Slicer, Python

- Open-sourced the first SAM-based medical image segmentation tool [\[repo\]\[3,10\]](#).

AR-Assisted Orbital Floor Reconstruction [\[link\]](#) | C#, Unity

- Developed an AR system for orbital floor reconstruction surgery involving functions of medical image registration, accuracy validation, implant shape generation, and intra-operative navigation. Deployed the system on Microsoft HoloLens.

- Collaborated with surgeons and shadowed surgeries for prototyping. Wrote a publication and presented in conference [\[1\]](#).

Applications of Machine Learning Methods | Python, Keras

- Helped as an undergraduate assistant for experimentations of machine learning methods in various projects including geomagnetic data reconstruction, real estate appraisal, and pipe performance management.
- Developed a binary classifier for pulsed eddy current analysis in metallic structures and published a journal article [\[Google Scholar\]](#).

Biomass Derived Carbon Cathode in Lithium Batteries [\[Google Scholar\]](#) | Chemical preparation, Battery assembly, Battery performance characterization

Research and Internships

06/2024 – 09/2024	3D Computer Vision Intern , Moon Surgical , San Carlos, CA
09/2020 – Present	Graduate Research Assistant , Medical automation, robotics and augmented reality (AR) research [2-3,5,7-10] , Prof. Mehran Armand, BIGSS and LCSR , JHU
09/2020 – Present	Trainee , Departments of Neurology and Neuroscience , Studies of balance, vestibular migraine, and perception of motion (autokinetic effect) [6] , VOR Lab , JH Medicine
05/2020 – 12/2020	Graduate Research Assistant , Augmented reality assisted craniofacial surgery [1] , Prof. Peter Kazanzides, SMARTS , JHU
05/2019 – 08/2019	Student Intern – Algorithm , Vision-based pose estimation, Rokae Robotics Technology
05/2017 – 04/2018	Undergraduate Research Assistant , Biomass-derived carbon cathode in lithium batteries [Google Scholar] , Prof. Jian Liu, NESC , UBC
10/2016 – 08/2017	Undergraduate Research Assistant , Various applications using machine learning methods [Google Scholar] , Prof. Zheng Liu, ISDP , UBC

Teaching

01/2022 – 05/2024	Teaching/Course Assistant , EN.601.453/454/653/654 Introduction to Augmented Reality / Applications of Augmented Reality / Augmented Reality, Prof. Alejandro Martin-Gomez, Prof. Nassir Navab, Prof. Ehsan Azimi, JHU <ul style="list-style-type: none"> ○ Mentored over 40 augmented reality projects and 120 students [student demos]. ○ Prepared class materials, developed teaching demonstration apps, held office hours, graded and designed assignments, and obtained high scores on evaluations 3 terms and counting. ○ Received the University Excellence in Teaching Award.
09/2021 – 12/2021	Teaching Assistant , EN.535.630 Kinematics & Dynamics of Robots, Prof. Mehran Armand, JHU
09/2020 – 12/2020	Course Assistant , EN.601.455 Computer-Integrated Surgery I, Prof. Russell H. Taylor, JHU
09/2019 – 12/2019	Teaching Assistant , EN.530.641 Statistical Learning for Engineers, Prof. Jin Seob Kim, JHU

Community Services and Leadership

2019 – present	Peer Reviewer <ul style="list-style-type: none"> ○ Scientific Reports, Nature ○ IEEE Transactions on Emerging Topics in Computational Intelligence, IEEE ○ Nondestructive Testing and Evaluation, Taylor & Francis ○ IEEE Access, IEEE ○ Computerized Medical Imaging and Graphics, Elsevier
09/2023 – present	Volunteer Developer , Tuberculosis Loss Predictor, JHU Non-profit <ul style="list-style-type: none"> ○ Developing the user interface for an application for clinical use, targeting the tuberculosis risk prediction in South Africa
09/2023 – present	Volunteer Developer , VectorCam, JHU Non-profit <ul style="list-style-type: none"> ○ Developing the user interface for an application targeting the recognition of the vectors of malaria used in areas in Africa, Southeast Asia, and Middle and South America
09/2022 – present	Communication Officer , Graduate Student Association, LCSR, JHU

- Representing the students in LCSR, the robotics research cluster of JHU consists of 200+ students and 40+ faculty members throughout departments and campuses.
- 12/2023 – present **Founder**, Let’s Code Club
- Helping graduate students prepare for technical interviews in tech companies.
 - Holding mock interviews and providing feedback.
- 04/2023 [Invited Talk](#): How good is SAM in medical images?, [SPARK Academy](#), McGill University
- 11/2018 – 06/2019 **Founder**, RoboMaster Club, UBC
- Founded the club for students who are interested in building robots for DJI’s RoboMaster Competition, and developed the fund-raising, schedule, and internal documentations. Was in charge of recruitment, sponsorship seeking, and organization coordination.

Awards

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| 2024 | Joel Dean Excellence in Teaching Award |
| 2024 | International Conference on Robotics and Automation Competitive Travel Grant |
| 2019 | Graduate with Distinction |
| 2018 | International Undergraduate Research Award |
| 2018 | Deputy Vice-Chancellor Scholarship |
| 2017 | Deputy Vice-Chancellor Scholarship |
| 2017 | International Student Faculty Award |
| 2015 - 2019 | Dean’s Honor List |