Fei Liu

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Research Focus

Robotics in system modeling, control, dynamics, physical-based simulation, constrained optimization, autonomy, haptic teleoperation and mechatronics, in particular for surgical and biomedical applications.

Bio

Fei is a postdoctoral researcher at the Contextual Robotics Institute at University of California San Diego (UCSD). He is currently working on robotic autonomy for surgical applications, with semantic modeling, real-to-sim simulation, and advanced control techniques. Before that, he served as a research associate/postdoctoral scholar both at the Biorobotics Institute at Scuola Superiore Sant'Anna (SSSA), and the Center for Micro-BioRobotics at Italian Institute of Technology (IIT) in Italy. He finished his Ph.D. at Laboratory Ampère at INSA de Lyon, a top French grande école and engineering university. Right after his PhD dissertation, he also worked for a start-up company (ROBO Medical Co., Ltd.) as a senior control engineer and project manager for the creation of a robot for endoscopic submucosal dissection (ESD) surgery. During the last few years, he has experiences in several robotic areas, including modeling, control, dynamics, planning, simulation, and optimization. I also have knowledge of sensor perception, signal processing, and computer vision. He has authored a number of journal and conference papers that have advanced and impacted on both the academic and industrial worlds.

Education

Institut National des Sciences Appliquées de Lyon (INSA de Lyon) **Sep. 2013 – Sep. 2016**

Ph.D. in Robotics *Lyon, France*

- Thesis title : Dual-user Haptic Training System
- Supervisors : Prof. Arnaud Lelevé, Prof. Tanneguy Redarce, Dr. Damien Eberard

Institut National des Sciences Appliquées de Lyon (INSA de Lyon) **Sep. 2012 – Aug. 2013**

Master of Science in Robotics *Lyon, France*

- Thesis title : Teleoperation System Using Port-Hamiltonian Approach
- Supervisor : Prof. Arnaud Lelevé

Northwestern Polytechnical University (NWPU, 985 & 211 Rank) **Sep. 2008 – Jul. 2012**

Bachelor of Science in Automation *Xi'an,China*

Speciality: Automation and Inertial Navigation

Working Appointments

Postdoctoral Scholar **Dec. 2019 – present**

Advanced Robotics and Controls Lab, University of California San Diego *San Diego, CA, USA*

Advisor: Prof. Michael Yip

Research Associate Scholar **Apr. 2019 – Nov. 2019**

Biorobotics Institute, Scuola Superiore Sant'Anna *Pisa, Italy*

Advisor: Prof. Filippo Cavallo

Postdoctoral Scholar **Mar. 2018 – Mar. 2019**

Center for Micro-BioRobotics, IIT@SSSA, Italian Institute of Technology *Pisa, Italy*

Senior Control Engineer & Project Director **Sep. 2017 – Feb. 2018**

ROBO Medical Technology Co., Ltd *Shenzhen, China*

Main works : Contol system design for single-port/cable-driven surgical robot and autonomous mobile robot with SLAM

Publications

Dissertation and Thesis:

- [PhD] Fei Liu, Dual-user Haptic Training System, archives-ouvertes.fr/tel-01514992, Ph.D. Dissertation, INSA de Lyon, 2017.
- [Master] Fei Liu, Cooperative Haptic Hands-on Minimally Invasive Surgery (MIS) Trainer, M.Sc. Thesis, INSA de Lyon, 2013.

To-submit/Pre-prints:

- [TS-J1] **Fei Liu**, Florian Richter, Fei Yin, Chong He, Cédrec Girerd, Michael C. Yip. Continuum Robot Shape Reconstruction and Tracking from Monocular Endoscopic Image Sequences. *IEEE Robotics and Automation Letters (RAL), To submit.*
- [TS-J2] Xiao Liang, Shan Lin, **Fei Liu**, Dimitri Schreiber, Michael C. Yip. ODERegNet: An ODE-based Recursive Image Registration Network for 4D Lung CT. *IEEE Transactions on Biomedical Engineering (T-BME), To submit.*
- [TS-J3] Zhaowei Yu, Dimitri A. Schreiber, **Fei Liu**, Alexander M. Grant, Michael C. Yip. An Underwater Remote Teleoperation Robot Arm with Rolling Diaphragm Actuation and End Effector Force Reconstruction. *IEEE/ASME Transactions on Mechatronics (T-MECH), To submit.*

Journal Articles ($\star$ shares the first author.):

- [J1] **Fei Liu***, Mingen Li*, Jingpei Lu, Entong Su, Michael C. Yip. Parameter Identification and Motion Control for Articulated Rigid Body Robots Using Differential Position-based Dynamics. *IEEE Transactions on Robotics (T-RO). In revision for re-submission.* arXiv: 2201.05753.
- [J2] **Fei Liu***, Entong Su*, Jingpei Lu, Mingen Li, Michael C. Yip. Differentiable Robotic Manipulation of Deformable Rope-like Objects Using Compliant Position-based Dynamics. to submit. *IEEE Robotics and Automation Letters (RAL). In revision for re-submission.* arXiv: 2202.09714
- [J3] Florian Richter, Shihao Shen, **Fei Liu**, Jingbin Huang, Emily K. Funk, Ryan K. Orosco, Michael C. Yip. Autonomous Robotic Suction to Clear the Surgical Field for Hemostasis Using Image-Based Blood Flow Detection. *IEEE Robotics and Automation Letters (RAL)*, 2021. DOI: 10.1109/LRA.2021.3056057
- [J4] Sarmad Mehrdad*, **Fei Liu***, Minh Tu Pham, Arnaud Lelevé, S. Farokh Atashzar. Review of Advanced Medical Telerobots. *Applied Sciences*, 2020. DOI: 10.3390/app11010209
- [J5] Angel R. Licona, **Fei Liu**, David Pinzon, Ali Torabi, Pierre Boulanger, Arnaud Lelevé, Richard Moreau, Minh Tu Pham, Mahdi Tavakoli, Troy McDaniel. Applications of Haptics in Medicine. *Haptic Interfaces for Accessibility, Health, and Enhanced Quality of Life*, Nov. 2019. DOI: 10.1007/978-3-030-34230-2_7
- [J6] **Fei Liu**, Angel Ricardo Licona, Arnaud Lelevé, Damien Eberard, Minh Tu Pham, Tanneguy Redarce. An Energy-Based Approach for n-dof Passive Dual-user Haptic Training Systems. *Robotica*, 2019. DOI: 10.1017/S0263574719001309

Conference Proceedings ($\star$ shares the first author.):

- [C1] Jingpei Lu*, **Fei Liu***, Michael C. Yip. Image-based Pose Estimation and Shape Reconstruction for Robot Manipulators and Soft, Continuum Robots via Differentiable Rendering. *IEEE International Conference on Robotics and Automation (ICRA) 2023. Submitted.* todo
- [C2] Neelay Joglekar, **Fei Liu**, Ryan Orosco, Michael C. Yip. Suture Thread Spline Reconstruction from Endoscopic Images for Robotic Surgery with Reliability-driven Keypoint Detection. *IEEE International Conference on Robotics and Automation (ICRA) 2023. Submitted.* arXiv: 2209.13657
- [C3] **Fei Liu***, Zihan Li*, Yuhai Han, Jingpei Lu, Florian Richter, Michael C. Yip. Real-to-Sim Registration of Deformable Soft-Tissue with Position-Based Dynamics for Surgical Robot Autonomy. *IEEE International Conference on Robotics and Automation (ICRA) 2021.* DOI: 10.1109/ICRA48506.2021.9561177

- [C4] Jingbin Huang*, **Fei Liu***, Florian Richter, Michael C. Yip. Model-Predictive Control of Blood Suction for Surgical Hemostasis using Differentiable Fluid Simulations. *IEEE International Conference on Robotics and Automation (ICRA), 2021.* DOI: 10.1109/ICRA48506.2021.9561624
- [C5] Yunhai Han, **Fei Liu**, Michael C. Yip. A 2D Surgical Simulation Framework for Tool-Tissue Interaction. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) Workshop on Cognitive Robotic Surgery, 2020.* arXiv: 2010.13936
- [C6] Jacob J. Johnson, Linjun Li, **Fei Liu**, Ahmed H. Qureshi, Michael C. Yip. Dynamically constrained motion planning networks for non-holonomic robots. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2020.* DOI: 10.1109/IROS45743.2020.9341283
- [C7] Angel Ricardo Licona Rodriguez, **Fei Liu**, Arnaud Lelevé, Damien Eberard, Minh Tu Pham. Collaborative Hands-on Training on Haptic Simulators. *7th International Conference on Mechatronics and Control Engineering, Nov. 2018.* DOI: 10.1145/3332305.3332318
- [C8] **Fei Liu**, Arnaud Lelevé, Damien Eberard, Tanneguy Redarce. An Energy Based Approach for Passive Dual-user Haptic Training Systems. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Oct. 2016.* DOI: 10.1109/IROS.2016.7759771
- [C9] **Fei Liu**, Arnaud Lelevé, Damien Eberard, Tanneguy Redarce. A Dual-user Teleoperation System with Online Authority Adjustment for Haptic Training. *37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Aug. 2015.* DOI: 10.1109/EMBC.2015.7318574
- [C10] **Fei Liu**, Arnaud Lelevé, Damien Eberard, Tanneguy Redarce. A Dual-user Teleoperation System with Adaptive Authority Adjustement for Haptic Training. *4th International Workshop on Medical and Service Robots, Jul. 2015.* DOI: https://doi.org/10.1007/978-3-319-30674-2_13
- [C11] **Fei Liu**, Yinan Sang, Jie He, Jie Fan, Ruichao Li, Xiongyi Cui, Haoyu Li, Jie Chen. Northwestern Polytechnical University Team Entry for the 2012 AUVSI International Aerial Robotics Competition. *International Aerial Robotics Competition (IARC) Symposium, Aug. 2012.* Link
- [C12] **Fei Liu**, Haoyu Li, Li Li. Modeling of the Snowboard Course, International Mathematical Contest in Modeling (MCM) Symposium, Apri. 2011

Selected Patents (part of)

- [P1] **Fei Liu**, Michael C. Yip, Florian Richter. Real-to-Simulation Matching of Deformable Soft Tissue and Other Objectss with Position-based Dynamics for Robot Control. PCT/US22/22820. 2022. *Submitted for application.*
- [P2] Jialin Yang, Qinghao Hu, Jianxiao Chen, **Fei Liu**, Fei Long. Flexible Mechanical Arm and Surgical Equipment. CN 215651505 U. 2021. *Active.*
- [P3] Jialin Yang, Qinghao Hu, Jianxiao Chen, **Fei Liu**, Fei Long, Luchen Shen, Liyang Lin. Main Hand Control Unit and Auxiliary Robot for Digestive Tract Operation. CN 216603056 U. 2021. *Active.*
- [P4] Jialin Yang, Qinghao Hu, Jianxiao Chen, **Fei Liu**, Fei Long, Luchen Shen, Liyang Lin. Main Operator and Force Feedback Device. CN 215273291 U. 2021. *Active.*
- [P5] Jialin Yang, Qinghao Hu, Jianxiao Chen, **Fei Liu**, Fei Long, Luchen Shen, Liyang Lin. Operation Executor. CN 114129228 A. 2021.
- [P6] Jialin Yang, Qinghao Hu, Jianxiao Chen, **Fei Liu**, Fei Long, Luchen Shen, Liyang Lin. Operation Executor. CN 114176660 A. 2021.
- [P7] Junjie Gao, **Fei Liu**, Shunzheng Meng, Sihao Zuo, Jialin Yang. A Kind of Flexible Joint Mechanism. CN 209713128 U. 2018. *Active.*
- [P8] Jialin Yang, Xilong Hou, Lijuan Yao, **Fei Liu**. Lifting Operation Instrument. CN 209574762 U. 2018. *Active.*

Research Experience

Advanced Robotics and Controls Lab, UCSD **Dec. 2019 – present**

PostDoc, ARCLab *San Diego, CA, USA*

- Modeling of deformable, rigid, articulated, fluid object using position-based dynamics (PBD), in particular for surgical scenes, i.e., soft tissue, membrane, blood and tools etc.
- Differentiability for the PBD simulation using adjoint method based on chain-rule.
- Simulation framework using NVIDIA-Flex, PBD, and self-written constrained based solver.
- Real-to-sim transfer techniques using non-rigid perception, registration, and tracking.
- Closed-loop controller design and validation using field robots, such as da Vinci Reseach Kit (DVRK), 7-dof Baxter Robotic Arm.
- **Continuum robot project**: Shape reconstruction using projection of geometrical primitives (cylinders, circles etc.) and perform visual servoing control.

Biorobotics Institute, Scuola Superiore Sant'Anna **Apr. 2019 – Nov. 2019**

Researcher, Assistive Robotics Lab *Pisa, Italy*

- Simultaneous localization and mapping (SLAM) of mobile robotic platform under ROS.
- Autonomous initialization through computer vision approaches using aruco markers (QR codes).
- Autonomous navigation of the mobile robot including path planning, obstacle avoidance.
- Shared control theory development and implementation of the mobile platform.
- Design of PHP/HTML-based web user interface.
- Experimental tests in Verona, Italy.

Center for Micro-BioRobotics IIT@SSSA **Mar. 2018 – Apr. 2019**

PostDoc, Istituto Italiano di Tecnologia *Pisa, Italy*

- Modeling and control KUKA LWR4+ robotic arm using ROS and Gazebo : motion control, trajectory planning, master-slave
- Modeling and control of flexible continuum surgical tool : static tension-deflection model, Euler-Lagrange dynamics, port-Hamiltonian based control.
- Analysis of several continuum structure prototypes : variation of design (notches, single-backbone, articulated).
- Develop teleoperation framework using haptic devices (Sigma.7).
- Preliminary study of simulation platform for flexible surgical tools using SOFA (Simulation Open Framework Architecture).

Control Engineer & Project Director **Aug. 2017 – Feb. 2018**

ROBO Medical Technology Co., Ltd *Shenzhen, China*

- Develop teleoperation of a single-port abdominal robotics surgical system using haptic devices (i.e., PHANTOM Omni, Novint Falcon, Omega.3) and joysticks (i.e., Logitech G Extreme 3D, Microsoft Xbox).
- Modeling and control of a tendon-driven articulated end-effector : kinematics, motion control, master-slave.
- Model-based uncertainties identification and compensation : hysteresis, friction.
- Modeling and control of a 4 dofs positioning arm (parallel mechanisms) : kinematics, motion control, master-slave.
- Caculation of the RCM point of positioning arm.
- Modeling and control (based on gait analysis) of a powered lower limb orthosis for rehabilitation.
- SLAM algorithm (build on ROS) of autonomous mobile robots for medical transporta- tion in hospitals.

PHD Thesis : Dual-user Haptic Training System **Sep. 2012 – Sep. 2016**

Advisors: Prof. Tanneguy Redarce, Prof. Arnaud Lelevé, Dr. Damien Eberard *INSA de Lyon, France*

- Focused on modeling and control aspects with/without time delays.
- Developed real-time experiments both with Matlab/Simulink, ROS and Chai3D.
- Published three international conference papers, and one journal paper.

Group Leader : DJI RoboMasters Mobile Manipulation Challenge **Aug. 2014**

Design of Autonomous Mobile Robot Using SLAM and Computer Vision Approach. *Shenzhen, China*

Dajiang Innovations Technology Co., Ltd (DJI)

- Developed SLAM framework for mobile robots (chariots) u on ROS.
- Implemented fast on-board object tracking and recognition algorithms.
- Developed multi-robot coordination and searching algorithms.

Master Thesis : Cooperative Haptic Hands-on MIS Trainer **Sep. 2012 – Aug. 2013**

Master Internship at Ampère Laboratory *INSA de Lyon, France*

- Designed teleoperation system using port-Hamiltonian approach.
- Implemented control algorithms with haptic devices (PHANTOM Omni).
- Developed real-time experiments using Matlab/Simulink.

Team Leader : International Aerial Robotics Competition (IARC) **Aug. 2012**

A Low Cost Autonomous Quadrotor UAV-Icarus *Peking, China*

- Mathmatical modeling of a self-made low cost laser rangefinder based on geometric caculation for environment mapping.
- Autonomous control of the quadrotor using environment mapping and detection algo- rithm (wall and window detection using point cloud analysis).
- Awarded **Innovative Design**.

Undergraduate Internship **Sep. 2011 – Jun. 2012**

Image Meta-data Feature Extraction for Content-Context Based Image Retrieval *NPU, Xi'an, China*

- Implemented image processing and classification algorithms.

Team Leader : International Mathematical Contest in Modeling (MCM) **Feb. 2012**

Optimal Design of U-shaped Snowboard Course *NPU, Xi'an, China*

- Awarded **Meritorious Winner** (First Prize Mention).

Team Leader : Robocup 3D Simulation Group **Sep. 2010 – Jun. 2012**

Robocup Soccer Center of NPU, Simulation Robots of Robocup Soccer *NPU, Xi'an, China*

- Designed gait algorithm of NAO (Humanoid) robot.
- Developed control strategies for simulated soccer competition under linux platform.
- Awarded **Third Prize** in China Open 2011.

Project Leader : Student Project of Chinese Ministry of Education **Nov. 2011 – Jun. 2012**

Mining Methods for Gene Expression Profile Classification *NPU, Xi'an, China*

- Implemented statistical and computing algorithms related to data mining.

Project Leader : Student Project of Chinese Ministry of Education **Nov. 2010 – Jun. 2011**

Path Planning of Mobile Robot *NPU, Xi'an, China*

- Implemented path planning algorithms of mobile robot ($A^{\star}$, genetic algorithm, fuzzy control etc.

"Freescale Cup" National Smart Car Design Competition **Dec. 2010 – May. 2011**

Design and Control of an Intelligent Car for Path Following *NPU, Xi'an, China*

- Awarded **Third Prize** in NPU Open 2011.

Research Assistant : Laboratory Project **Sep. 2010 – Jun. 2011**

Navigation of Unmanned Aerial Vehicle (UAV) Based on Digital Map *NPU, Xi'an, China*

- Supervisor: Prof. Suilao Li, College of Automation, NPU

Research Assistant : Laboratory Project **Sep. 2009 – Jun. 2010**

Design of Intelligent Vehicle and Autonomous Navigation *NPU, Xi'an, China*

- Supervisor: Prof. Suilao Li, College of Automation, NPU

Professional Activities

Journal/Conference Reviewer **2016 – present**

- *IEEE Transactions on Robotics (T-RO)*
- *IEEE Transactions on Mechatronics (T-MECH)*
- *IEEE Robotics and Automation Letters (RAL)*
- *IEEE Transactions on Medical Robotics and Bionics*
- *Control Engineering Practice*
- *Robotica*
- *International Conference on Robotics and Automation (ICRA)*
- *American Control Conference (ACC)*
- *International Conference on Learning Representations (ICLR)*
- *IFAC Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control (LHMNC)*

Poster Presentation **2015 – 2021**

- *Emerging Frontiers in Research and Innovation (EFRI) All-Teams Workshop, Virtual, USA.*
- *37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS), Milano, Italy.*

Oral Presentation **2015 – 2021**

- *2021 International Conference on Robotics and Automation, Virtual, Xi'an, China.*
- *7th Summer School on Surgical Robotics (SSSR 2015), Montpellier, France.*
- *37th EMBS Ignite Sessions, Milano, Italy.*
- *4th International Workshop on Medical and Service Robots (MESROB), Nantes, France.*

Volunteer **May. 2014**

- *20th World Olympic Collectors Fair, Lausanne, Switzerland.*

Membership **2015 – 2021**

- **IEEE Membership** 2017 – present
- **IEEE Student Membership.** 2015 – 2016
- **EMBS Membership.** 2015 – 2016

Supervision Activities

PhD Students

🎓 ***Yu Huan*** *: currently senior engineer at United-Imaging Healthcare Co., Ltd., Shanghai*
Mar. 2018 – Mar. 2019, Scuola Superiore Sant'Anna

- Topic : Design and control of flexible minature surgical tools (continuum robot).

Master Students

🎓 ***Junming Wu*** : *currently second-year master student at UCSD*
Sep. 2021 – present, Department of Electrical and Computer Engineering (ECE), UCSD

- Topic : Bi-manual close-loop control of dual-arm suturing using physical-based simulation.

Xiao Liang : *currently second-year master student at UCSD*
Sep. 2021 – present, Department of Computer Science Engineering (CSE), UCSD

- Topic : Reconstruction of 4D lung motionu using neural-ODE integration.

Chong He : *currently second-year master student at UCSD*
Sep. 2021 – Aug. 2022, Department of Mechanical and Aerospace Engineering (MAE), UCSD

- Topic : Shape reconstruction of catheter robot using monocular images.

Mingen Li : *currently first-year PhD student at University of Minnesota, Twin Cities*
Jan. 2021 – Jan. 2022, Department of ECE, UCSD

- Topic : Simulation and control of articulated rigid body robots using position-based dynamics.

Yunhai Han : *currently first-year PhD student at Georgia Institute of Technology*
Jan. 2021 – Jan. 2022, Department of MAE, UCSD

- Topic : Simulation framework using position-based dynamics using self-written constraints based solver.

Entong Su *: currently second-year master student at UCSD*
Jan. 2021 – Jan. 2022, Department of ECE, UCSD

- Topic : Simulation of rope-like object using position-based dynamics for shape control.

Zihan Li*: currently software algorithm engineer at OmniVision Technologies, Inc.*
Jan. 2020 – Nov. 2020, Department of ECE, UCSD

- Topic : Registration method for real-to-sim transfer applications of deformable tissue manipulation.

Jingbin Huang
Mar. 2020 – Nov. 2020, Department of ECE, UCSD

- Topic : Modeling and control of surgical tool for suction based simulation of blood fluid.

Sean Liu *: currently lead engineer at Hyperspec.ai*
Jun. 2020 – Sep. 2020, Department of ECE, UCSD

- Topic : Reconstruction of a catheter robot shape using projection of geometrical primitives.

Undergraduate Student

Neelay Joglekar *: currently third-year undergraduate student at UCSD*
Jan. 2021 – present, Department of ECE, UCSD

- Topic : Dynamic model of rope-like objects using cosserat rod theory and surgical thread reconstruction.

Yutong Zhang *: currently first-year master student at UCSD*
Jan. 2021 – present, Department of Computer Science, UCSD

- Topic : Simulation platform using libIGL/openGL rendering and visualization for various objects, i.e., rigid, articulated robots, deformable, fluid etc.

Bryan Yuan*: currently software engineer at Qualcomm Inc.*
Jan. 2021 – May 2022, Department of ECE, UCSD

- Topic : Coding of the gradients computed for position-based dynamics constraints.

Nemanja Babic *: currently senior engineer at Hypertherm Associates Inc.*
May. 2015 – Aug. 2015, Research Internship, University of Ottawa & INSA de Lyon

- Topic : Simulation of haptic systems using CHAI3D.

Supported Grants

CAREER: Contextually Informed Autonomous Robotic Surgery
Mar. 2021 – Present, *National Science Foundation (NSF)*
Grant No. : 2045803/PI: Prof. Michael Yip
Role : Postdoc Researcher

- Topic : Modeling and simulation of soft tissue deformation and interactive robotic tool control.

EFRI C3 SoRo: Safe Medical Continuum Robots: Sensing, Control and Fabrication
Nov. 2019 – Present, *National Science Foundation (NSF)*
Grant No. : 1935329/PI: Prof. Michael Yip
Role : Postdoc Researcher

- Topic : Shape reconstruction of catheter robots using endoscopic images and visual-servoing control.

Special Foundation for Intelligent Robots: Creation and Kinematic Model of Modular Variable Stiffness Continuum Flexible Actuator
Mar. 2019 – Nov. 2019, *Ministry of Science and Technology (MOST) of China*
Grant No. : 2018YFB1307700/PI: Shenzhen Robo Medical Technology CO ltd
Role : Project Leader

- Topic : Modeling and control of a continuum flexible ESD robot using curvature-based model.

Honors and Awards

Individual Awards

2012 **Innovative Design Award** at International Aerial Robotics Competition (IARC)
2012 **First Prize** at International Mathematical Contest in Modeling (MCM)
2011 **Third Prize** in Robocup China Open 2011
2008-2012 Yearly **Distinguished Student Scholarship** of Northwestern Polytechnical University

Paper Awards

2021 Nominated for **Best Paper** at IEEE International Conference on Robotics and Automation (ICRA)

Research Techniques and Relevant Skills

Computer Languages: Python, C++, C, MATLAB/Simulink, PHP

Sofware Skill: PyTorch, Linux, LaTEX, ROS, Gazebo, MoveIt, Chai3D, SOFA, OpenCV, Open3D, OSQP etc..

Hardware Experiences: da Vinci Reseach Kit (DVRK), 7-DOF Baxter Robotic Arm, KUKA LWR 4+, NDI Electromagnetic Sensor, Phantom Omni, Omega.3 & Sigma.7 (Force Dimension), Novint Falcon, MAXON Motors, EPOS Drivers, Aurora, SICK Laser Range-finder, IMU sensors, etc..

Languages

Chinese: Native
English: Advanced
French: Intermediate B1
Italian: Beginner

Media Publicity