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Jiewen Lai

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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

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.