HAOYING(JACK) ZHOU

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EDUCATION

Worcester Polytechnic Institute *Sep 2020 - Present*
Ph.D. in Robotics Engineering, GPA: 3.95/4.0

Boston University *Sep 2018 - May 2020*
Master of Science in Mechanical Engineering, GPA: 3.78/4.0

University of California, Berkeley *Sep 2017 - May 2018*
Senior-year Exchange program, Mechanical Engineering, GPA: 3.95/4.0

Beijing Institute of Technology, China *Sep 2014 - May 2018*
Bachelor of Science in Mechanical Engineering, ranked: 10/33

WORK EXPERIENCE

Visiting Graduate Scholar, *JHU LCSR, Baltimore, MD* *Jun 2023 - Present*
- Construct research on suturing tasks automation based on skills learned from demonstrations in simulation.
- Develop the software infrastructure of the 2021-2022 & 2023-204 AccelNet Surgical Robotics Challenge available on surgical-robotics-ai.github.io/surgical-robotics-challenge-2023/challenge-2023.html.
- Design the framework for customized controller teleoperation and robot motion recording & replaying system.
- Build and test the whole robot system model for daVinci Si surgical system in ROS.
- Generate a synthetic 6D pose estimation dataset in simulation and train deep learning models on the dataset.
- Construct novel phantom & needle meshes for the simulation using Blender.
- Leverage Magic Leap 1 as an alternative stereo viewer and enable eye focus tracking

Robotics Intern, *Philips Research North America, Boston, MA* *May 2022 - Aug 2022*
- Design a synthetic motion simulator with GUI in Python using 3D DICOM data as the only input.
- Implement phantom feature extraction, volume rendering and 3D volume visualization with VTK, ITK and VMTK.
- Construct data auto-generator based on the synthetic motion simulator with flexible configuration inputs.
- Integrate the simulator with Xbox controller as motion control input.
- Improve the refreshing rate of the simulator from 0.15 fps to 5 fps.
- Implement analytical analysis on the generated data.

Research Assistant, *WPI AIM Lab, Worcester, MA* *May 2021 - Present*
- Manage and lead all da Vinci Research Kit(dVRK) related projects, including suturing automation, dynamic identification, customized controller teleoperation, kinematic & dynamic controller design and customized tool integration.
- Reactivate a full da Vinci surgical system with dVRK software framework, actively repair, maintenance and improve both hardware and software infrastructures.
- Integrate probe for photoacoustic scanning on dVRK PSM (patient side manipulator) with auto-scanning enabled.
- Lead and manage user study for collecting human motion patterns on the physical dVRK.
- Implement suturing subtask automation using learning from demonstrations in simulation.

TECHNICAL SKILLS

Programming & System:	Python, Matlab, C++, Linux, Arduino, ROS, ROS2, PyQt, Pytorch, Tensorflow
Simulation:	Gazebo, Rviz, VREP, AMBF(Asynchronous Multi-Body Framework), ITK, VTK
Platform :	da Vinci Si surgical system, Slicer, dVRK(da Vinci Research Kit)
Design & Manufacturing:	Solidworks, Auto CAD, ANSYS FEA, Machining Skills

PUBLICATIONS

- Gao, S., Wang, Y., Ma, X., Zhou, H., Jiang, Y., Yang, K., ... & Zhang, H. K. (2023). Intraoperative Laparoscopic Photoacoustic Image Guidance System in the da Vinci Surgical System. Biomedical optics express.

- Gao, S., Wang, Y., Zhou, H., Yang, K., Jiang, Y., Lu, L., ... & Zhang, H. K. (2023, April). Laparoscopic photoacoustic imaging system integrated with the da Vinci surgical system. In Medical Imaging 2023: Image-Guided Procedures, Robotic Interventions, and Modeling (Vol. 12466, pp. 62-70). SPIE.

- Jiang, Y., Zhou, H., & Fischer, G. S. (2023, April). Markerless Suture Needle Tracking From A Robotic Endoscope Based On Deep Learning. In 2023 International Symposium on Medical Robotics (ISMR) (pp. 1-7). IEEE.

- Yang, K., Meier, T. B., Zhou, H., Fischer, G. S., & Nycz, C. J. (2022, July). A sEMG Proportional Control for the Gripper of Patient Side Manipulator in da Vinci Surgical System. In 2022 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC) (pp. 4843-4848). IEEE.

- Goldfarb, N., Zhou, H., Bales, C., & Fischer, G. S. (2021, November). Control of a lower limb exoskeleton using Learning from Demonstration and an iterative Linear Quadratic Regulator Controller: A simulation study. In 2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC) (pp. 4687-4693). IEEE.

PROJECTS

Point Cloud Completion, *Worcester Polytechnic Institute* *May 2023 - Present*
- Purpose a novel chamfer distance loss function for point cloud completion using Landau distribution,
- The purposed method achieves new state-of-the-art results on some benchmark dataset.

da Vinci Surgical System Teleoperation and Automation, *Worcester Polytechnic Institute* *Mar 2021 - Present*
- Construct research on learning from demonstrations algorithms for suturing subtasks with collected human demonstrations, successfully reproduce movements given arbitrary start and end positions.
- Develop multiple ROS packages for teleoperating dVRK PSM (Patient Side Manipulator) with Razer Hydra contorller and Geomagic Touch haptic device, demonstrate on 2022 WPI Touch Tomorrow and 2022 Boston DeviceTalks representing WPI PracticePoint.
- Build customized kinematic models for dVRK PSM in both MATLAB and Python with successful validation both on simulated and physical dVRK.
- Implement suturing needle 6D pose estimation algorithm using deep learning method, achieving estimated position errors less than 1mm and orientation errors around 2 degrees. Win second prize on 2021 AccelNet Surgical Robotics Challenge.

Exoskeleton Imitation Learning, *Worcester Polytechnic Institute* *Sep 2020 - Mar 2021*
- Construct and optimize an algorithm on imitation learning with Task-Parameterized Gaussian Mixture Model (TPGMM) applied to human walking strategies for lower-limb exoskeleton.
- Collect data using motion capture technique with real-life human motion.
- Leverage AMBF for simulating the exoskeleton and human lower limb movements.
- Design and implement iLQR controller to above algorithm and managed to find the optimal weight matrix.

Reach-to-grasp Imitation Learning, , *Boston University* *Oct 2018 - May 2020*
- Implement generalized research-to-grasp automation using imitation learning with dynamic movement primitives(DMP) in Python.
- Leverage VREP for simulating robot arm motions.
- Collect human demonstration data using joystick controller
- Accomplish 6D pose imitation learning for the end-effector of Baxter Robot.
- Write and defend my Master's Thesis, full-text available on open.bu.edu/handle/2144/40948

Autonomous Race Car Modelling and Control, *University of California, Berkeley* *Feb 2018 - May 2018*
- Construct the vehicle model and its tire model under different road conditions for predicting the vehicle movements.
- Utilize MATLAB, Simulink, and ROS Turtlesim to simulate BARC movements under different conditions.
- Remotely connect to the Linux-based vehicle operating system via VNC Viewer and SSH.
- Implement lane keeping, drift parking, and adaptive cruise control on BARC with linear controllers such as PID and LQR.
- Analyze data in MATLAB, including camera calibration and result data analysis utilizing methods such as FFT interpolation and least square method to obtain and discern relationships between variables.

Tri-Bot Design and Manufacturing, , *University of California, Berkeley* *Feb 2018 - May 2018*
- Utilize MyRio as the microprocessor and program in LabVIEW for target detection and tracking algorithm in the upper camera system.
- Leverage Arduino board as the processor and code in Arduino for lane keeping algorithm in the lower moving system.
- Champion full design and manufacturing of product from conception to delivery, more detail can be found at: sites.google.com/berkeley.edu/tri-bot-com/home.

Other selected project:

- Laboratory Animal Surgery, Worcester Polytechnic Institute
- SCARA Manipulator Design and Control with ROS Gazebo, Worcester Polytechnic Institute
- Adaptive Robustness Control Design for UAV with ROS Gazebo, Worcester Polytechnic Institute
- FaceSwap and 3D Scene Reconstruction (NeRF) Implementation, Worcester Polytechnic Institute
- Visual Inertial Odometry with Multi-Scale Constraint Kalman Filter, Worcester Polytechnic Institute

CERTIFICATION & ASSOCIATIONS

- **Machine Learning Certification** - *Coursera*
- **Student Member** - *IEEE & IEEE RAS*