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*Jiewen Lai*

# Jiewen Lai

## Academic Appointment

08/2023–now **Research Assistant Professor, Electronic Engineering**, The Chinese Univ. of Hong Kong.
Supported by CUHK Research Committee Research Assistant Professorship Scheme

06/2024–now **Associate Researcher (副研究員)**, CUHK Shenzhen Research Institute.

## Research Interests

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

## Education and Training

04/2022–06/2023 **Postdoctoral Fellow, Electronic Engineering (Medical Mechatronics)**, CUHK.
Advisors: Prof. Hongliang Ren

08/2018–02/2022 **PhD, Mechanical Engineering**, The Hong Kong Polytechnic University (PolyU).
Supervisors: Ir. Dr. Henry Kar Hang Chu & Prof. Li Cheng
Dissertation: Development of A Soft Continuum Robot System for Surgical Blood Suction
Committee: King W. Lai (City Univ of Hong Kong), Xueping Zhang (Aarhus Univ), Wai On Wong (Chair), Li Cheng (Co-supervisor), Henry K. Chu (Supervisor)

2017–2018 **MPhil (Transfer to PhD program), Mechanical Engineering**, PolyU.

2016–2017 **MSc, Mechanical & Automation Engineering**, CUHK.
Advisor: Prof. Yun-hui Liu
Final Project: Design and Modeling of A Uterine Robotic Manipulator

2012–2016 **BEng, Metallurgical Engineering**, Wuhan Univ. of Science & Technology.

## Selected Awards

2023 **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.

2019 **Best Paper Finalist Award**, (Top 10/480+), IEEE ROBIO 2019, Dali, China.

2016 **Outstanding Undergraduate Award**, (5/250+), WUST.

## Selected Publications

### Journal Articles

T-II **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. (Q1, Impact Factor: 12.3).

T-MECH **J. Lai**, B. Lu, K. Huang, and H. K. Chu*, "Gesture-based Steering Framework for Redundant Soft Robots," *IEEE/ASME Transactions on Mechatronics*, 2024. (Q1, Impact Factor: 6.4).

RA-L **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. (Q1, Impact Factor: 5.2).

T-MECH **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. (Q1, Impact Factor: 6.4).

T-MECH **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. (Q1, Impact Factor: 6.4).

### Conference Papars

IEEE AIM'20 **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)*, pp. 934–939, 2020.

IEEE ROBIO'19 **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)*, pp. 576–582, 2019. (Best Paper Finalist Award).

## Research Grants

CUHK-FDG 2024–2025 **Faculty Direct Grant**, Faculty of Engineering, CUHK.
- Deployable Micro-needles on Flexible Endoscopic Robots for Transluminal Submucosal Drug Delivery
- HKD 150,000, PI

CUHK-IDBF 2023–2024 **IdeaBooster Fund Award**, Venture Acceleration Unit, CUHK.
- Miniature Notched Tubular Soft Robots for Multimodal Endoscopy
- HKD 100,000, PI

## Selected Talks

05/2024 **Invited Speaker**, IEEE ICRA 2024 Workshop: Continuum and Soft Robotics for Medical Applications with **Rising Stars on the Stage**, Yokohama, Japan.

05/2023 **Job Talk**, on **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.

07/2020 **Conference Presentation**, IEEE/ASME AIM 2020, **Toward vision-based adaptive configuring of a bidirectional two-segment soft continuum manipulator**, Boston, USA.

12/2019 **Conference Presentation**, IEEE ROBIO 2019, **A learning-based inverse kinematics solver for a multi-segment continuum robot in robot-independent mapping**, Dali, China.

05/2019 **Workshop Presentation**, 9th EMAEW, **Collision-Free Approach for Multi-Segment Continuum Robots by Self-Motion Control in SE(2)**, Korea University, Seoul, Korea.

## Professional Services

- **Associate Editor**, IEEE ICRA 2024
- **Co-Chair**, ICRA 2024 Workshop on C4SR$^{+}$: Continuum, Compliant, Cooperative, Cognitive Surgical Robotic Systems in the Embodied AI Era
- **Guest Editor**, *Actuators*
- **Regular Reviewer**, *IEEE/ASME Transactions on Mechatronics*
- **Regular Reviewer**, *IEEE Robotics and Automation Letters*
- **Reviewer**, *IEEE Transactions on Industrial Informatics*
- **Reviewer**, *Nonlinear Dynamics*
- **Reviewer**, *Biomimetic Intelligence and Robotics*
- **Reviewer**, *Sensors*
- **Conference Reviewer**, IROS'24, RCAR'24, ICRA'24, RoboSoft'23, ARM'22, ICRA'22, ICRA'21, ICAR'21, AIM'20, CASE'20, IROS'19, ROBIO'19

## Teaching

ELEG4701 **Intelligent Interactive Robot Practice**, Course Teacher, CUHK.
- Spring 2024; Fall 2024
- Three-credit undergraduate major elective course about ROS, Simulation, Robot Arms, Mobile Robots, Visual sensors, Manipulation, Lidar Navigation

## Book Chapter

[1] **J. Lai**, B. Lu, and H. Ren, "Kinematics 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., Elsevier Press, 2024, ch. 4.

## Peer-Reviewed Journal Articles

[2] 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) [Major Revision].

[3] **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).

[4] 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, 2024, (Impact Factor: 7.9).

[5] **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).

[6] 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).

[7] 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).

[8] 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).

[9] 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).

[10] **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).

[11] 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).

[12] 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).

[13] **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).

[14] **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).

[15] 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).

[16] 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).

[17] 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).

[18] 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).

[19] 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

[20] 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. 1–8.

[21] **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.

[22] 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.

[23] **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).

[24] 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.