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

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

Honors 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, **PI**

IdeaBooster Fund Award, Venture Acceleration Unit, CUHK 06/2023–12/2024
Miniature Notched Tubular Soft Robots for Multimodal Endoscopy
HKD 100,000, **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

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

List of Publications

Book Chapter

[1] **J. Lai**, 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, **J. Lai**, 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, **J. Lai**, 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] **J. Lai**, 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, **J. Lai**, 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] **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 Transactions on Industrial Informatics*, vol. 20, no. 2, pp. 2365–2377, 2024, (Impact Factor: 12.3).

[8] G. Wang, T.-A. Ren, **J. Lai**, 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, **J. Lai**, 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. 59 442–59 485, 2022, (Impact Factor: 3.9).

[10] Q. Zhao, **J. Lai**, 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, **J. Lai**, 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] **J. Lai**, 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, **J. Lai**, 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. 13 111–13 120, 2021, (Impact Factor: 7.7).

[14] Q. Zhao, **J. Lai**, 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).

[15] **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 Transactions on Mechatronics*, vol. 27, no. 3, pp. 1545–1556, 2021, (Impact Factor: 6.4).

[16] **J. Lai**, 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, **J. Lai**, 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, **J. Lai**, 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, **J. Lai**, 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 **J. Lai**, "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, **J. Lai**, 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 **J. Lai***, "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, **J. Lai***, 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, **J. Lai**, 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, **J. Lai**, 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] **J. Lai**, 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.