Zerui Wang | Curriculum Vitae

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SUMMARY

- Solid training in robotics, mechatronics, and control theory with good publication record.
- Experience in researches related to medical robotics with emphasis on both scientific and engineering aspects.
- Efficient individual contributor, team leader, and team player.

EMPLOYMENT

Research Assistant Professor — Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong Mar. 2018 — Present

- Lead research about advanced visual servoing algorithms for deformation control;
- Lead intuitive interface development of surgical robot assistants from UI Software and Visual Servoing Control Algorithms;
- Lead development of surgical robot systems from mechatronics, control algorithms, and software.

Post-Doctoral Fellow — Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong Sep. 2017 — Feb. 2018

- Conducted researches on vision-based deformable object manipulation, dissection, and suturing.

EDUCATION

The Chinese Univ. of Hong Kong — Ph.D. Degree in Mechanical & Automation Engineering Sep. 2013 — Sep. 2017

- **Supervisor:** Prof. Yun-Hui Liu
- **Overall GPA:** 3.97/4.
- **Skills:** C++, Python, bash, Matlab, Linux, LaTex, SolidWorks.
- Designed and fabricated a compliant safe joint which has multiple states. The joint works as a normal rigid joint when the working load is smaller than a predefined threshold and becomes compliant when the working load exceeds the threshold. The design was patented in US.
- Proposed a new method to fully control complete 4-image-DoF manipulation of laparoscopic instruments (with RCM mechanism) based on the geometric features of a designed marker in a 2D image.
- Developed a vision-based calibration method for dual remote center-of-motion (RCM) based robot arms. The method does not require any external tracking sensors and directly uses images captured by the endoscopic camera and the robot encoder readings as calibration data.
- Proposed a generic autonomous optimization-based framework for manipulating unknown deformable objects in a constrained environment with unexpected disturbances.

Johns Hopkins University — Visiting Student in Computer Science Jan. 2016 — Apr. 2017

- **Supervisors:** Prof. Russell H. Taylor, Prof. Peter Kazanzides
- Proposed a semi-autonomous clinician-in-the-loop strategy to perform the laparoscopic cryoablation of small kidney tumors.
- Proposed a method of controlling a continuum manipulator in free or obstructed environments with no prior knowledge about the deformation behavior of the continuum manipulator and the stiffness and geometry of the interacting obstructed environment.
- Contributed to dvrk-ros and cisst-saw software environment in terms of trajectory generator, Matlab wrapper, joint torque control interface, etc.

Beihang University — B.Eng. Degree in Quality and Reliability Engineering Sep. 2009 — Jun. 2013

- **Overall GPA:** 3.84/4 (90.04/100), rank 1st in my school.

AWARDS AND HONURS

- Best Innovation Prize in Surgical Robot Challenge of Hamlyn Symposium — Jul. 2017
- Overseas Research Attachment Programme Scholarship — Oct. 2015
- Reaching Out Award (Government Scholarship) — Jun. 2015
- Hong Kong PhD Fellowship (Government Scholarship) — Aug. 2013
- Champion of Innovative Underwater Robot Design RoboCup Open (China) — Nov. 2012
- The 2nd-Prize in National University Mechanical Innovation Competition (10%) — Jul. 2012
- The 2nd-Prize in National Undergraduate Physics Competition (7.5%) — Dec. 2010
- National Scholarship for University Students (2.6%) — Nov. 2010
- Excellent Students Awards of Beijing (1.1%) — Nov. 2011
- Elite Student of Beihang University (3%) — Nov. 2011
- Outstanding Student Award, Yang Weimin Special Scholarship (0.8%) — Mar. 2012
- The 2nd-Prize Scholarship of Academic Contest (3%) — Dec. 2011
- The 1st-Prize Scholarship of Science and Engineering Contest (7%) — 2010-2012
- The 1st-Prize Scholarship of Academic Performance (3%) — 2010-2012

PUBLICATIONS

* denotes co-first authorship; † denotes corresponding authorship.

Journal

1. Wu, J., **Wang, Z.**†, Chen, W., Wang, Y., and Liu, Y.-H., *"Design and Test a Modular Hollow Shaft Compliant Unit with Adjustable Stiffness,"* IEEE Robotics and Automation Letters (RA-L), under review, 2019.
2. Zhong, F., **Wang, Z.**†, Wang, Y., and Liu, Y.-H., *"Collaborative Needle Insertion With Active Tissue Deformation Control,"* IEEE Robotics and Automation Letters (RA-L), under review, 2019.
3. Yip, H.M., **Wang, Z.**, Navarro-Alarcon, D., Li, P., Cheung, T.H., Greiffenhagen, C., and Liu, Y.-H., *"A Collaborative Robotic Uterine Positioning System for Laparoscopic Hysterectomy: Design, Modeling and Experiments,"* International Journal of Medical Robotics and Computer Assisted Surgery, under review, 2018.
4. Sui, C., Wu, J., Ma, G., **Wang, Z.**†, and Liu, Y.-H., *"A Real-time 3D Laparoscopic Imaging System: Design, Method and Validation,"* IEEE Transactions on Medical Imaging (T-MI), major revision, 2018.
5. Alambeigi, F.*, **Wang, Z.***, Liu, Y.-H., Taylor, R. H., and Armand, M., *"A Versatile Data-Driven Framework for Model-Independent Control of Continuum Manipulators Interacting with Obstructed Environments with Unknown Geometry and Stiffness,"* International Journal of Robotics Research (IJRR), minor revision resubmitted, 2018.
6. Alambeigi, F., **Wang, Z.**, Hegeman, R., Liu, Y.-H., and Armand, M., *"Autonomous data-driven manipulation of unknown anisotropic deformable tissues using unmodelled continuum manipulators,"* IEEE Robotics and Automation Letters (RA-L), vol. 4, no. 2, pp. 254-261, Apr. 2019.
7. Alambeigi, F.*, **Wang, Z.***, Hegeman, R., Liu, Y.-H., and Armand, M., *"A robust data-driven approach for online learning and manipulation of unmodeled 3-D heterogeneous compliant objects,"* IEEE Robotics and Automation Letters (RA-L), vol. 3, no. 4, pp. 4140-4147, Oct. 2018.
8. Alambeigi, F.*, **Wang, Z.***, Liu, Y.-H., Taylor, R. H., and Armand, M., *"Toward semi-autonomous cryoablation of kidney tumors via model-independent deformable tissue manipulation technique,"* Annals of Biomedical Engineering (ABME), vol. 46, no. 10, pp. 1650-1662, Oct. 2018.
9. **Wang, Z.**, Liu, Z., Ma, Q., Cheng, A., Liu, Y.-H., Kim, S., Deguet, A., Reiter, A., Kazanzides, P., and Taylor, R.H., *"Vision-based calibration of dual RCM-based robot arms in human-robot collaborative minimally invasive surgery,"* IEEE Robotics and Automation Letters (RA-L), vol. 3, no. 2, pp. 672-679, Apr. 2018.
10. **Wang, Z.**, Lee, S. C., Zhong, F., Navarro-Alarcon, D., Liu, Y.-H., Deguet, A., Kazanzides, P. and Taylor, R. H., *"Image-based trajectory tracking control of 4-DOF laparoscopic instruments using a rotation distinguishing marker,"* IEEE Robotics and Automation Letters (RA-L), vol. 2, no. 3, pp. 1586-1592, Mar. 2017.

11. Navarro-Alarcon, D., Yip, H. M., **Wang, Z.**, Liu, Y.-H., Zhong, F., Zhang, T. and Li, P., *"Automatic 3-D manipulation of soft objects by robotic arms with an adaptive deformation model,"* IEEE Transactions on Robotics (T-RO), vol. 32, no. 2, pp. 429 - 441, Apr. 2016.
12. **Wang, Z.**, Yip, H. M., Navarro-Alarcon, D., Li, P., Liu, Y.-H., Sun, D., Wang, H., and Cheung, T. H., *"Design of a novel compliant safe robot joint with multiple working states,"* IEEE/ASME Transactions on Mechatronics (T-MECH), vol. 21, no. 2, pp. 1193-1198, Apr. 2016.

Conference

1. Sui, C., He, K., Lyu, C., **Wang, Z.**†, and Liu, Y.-H., *"3D Surface Reconstruction Using A Two-Step Stereo Matching Method Assisted with Five Projected Patterns,"* IEEE Int. Conf. Robotics and Automation (ICRA), accepted.
2. Li, D., **Wang, Z.**†, Ouyang, B., and Liu, Y.-H., *"A Reconfigurable Variable Stiffness Manipulator by a Sliding Layer Mechanism,"* IEEE Int. Conf. Robotics and Automation (ICRA), accepted.
3. Qian, L., Deguet, A., **Wang, Z.**, Liu, Y.-H., and Kazanzides, P., *"Augmented Reality Assisted Instrument Insertion and Tool Manipulation for the First Assistant in Robotic Surgery,"* IEEE Int. Conf. Robotics and Automation (ICRA), accepted.
4. Alambeigi, F., **Wang, Z.**, Hegeman, R., Liu, Y.-H., and Armand, M., *"Autonomous Data-Driven Manipulation of Unknown Anisotropic Deformable Tissues Using Unmodelled Continuum Manipulators,"* IEEE Int. Conf. Robotics and Automation (ICRA), accepted.
5. Alambeigi, F.*, **Wang, Z.***, Hegeman, R., Liu, Y.-H., and Armand, M., *"A robust data-driven approach for online learning and manipulation of unmodeled 3-D heterogeneous compliant objects,"* IEEE/RSJ Int. Conf. Intelligent Robots and Systems (IROS), presented, 2018.
6. **Wang, Z.**, Li, X., Navarro-Alarcon, D., and Liu, Y.-H., *"A unified controller for region-reaching and deforming of soft objects,"* IEEE/RSJ Int. Conf. Intelligent Robots and Systems (IROS), pp. 472-478, 2018.
7. Sui, C., **Wang, Z.**†, and Liu, Y.-H., *"A 3D laparoscopic imaging system based on stereo-photogrammetry with random patterns,"* IEEE/RSJ Int. Conf. Intelligent Robots and Systems (IROS), pp. 1276-1282, 2018.
8. **Wang, Z.**, Liu, Z., Ma, Q., Cheng, A., Liu, Y.-H., Kim, S., Deguet, A., Reiter, A., Kazanzides, P., and Taylor, R. H., *"Vision-based calibration of dual RCM-based robot arms in human-robot collaborative minimally invasive surgery,"* IEEE/RSJ Int. Conf. Intelligent Robots and Systems (IROS), presented, 2017.
9. Alambeigi, F.*, **Wang, Z.***, Liu, Y.-H., Armand, M., and Taylor, R. H., *"Smart autonomous unknown deformable object manipulation using the da vinci research kit: from soft tissues to continuum robots manipulation,"* Hamlyn Symposium Surgical Robot Challenge, 2017. **Best Innovation Prize**
10. Zhong, F., Navarro-Alarcon, D., **Wang, Z.**, Liu, Y.-H., Zhang, T., and Yip, H. M., *"Adaptive 3D pose computation of suturing needle using constraints from static monocular image feedback,"* IEEE/RSJ Int. Conf. Intelligent Robots and Systems (IROS), pp. 5521-5526, 2016.
11. Navarro-Alarcon, D., **Wang, Z.**, Yip, H. M., Liu, Y.-H., Zhong, F., and Zhang, T., *"Robust image-based computation of the 3D position of RCM instruments and its application to image-guided manipulation,"* IEEE Int. Conf. Robotics and Automation (ICRA), pp. 4115–4121, 2016.
12. Yip, H. M., **Wang, Z.**, Navarro-Alarcon, D., Li, P., and Liu, Y.-H., *"A new robotic uterine positioner for laparoscopic hysterectomy with passive safety mechanisms: design and experiments,"* IEEE/RSJ Int. Conf. Intelligent Robots and Systems (IROS), pp. 3188–3194, 2015.
13. Navarro-Alarcon, D., Yip, H. M., **Wang, Z.**, Liu, Y.-H., Lin, W., Li, P., *"Adaptive image-based positioning of RCM mechanisms using angle and distance features,"* IEEE/RSJ Int. Conf. Intelligent Robots and Systems (IROS), pp. 5403–5409, 2015.
14. Lin, W., Navarro-Alarcon, D., Li, P., **Wang, Z.**, Yip, H. M., Liu, Y.-H., *"Modeling, design and control of an endoscope manipulator for FESS,"* IEEE/RSJ Int. Conf. Intelligent Robots and Systems (IROS), pp. 811–816, 2015.
15. **Wang, Z.**, Li, P., Navarro-Alarcon, D., Yip, H. M., Liu, Y.-H., Lin, W., and Li, L., *"Design and control of a novel multi-state compliant safe joint for robotic surgery,"* IEEE Int. Conf. Robotics and Automation (ICRA), pp. 1023-1028, 2015.
16. Navarro-Alarcon, D., **Wang, Z.**, Yip, H. M., Liu, Y.-H., Li, P., and Lin, W., *"A method to regulate the torque of flexible-joint manipulators with velocity control inputs,"* IEEE Int. Conf. Robotics and Biomimetics (ROBIO), pp. 2437–2442, 2014.
17. Yip, H. M., Li, P., Navarro-Alarcon, D., **Wang, Z.**, and Liu, Y.-H., *"A new circular-guided remote center of motion mechanism for assistive surgical robots,"* IEEE Int. Conf. Robotics and Biomimetics (ROBIO), pp. 217–222, 2014.

Patent

1. P. Li, **Z. Wang**, Y.-H. Liu. *"Compliant Safe Joint and Manufacturing Method Thereof,"* U.S. Patent, US20160298696, 2016.