SHAN LIN

Assistant Professor, School of Electrical, Computer and Energy Engineering
Arizona State University, Tempe, AZ, USA
Personal Website Google Scholar shan.lin.2@asu.edu

RESEARCH INTERESTS

My research interests lie in the integration of artificial intelligence, robotic perception, motion planning, control, and manipulation, with a primary focus on addressing challenges in unstructured, dynamic, and deformable environments to create lifesaving robotic technologies for healthcare applications.

Research Themes

- Autonomous Robotic Surgery
- Computer- and Robot-Assisted Surgery
- Artificial Intelligence
- Robotic Perception
- Surgical Scene Reconstruction and Tracking
- Medical Image Analysis
- Robotic Manipulation

EDUCATION

Ph.D. in Electrical Engineering *Advisor: Blake Hannaford*
University of Washington, Seattle, WA, USA 2017 – 2021
- Dissertation: Vision-based Surgical Instrument Segmentation and Endoscopic Sinus Surgery Skill Assessment.

M.S. in Electrical Engineering *Advisor: Robert J. Webster III*
Vanderbilt University, Nashville, TN, USA 2015 – 2017
- Thesis: Monitoring of Thermal Processes for Medical Applications Using Infrared Thermography.

B.E. in Electronic and Information Engineering
Xiamen University, Xiamen, China 2011 – 2015
- Thesis: The Analysis of Semiconductor Laser Self-mixing Interference Technology and Its Applications.

PROFESSIONAL POSITIONS

Arizona State University *Tempe, AZ, USA*
- Assistant Professor, Tenure-Track, School of Electrical, Computer and Energy Engineering 2025 –

University of California, San Diego *La Jolla, CA, USA*
• Postdoctoral Scholar-Employee, Electrical and Computer Engineering 2021 – 2024

University of Washington *Seattle, WA, USA*
• Research Associate, UW BioRobotics Lab 2017 – 2021

Harvard Medical School *Boston, MA, USA*
• Research Intern, Center for Advanced Medical Computing and Analysis 2020

Vanderbilt University *Nashville, TN, USA*
• Research Assistant, Medical Engineering and Discovery Lab 2016 – 2017

AWARDS

• Best Student Paper Award, International Symposium on Medical Robotics (ISMR) 2024.

• Pioneers of Medical Robotics Award, Data vs. Model in Medical Robotics Workshop at International Conference on Intelligent Robots and Systems (IROS) 2023. Award description: An award as part of the workshop to select two stellar doctoral/post-doctoral candidates in the field of medical robotics.

• Rising Star in EECS, Oct. 2022. Description: As part of the international workshop for doctoral/post-doctoral candidates with historically underrepresented genders who are interested in pursuing academic careers.

PUBLICATIONS

* Equal contribution

JOURNALS

J8. Detection of Fragmentation While Dusting During Retrograde Intrarenal Laser Lithotripsy: A Novel Computer Vision and Perception Pipeline
J.E. Katz, O. Diaz-Ramos, C.Y.Z. Lo, J. Finegan, T.Y. Chiang, Y. He, Z. Liang, M. Yip, R.L. Sur, **S. Lin**
Lasers in Medical Science, 41(1), p.45, 2026 [paper]

J7. 3D Rendering of Cystoscopy Video Footage: A Novel Method Utilizing Neural Radiance Field Processing
J.E. Katz, J. Finegan, P.F. Beutelspacher, J. Lu, **S. Lin**, M. Yip, R.L. Sur
Cureus, 17(8), 2025 [paper]

J6. Efficient Data-Driven Joint-Level Calibration of Cable-Driven Surgical Robots
H. Peng, A. Lewis, Y.H. Su, **S. Lin**, D.T. Chiang, W. Jiang, H. Lai, B. Hannaford
npj Robotics, 2(1), p.9, 2024 [paper]

J5. Reducing Annotating Load: Active Learning with Synthetic Images in Surgical Instrument Segmentation
H. Peng, **S. Lin**, D. King, Y.H. Su, R.A. Bly, K.S. Moe, and B. Hannaford

Medical Image Analysis, 97, p.103246, 2024 [paper]

J4. ORRN: An ODE-based Recursive Registration Network for Deformable Respiratory Motion Estimation With Lung 4DCT Images
X. Liang, **S. Lin**, F. Liu, D. Schreiber, and M.C. Yip
IEEE Transactions on Biomedical Engineering, pp. 1-12, 2023 [paper][github]

J3. Contour Primitive of Interest Extraction Network Based on Dual-Metric One-Shot Learning for Vision Measurement
F. Qin, **S. Lin**, and D. Xu
IEEE Transactions on Industrial Informatics, 19(4), pp.5839-5848, 2022 [paper]

J2. Multi-frame Feature Aggregation for Real-time Instrument Segmentation in Endoscopic Video
S. Lin, F. Qin, H. Peng, R.A. Bly, K.S. Moe, and B. Hannaford
IEEE Robotics and Automation Letters, 6(4), pp.6773-6780, 2021 [paper]

J1. Towards Better Surgical Instrument Segmentation in Endoscopic Vision: Multi-angle Feature Aggregation and Contour Supervision
F. Qin, **S. Lin**, Y. Li, R.A. Bly, K.S. Moe, and B. Hannaford
IEEE Robotics and Automation Letters, 5(4), pp.6639-6646, 2020 [paper]

CONFERENCES

C17. TwinTrack: Bridging Vision and Contact Physics for Real-Time Tracking of Unknown Dynamic Objects
W. Yang, Z. Xie, X. Zhang, H. B. Amor, **S. Lin**, W. Jin
IEEE International Conference on Robotics and Automation (ICRA), 2026 [paper]

C16. PalpAid: Multimodal Pneumatic Tactile Sensor for Tissue Palpation
D. Yuliarti, R. Prakash, H. C. Cheung, A. Strong, P. J. Codd, **S. Lin**
9th IEEE-RAS International Conference on Soft Robotics (RoboSoft), 2026 [paper]

C15. SurgXBench: Explainable Vision-Language Model Benchmark for Surgery
J. Cheng, X. Zhao, S. Liu, X. Yu, R. Prakash, P. J. Codd, J. E. Katz, **S. Lin**
Accepted to *IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, 2026 [paper]

C14. CtRNet-X: Camera-to-Robot Pose Estimation in Real-World Conditions Using a Single Camera
J. Lu, Z. Liang, T. Xie, F. Ritcher, **S. Lin**, S. Liu, M.C. Yip
IEEE International Conference on Robotics and Automation (ICRA), 2025 [paper]

C13. BASED: Bundle-Adjusting Surgical Endoscopic Dynamic Video Reconstruction using Neural Radiance Fields
S. Saha, Z. Liang, **S. Lin**, J. Lu, M.C. Yip, and S. Liu
IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), 2025 [paper]

C12. SuPerPM: A Surgical Perception Framework Based on Deep Point Matching Learned from Physical Constrained Simulation Data

S. Lin, A.J. Miao, A. Alabiad, F. Liu, K. Wang, J. Lu, F. Richter, and M.C. Yip
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2024 [paper]

C11. Coauthor of DROID: A Large-Scale In-The-Wild Robot Manipulation Dataset
Robotics: Science and Systems (RSS), 2024 [paper][website]

C10. HemoSet: The First Blood Segmentation Dataset for Automation of Hemostasis Management
A.J. Miao, **S. Lin**, J. Lu, F. Richter, B. Ostrander, E. Funk, R. Orosco, and M.C. Yip
International Symposium on Medical Robotics (ISMR), 2024 [paper]
Best Student Paper Award

C9. Tracking Snake-like Robots in the Wild Using Only a Single Camera
J. Lu, F. Richter, **S. Lin**, and M.C. Yip
IEEE International Conference on Robotics and Automation (ICRA), 2024 [paper]

C8. Real-to-Sim Deformable Object Manipulation: Optimizing Physics Models with Residual Mappings for Robotic Surgery
X. Liang, F. Liu, Y. Zhang, Y. Li, **S. Lin**, and M.C. Yip
IEEE International Conference on Robotics and Automation (ICRA), 2024 [paper]

C7. AnyOKP: One-Shot and Instance-Aware Object Keypoint Extraction with Pretrained ViT
F. Qin, T. Hou, **S. Lin**, Kaiyuan Wang, Michael C. Yip, and Shan Yu
IEEE International Conference on Robotics and Automation (ICRA), 2024 [paper][github]

C6. Coauthor of Open X-Embodiment: Robotic Learning Datasets and RT-X Models
IEEE International Conference on Robotics and Automation (ICRA), 2024 [paper][website]
Best Conference Paper Award

C5. Semantic-SuPer: A Semantic-aware Surgical Perception Framework for Endoscopic Tissue Identification, Reconstruction, and Tracking
S. Lin, A.J. Miao, J. Lu, S. Yu, Z.Y. Chiu, F. Richter, and M.C. Yip
IEEE International Conference on Robotics and Automation (ICRA), pp. 4739-4746, 2023 [paper][github]

C4. Endoscope Localization and Dense Surgical Scene Reconstruction for Stereo Endoscopy by Unsupervised Optical Flow and Kanade-Lucas-Tomasi Tracking
Z. Yang, **S. Lin**, R. Simon, and C.A. Linte
Annual International Conference of the IEEE Engineering in Medicine & Biology Society, pp. 4839-4842, 2022 [paper][github]

C3. LC-GAN: Image-to-Image Translation Based on Generative Adversarial Network for Endoscopic Images
S. Lin, F. Qin, Y. Li, R.A. Bly, K.S. Moe, and B. Hannaford
International Conference on Intelligent Robots and Systems (IROS), pp. 2914-2920, 2020 [paper]

C2. Video-based Automatic and Objective Endoscopic Sinus Surgery Skill Assessment
S. Lin, X. Gu, R.A. Bly, K.S. Moe, and B. Hannaford
SPIE Medical Imaging 2020: Image-Guided Procedures, Robotic Interventions, and Modeling, Vol. 11315, pp. 663-670, 2020 [paper]

C1. Don't Get Burned: Thermal Monitoring of Vessel Sealing Using a Miniature Infrared Camera
S. Lin, L. Fichera, M.J. Fulton, and R.J. Webster III
SPIE Medical Imaging 2017: Image-Guided Procedures, Robotic Interventions, and Modeling, Vol. 10135, pp. 263-269, 2017 [paper]

PRE-PRINTS

P1. TrajPred: Trajectory-Conditioned Joint Embedding Prediction for Surgical Instrument-Tissue Interaction Recognition in Vision-Language Models
J. Cheng, X. Yu, S. Tripathi, S. Liu, **S Lin**
arXiv preprint, 2026 [paper]

WORKSHOPS

W3. BAA-NGP: Bundle-Adjusting Accelerated Neural Graphics Primitives
S. Liu*, **S. Lin***, J. Lu, A. Supikov, and M.C. Yip
Workshop on Visual Odometry and Computer Vision Applications Based on Location Clues at CVPR, 2024 [paper][github]

W2. Semantic-SuPer: Employing Semantic Perception for Endoscopic Tissue Identification, Reconstruction, and Tracking
S. Lin, J. Lu, F. Richter, and M.C. Yip
Workshop on Integrated Perception, Planning, and Control for Physically and Contextually-Aware Robot Autonomy at IROS, 2023 [paper]

W1. Automatic Sinus Surgery Skill Assessment Based on Instrument Segmentation and Tracking in Endoscopic Video
S. Lin, F. Qin, R.A. Bly, K.S. Moe, and B. Hannaford
Multiscale Multimodal Medical Imaging at MICCAI, pp. 93-100, 2019 [paper]

THESES

T2. Vision-based Surgical Instrument Segmentation and Endoscopic Sinus Surgery Skill Assessment
S. Lin, Ph.D. Dissertation, University of Washington, 2021 [paper]

T1. Monitoring of Thermal Processes for Medical Applications Using Infrared Thermography
S. Lin, M.S. Thesis, Vanderbilt University, 2017 [paper]

INVITED TALKS AND GUEST LECTURES

INVITED TALK

• **2026 International Symposium on Medical Robotics (ISMR), The Holistic Forum of Medical Robotics Junior Professors.** 04/22/2026, Knoxville, USA.

• **2025 IEEE International Conference on Robotics and Automation (ICRA), 1st International Workshop on the Evolving Landscape of Surgical Robotics.** Intelligent, Multimodal Surgical Perception. 05/19/2025, Atlanta, USA.

• **Southwest Robotics Symposium.** ASU Faculty Talks. 10/31/2024, Tempe, USA.

• **International Symposium for Medical Robotics 2024 Workshop on Machine Learning with the da Vinci Research Kit.** Bringing Deep Learning to Surgical Scene Reconstruction and Tracking. 06/03/2024, Atlanta, USA.

• **Arizona State University.** Robust Surgical Perception: Toward Autonomous Robotic Surgery. 03/20/2024, Phoenix, USA.

• **Duke University.** Robust Surgical Perception: Toward Autonomous Robotic Surgery. 03/11/2024, Durham, USA.

• **Worcester Polytechnic Institute.** Robust Surgical Perception: Toward Autonomous Robotic Surgery. 02/23/2024, Worcester, USA.

• **University of Rochester.** Robust Surgical Perception: Toward Autonomous Robotic Surgery. 02/09/2024, Rochester, USA.

• **2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Workshop on Data vs. Model in Medical Robotics.** Employing Robust, Semantic Perception for Endoscopic Tissue Identification, Tracking, and Reconstruction. 10/05/2023, Detroit, USA.

• **Worcester Polytechnic Institute Robotics Colloquium.** Exploring Robust Real-time Instrument Segmentation for Endoscopic Sinus Surgery. 09/10/2021, virtual.

• **University of California San Diego.** Exploring More Generalizable and Robust Instrument Segmentation for Endoscopic Sinus Surgery. 05/07/2021, virtual.

• **Mount Holyoke College CS Seminar.** Exploring Robust Real-time Instrument Segmentation for Endoscopic Sinus Surgery. 03/05/2020, virtual.

• **Johns Hopkins University LCSR Seminar.** Exploring Robust Real-time Instrument Segmentation for Endoscopic Sinus Surgery. 02/10/2020, virtual.

GUEST LECTURE

• **Georgia Institute of Technology**, Medical Robotics (Instructor: Yue Chen). Intelligent, Autonomous Robotic Surgery. 11/19/2025, virtual.

NEWS COVERAGE

• **ASU Full Circle.** *New Faculty Member, 2024–25*. Oct, 2024.

• **Computer Vision News**. *Pioneers of Medical Robotics from Data vs Model in Medical Robotics Workshop – IROS 2023*. Oct, 2023.

PROFESSIONAL SERVICES

Workshop / Symposium Organizer:

• 1st International Workshop on the Evolving Landscape of Surgical Robotics (ELSR), ICRA 2025, Atlanta, USA

• Southwest Robotics Symposium 2025, Arizona State University

• Southwest Robotics Symposium 2024, Arizona State University

Associate Editor:

• IEEE Robotics and Automation Letters (RA-L), 2025 –

Reviewer:

Journals

• IEEE Transactions on Robotics (T-RO)

• International Journal of Robotics Research (IJRR)

• IEEE Transactions on Medical Imaging (TMI)

• IEEE Robotics and Automation Letters (RA-L)

• npj Digital Medicine

• IEEE Transactions on Medical Robotics and Bionics (T-MRB)

• Journal of Medical Robotics Research (JMRR)

• Robotics and Autonomous Systems

• IEEE Access

Conferences

• Robotics: Science and Systems (RSS)

• IEEE International Conference on Robotics and Automation (ICRA)

• IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

• International Symposium on Medical Robotics (ISMR)

• IEEE International Conference on Soft Robotics (RoboSoft)

• IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BIOROB)

MENTORSHIP

PhD Student

Arizona State University

• Jiajun Cheng *2025*

Benchmarking and Developing Vision Language Models for Surgical Data

- Haokai Xu *2025*
  Dynamic and Deformable Scene 3D Reconstruction
- Hiu Ching (Athena) Cheung - Joining in Fall 2026 *2026*
  Soft Robotics with Multimodal Sensing for Safer Surgical Manipulation

Undergraduate Student Mentorship

Arizona State University

- Juha Choi *2026*
  Surgical Skill Assessment

TEACHING

Arizona State University, Tempe, USA

School of Electrical, Computer and Energy Engineering

- EEE 203 Signals and Systems *01/2025 – 05/2025, 10/2025 – 12/2025, 01/2026 – 05/2026*