Jiewen Lai, Ph.D.

Research Assistant Professor, Department of Electronic Engineering The Chinese University of Hong Kong

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Research Interests

Continuum Robots, Soft Robotics, Mechatronics, Medical Robots, Robot Control, Robophysics, Robot Perception, Machine Intelligence

Education

The Hong Kong Polytechnic University, Hong Kong

2017-2022

Ph.D. in Mechanical Engineering, Faculty of Engineering

M.Phil. in Mechanical Engineering (Transfer to the PhD program in 2018)

Dissertation: Development of A Soft Continuum Robot System for Surgical Blood Suction

Advisors: Ir. Dr. Henry K. Chu, Prof. Li Cheng (FRSC, FCAE, FASC, FHKIE, FHKIOA, FIMechE)

The Chinese University of Hong Kong, Hong Kong

2016-2017

M.Sc. in Mechanical & Automation Engineering, Faculty of Engineering

Advisors: Prof. Yun-hui Liu (FIEEE, FHKIE)

Wuhan University of Science and Technology, Wuhan, China

2012 - 2016

B.Eng. in Metallurgical Engineering, School of Materials and Metallurgy

Academic Appointment

The Chinese University of Hong Kong, Hong Kong

09/2023-Present

Research Assistant Professor, Department of Electronic Engineering, Faculty of Engineering CUHK Research Committee Research Assistant Professorship Scheme

CUHK Shenzhen Research Institute, Shenzhen, China

03/2024-Present

Associate Research Fellow (副研究員), by Courtesy

The Chinese University of Hong Kong, Hong Kong

04/2022 - 06/2023

Postdoctoral Fellow, Medical Mechatronics Laboratory

Advisor: Prof. Hongliang Ren (SrMIEEE)

Professional Membership

Senior Member, Chinese Mechanical Engineering Society (CMES)

Member, Chinese Association of Automation (CAA)

Member, IEEE, & IEEE Robotics and Automation Society (RAS)

Member, IEEE Robotics and Automation Technical Committee on Soft Robotics

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Selected Publications

- J. Lai, B. Lu, K. Huang, and H. K. Chu*, "Gesture-based steering framework for redundant soft robots," *IEEE/ASME Trans. Mechatron.*, 2024
- J. Lai, T.-A. Ren, W. Yue, S. Su, J. Y. K. Chan, and H. Ren*, "Sim-to-real transfer of soft robotic navigation strategies that learns from the virtual eye-in-hand vision," *IEEE Trans. Ind. Inform.*, vol. 20, no. 2, pp. 2365–2377, 2024
- J. Lai, B. Lu, Q. Zhao, and H. K. Chu*, "Constrained motion planning of a cable-driven soft robot with compressible curvature modeling," *IEEE Robot. Autom. Lett.*, vol. 7, no. 2, pp. 4813–4820, 2022
- J. Lai, K. Huang, B. Lu, Q. Zhao, and H. K. Chu*, "Verticalized-tip trajectory tracking of a 3d-printable soft continuum robot: Enabling surgical blood suction automation," *IEEE/ASME Trans. Mechatron.*, vol. 27, no. 3, pp. 1545–1556, 2021
- J. Lai, B. Lu, and H. K. Chu*, "Variable-stiffness control of a dual-segment soft robot using depth vision," *IEEE/ASME Trans. Mechatron.*, vol. 27, no. 2, pp. 1034–1045, 2021

Hornors and Awards

• IdeaBooster Fund Award, Venture Acceleration Unit, CUHK	2023
• Best Poster Award, IEEE ICRA Workshop on Surgical Robots, London, UK	2023
• Dr. Barbara Kwok Young Postdoctoral Researcher Travel Grants Award, CUHK	2023
• Best Paper Finalist Award, (Top 10/480+), IEEE ROBIO 2019	2019
• Outstanding Undergraduate Award, (5/250+), WUST	2016

Research Grants

Young Scientists Fund, National Natural Science Foundation of China (NSFC) 01/2025–12/2027 Coupled Tendon-driven Continuum Robots for Robot-assisted Minimally Invasive Surgery CNY 300,000, PI

Acceptance rate: 15.54% out of 149,489 applicants

Research Direct Grant, Faculty of Engineering, CUHK

01/2024 - 11/2025

Deployable Micro-needles on Flexible Endoscopic Robots for Transluminal Submucosal Drug Delivery HKD $150,000,\,\mathbf{PI}$

IdeaBooster Fund Award, Venture Acceleration Unit, CUHK

06/2023 - 12/2024

Miniature Notched Tubular Soft Robots for Multimodal Endoscopy HKD 100,000, ${f PI}$

Selected Talks

- Invited Speaker, IEEE ICRA 2024 Workshop: Continuum and Soft Robotics for Medical Applications with *Rising Stars on the Stage*, Yokohama, Japan, 05/2024
- Seminar (Job Talk), "Steerable Soft-Bodied Robots for Safer Robot-Assisted Minimally Invasive Surgery", Department of Electronic Engineering, CUHK, Hong Kong, 05/2023
- Conference Presentation, PPS-38 Special Symposium on Soft Robotics, "Sim2Real Transfer of Soft Robotic Navigation Strategies That Learns from Visual Perception", St. Gallen, Switzerland, 05/2023
- Conference Presentation, IEEE/ASME AIM 2020, "Toward vision-based adaptive configuring of a bidirectional two-segment soft continuum manipulator" Boston, USA, 07/2020
- Conference Presentation, IEEE ROBIO 2019, "A learning-based inverse kinematics solver for a multi-segment continuum robot in robot-independent mapping" Dali, China, 12/2019
- Workshop Presentation, 9th EMAEW, "Collision-Free Approach for Multi-Segment Continuum Robots by Self-Motion Control in SE(2)", Korea University, Seoul, Korea, 05/2019

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Professional Services

Editorship

- Associate Editor, 2025 IEEE International Conference on Robotics and Automation
- Associate Editor, 2024 IEEE International Conference on Robotics and Automation
- Guest Editor, Special Issue: Multimodal Deployable Flexible Robots in Medical Domains, Actuators

Chair

• Organizer & Chair, ICRA 2024 Workshop on 2nd Continuum, Compliant, Cooperative, Cognitive Surgical Robotic Systems in the Embodied AI Era (C4SR+), Yokohama, Japan, 2024

Journal Reviewer

- IEEE/ASME Transactions on Mechatronics
- IEEE Robotics and Automation Letters
- IEEE Transactions on Industrial Informatics
- IEEE Transactions on Automation Science and Engineering
- IEEE Access
- Journal of Field Robotics
- Nonlinear Dynamics
- Biomimetic Intelligence and Robotics
- Sensors
- Machines

Conference Reviewer

ICSR'24, IROS'24, RCAR'24, ICRA'24, RoboSoft'23, ARM'22, ICRA'22, ICRA'21, ICAR'21, AIM'20, CASE'20, IROS'19, ROBIO'19

Thesis Examiner

• Internal Examiner, PhD thesis, Dr. Ang Li, PhD in Electronic Engineering, CUHK, 2024

Departmental/University Services

Committee Member, Undergraduate Admission Committee, Dept Electronic Engineering, CUHK 2024
Committee Member, Staff-Student Consultative Committee, Dept Electronic Engineering, CUHK 2024
Committee Member, Teaching Lab/Project Panel, Dept Electronic Engineering, CUHK 2024

Teaching

ELEG4701 Intelligent Interactive Robot Practice, Course Teacher, CUHK

2024 Spring (22 students) / 2024 Fall (31 students)

Three-credit undergraduate major elective course about ROS, Simulation, Robot Arms, Mobile Robots, Visual sensors, Manipulation, Lidar Navigation

ELEG4998/9 Final Year Project I/II, Supervisor, CUHK

2024–25 (2 students)

Final year project for EE undergraduate students

ELEG5802 MSc Research & Development Project, Supervisor, CUHK

2023–24 (2 students) / 2024–25 (5 students)

Whole year research project for EE MSc students

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List of Publications

Book Chapter

[1] <u>J. Lai</u>, B. Lu, and H. Ren, "Chapter 4 - kinematic concepts in minimally invasive surgical flexible robotic manipulators: State of the art," in *Handbook of Robotic Surgery*, S. de Cássio Zequi and H. Ren, Eds., Academic Press, 2025, pp. 27–41, ISBN: 978-0-443-13271-1.

Peer-Reviewed Journal Articles

- [2] K. Huang, <u>J. Lai</u>, H. Ren, C. Wu, X. Cheng, and H. K. Chu*, "Large-scale selective micropatterning with robotics ndep tweezers and hydrogel encapsulation," *ACS Applied Materials & Interfaces*, 2024, (Impact Factor: 8.3).
- [3] L. Zhao, G. Tan, <u>J. Lai</u>, C. M. Lim, W. K. Wong, H. Ren, and K. Li*, "Visual feedback predicting framework for ultrasound-assisted percutaneous kidney biopsy in 5g remote surgery," *IEEE Transactions on Mobile Computing*, 2024, (Impact Factor: 7.9).
- [4] Z. Zhang, A. Zhang, J. Lai, H. Ren, R. Song, Y. Li, M. Q.-H. Meng, and Z. Min*, "Ghmm: Learning generative hybrid mixture models for generalized point set registration in computer-assisted orthopedic surgery," *IEEE Transactions on Medical Robotics and Bionics*, vol. 6, no. 3, pp. 1285–1295, 2024, (Impact Factor: 3.4).
- [5] <u>J. Lai</u>, B. Lu, K. Huang, and H. K. Chu*, "Gesture-based steering framework for redundant soft robots," *IEEE/ASME Transactions on Mechatronics*, 2024, (Impact Factor: 6.4).
- [6] Y. Yang, <u>J. Lai</u>, C. Xu, Z. He, P. Jiao, and H. Ren*, "Lightweight pneumatically elastic backbone structure with modular construction and nonlinear interaction for soft actuators," *Soft Robotics*, vol. 11, no. 1, pp. 57–69, 2024, (Impact Factor: 7.9).
- [7] <u>J. Lai</u>, T.-A. Ren, W. Yue, S. Su, J. Y. K. Chan, and H. Ren*, "Sim-to-real transfer of soft robotic navigation strategies that learns from the virtual eye-in-hand vision," *IEEE Transactions on Industrial Informatics*, vol. 20, no. 2, pp. 2365–2377, 2024, (Impact Factor: 12.3).
- [8] G. Wang, T.-A. Ren, <u>J. Lai</u>, L. Bai, and H. Ren*, "Domain adaptive sim-to-real segmentation of oropharyngeal organs," *Medical & Biological Engineering & Computing*, vol. 61, pp. 2745–2755, 2023, (Impact Factor: 3.2).
- [9] M. S. Xavier, C. D. Tawk, A. Zolfagharian, J. Pinskier, D. Howard, T. Young, <u>J. Lai</u>, S. M. Harrison, Y. K. Yong, M. Bodaghi, et al., "Soft pneumatic actuators: A review of design, fabrication, modeling, sensing, control and applications," *IEEE Access*, vol. 10, pp. 59442–59485, 2022, (Impact Factor: 3.9).
- [10] Q. Zhao, <u>J. Lai</u>, X. Hu, and H. K. Chu*, "Dual-segment continuum robot with continuous rotational motion along the deformable backbone," *IEEE/ASME Transactions on Mechatronics*, vol. 27, no. 6, pp. 4994–5004, 2022, (Impact Factor: 6.4).
- [11] Z. Cui, W. Ma, <u>J. Lai</u>, H. K. Chu*, and Y. Guo, "Coupled multiple dynamic movement primitives generalization for deformable object manipulation," *IEEE Robotics and Automation Letters*, vol. 7, no. 2, pp. 5381–5388, 2022, (Impact Factor: 5.2).
- [12] <u>J. Lai</u>, B. Lu, Q. Zhao, and H. K. Chu*, "Constrained motion planning of a cable-driven soft robot with compressible curvature modeling," *IEEE Robotics and Automation Letters*, vol. 7, no. 2, pp. 4813– 4820, 2022, (Impact Factor: 5.2).
- [13] Q. Zhao, <u>J. Lai</u>, and H. K. Chu*, "Reconstructing external force on the circumferential body of continuum robot with embedded proprioceptive sensors," *IEEE Transactions on Industrial Electronics*, vol. 69, no. 12, pp. 13111–13120, 2021, (Impact Factor: 7.7).
- [14] Q. Zhao, <u>J. Lai</u>, K. Huang, X. Hu, and H. K. Chu*, "Shape estimation and control of a soft continuum robot under external payloads," *IEEE/ASME Transactions on Mechatronics*, vol. 27, no. 5, pp. 2511– 2522, 2021, (Impact Factor: 6.4).

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- [15] <u>J. Lai</u>, K. Huang, B. Lu, Q. Zhao, and H. K. Chu*, "Verticalized-tip trajectory tracking of a 3d-printable soft continuum robot: Enabling surgical blood suction automation," *IEEE/ASME Transactions on Mechatronics*, vol. 27, no. 3, pp. 1545–1556, 2021, (Impact Factor: 6.4).
- [16] <u>J. Lai</u>, B. Lu, and H. K. Chu*, "Variable-stiffness control of a dual-segment soft robot using depth vision," *IEEE/ASME Transactions on Mechatronics*, vol. 27, no. 2, pp. 1034–1045, 2021, (Impact Factor: 6.4).
- [17] K. Huang, Z. Cui, <u>J. Lai</u>, B. Lu, and H. K. Chu*, "Optimization of a single-particle micropatterning system with robotic ndep-tweezers," *IEEE Transactions on Automation Science and Engineering*, vol. 19, no. 2, pp. 818–832, 2021, (Impact Factor: 5.6).
- [18] K. Huang, I. A. Ajamieh, Z. Cui, <u>J. Lai</u>, J. K. Mills, and H. K. Chu*, "Automated embryo manipulation and rotation via robotic ndep-tweezers," *IEEE Transactions on Biomedical Engineering*, vol. 68, no. 7, pp. 2152–2163, 2020, (Impact Factor: 4.6).
- [19] B. Lu, X. Yu, <u>J. Lai</u>, K. Huang, K. C. Chan, and H. K. Chu*, "A learning approach for suture thread detection with feature enhancement and segmentation for 3-d shape reconstruction," *IEEE Transactions on Automation Science and Engineering*, vol. 17, no. 2, pp. 858–870, 2019, (Impact Factor: 5.6).
- [20] B. Lu, H. K. Chu*, K. Huang, and <u>J. Lai</u>, "Surgical suture thread detection and 3-d reconstruction using a model-free approach in a calibrated stereo visual system," *IEEE/ASME Transactions on Mechatronics*, vol. 25, no. 2, pp. 792–803, 2019, (Impact Factor: 6.4).
- [21] K. Huang, B. Lu, <u>J. Lai</u>, and H. K. H. Chu*, "Microchip system for patterning cells on different substrates via negative dielectrophoresis," *IEEE Transactions on Biomedical Circuits and Systems*, vol. 13, no. 5, pp. 1063–1074, 2019, (Impact Factor: 5.1).

Peer-Reviewed Conference Papers

- [22] T.-A. Ren, W. Liu, T. Zhang, L. Zhao, H. Ren*, and <u>J. Lai*</u>, "Three-dimensional morphological reconstruction of millimeter-scale soft continuum robots based on dual stereo vision," in 2024 IEEE International Conference on Robotics and Biomimetics (ROBIO), 2024.
- [23] T. Zhang, S. Kadir, H. Geng, H. Pan, A. Wang, <u>J. Lai*</u>, and H. Ren*, "Lightweight handheld detachable compliant robotic laryngoscope with lightweight intelligent visual guidance," in 2024 IEEE International Conference on Robotics and Biomimetics (ROBIO), 2024.
- [24] C.-K. Ng, H. Gao, T.-A. Ren, <u>J. Lai</u>, and H. Ren*, "Navigation of tendon-driven flexible robotic endoscope through deep reinforcement learning," in 2024 IEEE International Conference on Advanced Robotics and Its Social Impacts (ARSO), 2024, pp. 134–139.
- [25] J. Lai, K. Huang, B. Lu, and H. K. Chu*, "Toward vision-based adaptive configuring of a bidirectional two-segment soft continuum manipulator," in 2020 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM), 2020, pp. 934–939.
- [26] K. Huang, Z. Cui, I. A. Ajamieh, <u>J. Lai</u>, J. K. Mills, and H. K. Chu*, "Automated single-microparticle patterning system for micro-analytics," in 2020 IEEE 16th International Conference on Automation Science and Engineering (CASE), 2020, pp. 390–396.
- [27] <u>J. Lai</u>, K. Huang, and H. K. Chu*, "A learning-based inverse kinematics solver for a multi-segment continuum robot in robot-independent mapping," in 2019 IEEE International Conference on Robotics and Biomimetics (ROBIO), 2019, pp. 576–582. (Best Paper Finalist Award).
- [28] K. Huang, H. K. Chu*, B. Lu, J. Lai, and L. Cheng, "Automated cell patterning system with a microchip using dielectrophoresis," in 2019 IEEE International Conference on Robotics and Automation (ICRA), 2019, pp. 634–639.

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