Fangxun (Billy) ZHONG

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Brief Introduction

Fangxun Zhong received the Ph.D. degree at Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong, China, in 2021, supervised by Prof. Yun-Hui Liu. His research interest includes **robot autonomy in surgery**, **robot control in complex environment**, **medical robotics**, and **learning-driven perception**. He has published 26 papers in refereed journals and conferences, including first-author papers in **IJRR**, **T-RO**, **RA-L**, ICRA, IROS, etc. Dr. Zhong serves as a technical reviewer for journals including IEEE T-RO, RA-L, T-ASE, etc., and was a technical program committee member in IEEE RCAR 2021. He has participated in several Hong Kong government funded projects, including one RGC-TRS project, two RGC-GRF projects, two ITF projects, and one Shenzhen local project.

Dr. Zhong is currently the assistant director of The CUHK Shenzhen Innovation and Technology Research Institute (Futian) and is the acting PI for the project "Shenzhen-Hong Kong Research Center for Medical Robotics". He is also the research leader of medical robotics team at CUHK T Stone Robotics Institute.

Working Experience

2021.05 - 2023.04	Postdoctoral Fellow, Hong Kong Centre For Logistics Robotics, HKSAR.
2023.04 - Now	Postdoctoral Fellow, T Stone Robotics Institute, CUHK, HKSAR.

Education

2015.08 - 2021.03	Ph.D. Mechanical and Automation Engineering, The Chinese University of Hong Kong, HKSAR
2014.08 - 2015.07	M.Sc. Mechanical and Automation Engineering, The Chinese University of Hong Kong, HKSAR
2010.08 - 2014.07	B.Eng. Automation, Beijing Institute of Technology, Beijing

Publications

Journals

- **F. Zhong** et al. "Robot-Target Active Safe Interaction Using A State Convolution Controller", *IEEE Transactions on Robotics*. **(Working Paper)**
- **F. Zhong** et al. "An Interaction-Reactive Framework for Robot Manipulation of Soft Objects with Unknown Heterogeneous Deformation", *IEEE Transactions on Robotics*. **(Under Review)**
- **F. Zhong**, B. Li, W. Chen, Y. Liu. "Robot-Camera Calibration in Tightly Constrained Environment Using Interactive Perception", *IEEE Transactions on Robotics*, p1-19, 2023. **(Accepted)**
- **F. Zhong**, Y. Liu. "Integrated Planning and Control of Robotic Surgical Instruments for Task Autonomy". *The International Journal of Robotics Research*, 42(7), 504-536, 2023.
- **F. Zhong**, Z. Wang, W. Chen, K. He, Y. Wang, Y. Liu. "Hand-Eye Calibration of Robotic Surgical Instrument for Autonomous Surgery Using Interactive Manipulation", *IEEE Robotics and Automation Letters*, 2(3), 2020. **(With ICRA)**
- **F. Zhong**, P. Li, J. Shi, Z. Wang, J. Wu, JYK. Chan, N. Leung, I. Leung, MCF. Tong, Y. Liu. "Foot-controlled Robot-Enable EnDOscope Manipulator (FREEDOM) for Sinus Surgery : Design, Control and Evaluation", *IEEE Transactions on Biomedical Engineering*, 67(6), 1530-1541, 2020. **(Featured article of the issue)**
- **F. Zhong**, Y. Wang, Z. Wang, Y. Liu. "Dual-Arm Robotic Needle Insertion With Active Tissue Deformation for Autonomous Suturing", *IEEE Robotics and Automation Letters*, 4(3), 2669-2676, 2019. **(With IROS)**
- **F. Zhong**, Y. Liu. "Image-Based Pose Reconstruction of Surgical Needle In Robot-Assisted Laparoscopic Suturing", *Chinese Journal of Electronics*, 2018, 27(3), 476-482.

- B. Yang, C. Sui, **F. Zhong**, Y. Liu. "Modal-graph 3D shape servoing of deformable objects with raw point clouds". *The International Journal of Robotics Research*, 2023. **(Accepted)**
- B. Yang, B. Lu, W. Chen, **F. Zhong**, Y. Liu. "Model-Free 3D Shape Control of Deformable Objects Using Novel Features Based on Modal Analysis". *IEEE Transactions on Robotics*, 2023.
- J. Wu, T. Wang, H. Guo, Y. Wang, D. Guo, B. Lu, Z Wang, **F. Zhong**, H. Wang, J. Yuan, Y li, T Cheung, Y Wang, Y. Liu. "Design, Control, and Experiments of A Novel Robotic Uterine Manipulator with the Motorized 3-DoF Manipulation Rod", *IEEE Transactions on Biomedical Engineering*, 2023.
- J Wu, W Chen, D Guo, G Ma, Z Wang, Y He, **F Zhong**, B. Lu, Y. Wang, T. Cheung, Y. Liu. "Robot-Enabled Uterus Manipulator for Laparoscopic Hysterectomy With Soft RCM Constraints : Design, Control, and Evaluation", *IEEE Transactions on Medical Robotics and Bionics*, 4(3), 656-666, 2023.
- B. Li, B. Lu, Z. Wang, **F. Zhong**, Q. Dou, Y. Liu. "Learning laparoscope actions via video features for proactive robotic field-of-view ", *IEEE Robotics and Automation Letters*, 7(3), 6653-6660, 2022.
- S. Miao, Z. Jiang, J. Luo, **F. Zhong**, H. Wei, X. Sun, X. Jiang, M. Jiang, Y. Liu. "A Robotic System with Embedded Open Microfluidic Chip for Automatic Embryo Vitrification", *IEEE Transactions on Biomedical Engineering*, 69(12), 3562-3571, 2022.
- A. Ghalamzan, K. Nazari, H. Hashempour and **F. Zhong**. "Deep-LfD : Deep robot learning from demonstrations". *Software Impacts*, 9, 100087. 2021.
- W. Chen, J. Zhou, S. Cheng, Y. Lu, **F. Zhong**, Y. Gao, Y. Wang, L. Xue, C. Tong, Y. liu. "Tele-operated oropharyngeal swab (TOOS) robot enabled by TSS soft hand for safe and effective sampling", *IEEE Transactions on Medical Robotics and Bionics*, 3(4), 1040-1053,2021.
- M. Yu, H. Zhong, **F. Zhong**, X. Li. "Adaptive Control for Robotic Manipulation of Deformable Linear Objects with Offline and Online Learning of Unknown Models". *arXiv preprint* : 2107.00194, 2021.
- Z. Wang, S. C. Lee, **F. Zhong**, D. Navarro-Alarcon, Y. Liu, A. Deguet, P. Kazanzides, R. H. Taylor. "Image Based Trajectory Tracking of 4-DoF Laparoscopic Instruments Using a Rotation Distinguishing Marker", *IEEE Robotics and Automation Letters*, 2(3), 1586-1592, 2017.
- D. Navarro-Alarcon, H. M. Yip, Z. Wang, Y. Liu, **F. Zhong**, T. Zhang, P. Li. "Automatic 3D Manipulation of Soft Objects by Robotic Arms with Adaptive Deformation Model", *IEEE Transactions on Robotics*, 32(2), 429-441 2016.

Conferences

- J. Guo, **F. Zhong**, R. Xiong, Y. Liu, Y Wang, Y. Liao. "A visual navigation perspective for category-level object pose estimation", *ECCV*, p123-141, 2022.
- R. Wei, B. Li, H. Mo, **F. Zhong**, Y. Long, Q. Dou, Y. Liu. "Distilled Visual and Robot Kinematics Embeddings for Metric Depth Estimation in Monocular Scene Reconstruction", *IEEE/RSJ IROS*, p8022-8027, 2022.
- Z. Wang, B. Lu, Y. Long, **F. Zhong**, T. Cheung, Q. Dou, Y. Liu. "AutoLap : A New Dataset with Integrated Multi-Tasks towards Image-Guided Surgical Automation in Laparoscopic Hysterectomy", *MICCAI*, p486-496, 2022.
- **F. Zhong**, D. Navarro-Alarcon, Z. Wang, Y. Liu, T. Zhang, H. M. Yip. "Adaptive 3D Pose Computation of Suturing Needle Using Constraints From Static Monocular Image Feedback", *IEEE/RSJ IROS*, 2016, 5521-5526.
- D. Navarro-Alarcon, Z. Wang, H.M. Yip, Y.H. Liu, **F. Zhong**, T. Zhang. "Robust Image-based Computation of the 3D Position of Laparoscopic Instruments and its Application to Image-guided Manipulation", *IEEE ICRA*, 2016, 4115-4121.

Patents

- **F. Zhong**, Y. Liu. "A method for fast and autonomous robot-camera calibration", China National Invention Patent, 2023. **(Filed)**
- Y Liu, C. F. Tong, **F. Zhong**, Z Wang, H.M. Yip. "Endoscope Manipulator and Method for Controlling the Same", *U.S. Patent*. 16/533,866, 2020. **(Drafting Inventor)**

Projects

KCZYB
2021 - Now

Shenzhen - Hong Kong Research Centre for Medical Robotics (50M RMB)

- Role : **Acting Director**
- Duty : Lab design, research deliverables management, review, etc.
- Project Outline : Development of hardware (surgical robot prototype and its clinical study) and software (intelligent robot sensing and actuation system)

MRC - LCSR
2020 - Now

Image-based Automation and Assistance in Robotic Surgery

- Role : **Joint Coordinator**
- Duty : Joint coordination between CUHK and Johns Hopkins University
- Project Outline : Image-guided robot autonomy in surgical applications

RGC TRS '18
2018 - 2023

Image-Guided Robotic Surgery (∼49M HKD)

- Role : **Project Acting Leader**
- Duty : Leader of research team in routine progress management
- Project Outline : Design and validation of surgical robots and AI-based recognition algorithms for medical images

ITF '15
2015 - 2018

A New Robot Assisting Nasal Surgical Procedures with Natural Interface (4.5M HKD)

- Role : **Project Acting Leader**
- Duty : In charge of developing electrical system, software and interface part of the robot, and conducting clinical study
- Project Outline : Design of a sinus surgery assistive robot for intra-operative endoscope manipulation and its clinical trials

RGC CRF '13
2014 - 2016

Assistive Surgical Robots (∼7.0M HKD)

- Role : **Participant**
- Duty : Assisting mechanical and electrical testing for the robot prototype and developed data collection framework for clinical study
- Project Outline : Design of surgical robot prototypes and validate their applicability through cadaver and clinical study of minimally-invasive surgery

Research Activities

Technical Reviewer Journals : IJRR, IEEE T-RO, T-BME, T-MRB, RA-L, RA-M, Applied Science, etc.
Conferences : IEEE/RSJ IROS, IEEE ICRA, CASE, BioRob, IEEE/ASME AIM, etc.

Pres & Talks

2020.11 - **Invited Speaker**, SIGS Distinguished Lecture Talk
2021.12 - **Seminar Presenter**, Department of Automation, Tsinghua University
2022.11 - **Invited Speaker**, Shenzhen-Hong Kong Forum for Translational Medical Devices and Systems
2023.03 - **Presenter**, plaque unveiling ceremony for CUHK Hong Kong-Shenzhen Innovation and Technology Research Institute (Futian)
2023.04 - **Seminar Presenter**, Shenzhen Nanshan People's Hospital
2023.06 - **Invited Speaker**, Internation Conference of Digital Medical Innovation & Application Development
2023.07 - **Seminar Presenter**, The Third Affiliated Hospital, Sun Yat-Sen University

Awards

2017.08 Excellent Tutor Award Dept. MAE, CUHK
2015.11 M.Sc. Dean's List Dept. MAE, CUHK