Shuying Li

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https://scholar.google.com/citations?user=YniFlEcAAAAJ&hl=en

EDUCATION

Washington University in St. Louis (WashU)   **St. Louis, US**

Ph.D., Biomedical Engineering   05.2023

Thesis: *Cancer Assessment with Optical Imaging: Algorithms and Machine Learning*

University of Michigan   **Ann Arbor, US**

MS, Mechanical Engineering   04.2018

Zhejiang University   **Hangzhou, China**

BS, Energy & Environmental Systems Engineering (*Outstanding graduates of Zhejiang*)   06.2016

EMPLOYMENT

Miami University–Oxford   **Oxford, OH**

Assistant Professor, Dept. of Chemical, Paper, and Biomedical Engineering   08.2025-

Boston University (BU)   **Boston, US**

Postdoctoral Associate, Dept. of Electrical & Computer Engineering   06.2023-present

RESEARCH EXPERIENCES

Research Interests:

Trustworthy AI, Biomedical Imaging, Optical Imaging, Cancer, Neurodegenerative Disease

Postdoctoral Associate, Computational Imaging Systems Lab

Advisors: Dr. Lei Tian & Dr. Irving Bigio

Digital Neuropathology with Deep Learning   2023-present

- Applied attention-based multiple instance learning to classify stages of Chronic Traumatic Encephalopathy (CTE) and generated interpretable attention maps.
- Used weakly-supervised learning to predict pathological staining density from structural staining and identified structural markers correlated with neurodegenerative diseases.
- Employed a combination of multi-modal, multi-region, and multi-stain approaches to enhance the performance.
- Trained a generalizable vision foundation model for neuropathology using self-supervised learning to advance neuropathological image analysis.

Deep Learning Analysis of Multi-modal Optical Imaging of Human Brain Tissue   2023-present

- Applied weakly-supervised learning to identify changes correlated with neurodegenerative diseases in brain images acquired using Polarization-Sensitive Optical Coherence Tomography (PS-OCT).
- Developed self-supervised registration for PS-OCT and quantitative birefringence microscopy (qBRM) images.
- Contributed to implementing object detection to identify myelin defects in qBRM images.

PhD Student, Optical and Ultrasound Imaging Lab

Advisor: Dr. Quing Zhu

Ultrasound (US)-guided Diffuse Optical Tomography (DOT) for Breast Cancer Imaging   2018-2023

- Developed a projection-based outlier removal algorithm and a connect component analysis-based artifact removal algorithm guided with ultrasound segmentation to reduce image artifacts.

- Designed an artificial neural network to generate data for DOT difference imaging to simplify the data acquisition and mitigate mismatch errors.
- Designed a convolutional autoencoder to extract features from DOT measurements and a Random Forest classifier for real-time breast lesion classification without DOT reconstruction.
- Developed a two-stage, deep learning-based scheme to classify breast lesions with DOT and US.
- Involved in developing a CNN to estimate breast tissue optical properties using DOT.
  Involved in developing a neural network with physical constraints for DOT image reconstruction.

Optical Coherence Tomography (OCT) for Colorectal & Ovarian Cancer Diagnosis   2018-2023

- Calculated statistical features of depth-resolved attenuation maps from OCT images for ovarian cancer diagnosis.
- Designed a customized ResNet to classify OCT colorectal images and achieved an AUC of 0.97.
- Involved in developing an object detection RetinaNet for colorectal cancer diagnosis.

Spatial Frequency Domain Imaging (SFDI) for Colorectal Tissue Assessment   2018-2020

- Designed an AdaBoost algorithm for SFDI colorectal image classification.

<u>Master's Student, Optical Imaging Laboratory</u>
<u>Advisors: Dr. Xueding Wang & Dr. Xinmai Yang</u>

Image-guided Photo-mediated Ultrasound Therapy   2017-2018

- Simultaneously applied laser and ultrasound treat neovascularization in rabbit eyes guided by OCT & photoacoustic microscopy (PAM).
- Simulated bubble dynamics under simultaneous laser & ultrasound and validated the simulations with experiments on tubes filled with blood.

AWARDS & HONORS

- Best Poster Award (top 3), Northeast Symposium on Biomedical Optics   2024
- Best Poster Award (top 6), Gordon Research Seminar - Optics and Photonics in Medicine & Biology   2024
- Poster Session Honorable Mention (top 4), Imaging Sciences Pathway Retreat, WashU in St. Louis   2023
- PhD Outstanding Research Awards (recognizing independent research that gained recognition at   2022
  the national or international level), Department of Biomedical Engineering, WashU in St. Louis
- Travel grant ($600), Gordon Research Seminar - Optics and Photonics in Medicine & Biology   2022
- BMES travel award ($800), Department of Biomedical Engineering, WashU in St. Louis
- Best Poster Award (top 5), Siteman Cancer Center Research Forum   2020
- Rackham Graduate Student Research Grant ($1500), University of Michigan   2017
- Jean and Sidney Grossman Fellowship, Department of Biomedical Engineering, WashU in St. Louis   2018
- Outstanding Graduates (given to top 4% undergraduate graduates), Zhejiang Province, China   2016
- Dean's Scholarship (top 5%), Zhejiang University, China   2016
- Excellent Graduation Thesis Award (given to top 25% thesis), Zhejiang University, China   2016
- National Scholarship (given to top 2% undergraduate students for excellence in academics), China   2015 & 2016
- Second-class Scholarship (top 11%), Zhejiang University, China   2014

PUBLICATIONS

Peer-reviewed journals
As the first or co-first[†] author

- **Li, S.,** Malamut, M., McKee, A., Cherry, J.[*], & Tian, L.[*] Age-Informed, Attention-Based Weakly-Supervised Learning for Neuropathological Image Assessment. (**Manuscripts Submitted**)

- **Li, S.,** Zhang, M., Xue, M., & Zhu, Q. (2024). Real-time breast lesion classification combining diffuse optical tomography frequency domain data and BI-RADS assessment. *Journal of Biophotonics*, 202300483.
- Zhang, M.[†], **Li, S.** [†]**,** Xue, M., & Zhu, Q. (2023), A two-step classification scheme for breast lesion diagnosis using ultrasound-guided diffuse optical tomography and deep learning. *Journal of Biomedical Optics*, 28(8), 086002-086002.
- **Li, S.**[†], Luo, H.[†], Kou, S., Hagemann, I., & Zhu, Q. (2023). Depth-resolved attenuation mapping of human ovary and fallopian tube using optical coherence tomography. *Journal of Biophotonics*, e202300002.
- **Li, S.,** Zhang, M., Xue, M., & Zhu, Q. (2022). Difference imaging from single measurements in diffuse optical tomography: A deep learning approach. *Journal of Biomedical Optics*, *27*(8), 086003. **(Promoted on the SPIE WeChat account)**
- Luo, H.[†], **Li, S.**[†]**,** Zeng, Y.[†], …, Zhu, Q. (2022). Human colorectal cancer tissue assessment using optical coherence tomography catheter and deep learning. *Journal of Biophotonics,* e202100349. **(Inside cover, top-10 most cited papers** among papers published in 2022 in Journal of Biophotonics**)**
  - ➢ *WashU The Source:* https://source.washu.edu/2022/08/pairing-imaging-ai-may-improve-colon-cancer-screening-diagnosis/
- **Li, S.,** Zhang, M., & Zhu, Q. (2021). Ultrasound segmentation-guided edge artifact reduction in diffuse optical tomography using connected component analysis. *Biomedical Optics Express,* *12*(8), 5320-5336.
- **Li, S.,** Huang, K., Zhang, M., Uddin, K. S., & Zhu, Q. (2021). Effect and correction of optode coupling errors in breast imaging using diffuse optical tomography. *Biomedical Optics Express,* *12*(2), 689-704. **(Most downloaded papers)**
- **Li, S.**[†]**,** Zeng, Y.[†], Chapman Jr, W. C. [†], Erfanzadeh, M., Nandy, S., Mutch, M., & Zhu, Q. (2020). Adaptive Boosting (AdaBoost)-based multiwavelength spatial frequency domain imaging and characterization for ex vivo human colorectal tissue assessment. *Journal of Biophotonics*, *13*(6), e201960241. **(Inside cover)**
  - ➢ *WashU School of Engineering News & Events:* https://engineering.wustl.edu/news/2020/Machine-learning-imaging-technique-provide-better-insight-into-colorectal-tissue.html
- **Li, S.** [†], Qin, Y. [†], Wang, X., & Yang, X. (2018). Bubble growth in cylindrically-shaped optical absorbers during photo-mediated ultrasound therapy. *Physics in Medicine & Biology*, *63*(12), 125017.

As a contributing author

- Luo, H., Nie, H., Lamm, V., **Li, S.**, Thakur, S., Hollander, T., Cho, D., …, & Zhu, Q. In vivo Evaluation of Complex Polyps with Endoscopic Optical Coherence Tomography and Deep Learning during Routine Colonoscopy: A Feasibility Study. (Accepted, *Scientific Reports*)
- Xue, M., **Li, S.,** & Zhu, Q. (2024). Improving diffuse optical tomography imaging quality using APU-Net: an attention-based physical U-Net model. *Journal of Biomedical Optics*, 29(8), 086001-086001.
- Xue, M., Zhang, M., **Li, S.,** Zou, Y., & Zhu, Q. (2023). Automated pipeline for breast cancer diagnosis using US assisted diffuse optical tomography. *Biomedical Optics Express,* 14(11), 6072-6087.
- Luo, H., **Li, S.,** Kou, S., Lin, Y., Hagemann, I. S., & Zhu, Q. (2023). Enhanced 3D visualization of human fallopian tube morphology using a miniature optical coherence tomography catheter. *Biomedical Optics Express*, 14(7), 3225-3233.
- Zhang, M., Xue, M., **Li, S.,** Zou, Y., & Zhu, Q. (2023). Fusion deep learning approach combining diffuse optical tomography and ultrasound for improving breast cancer classification. *Biomedical Optics Express*, 14(4), 1636-1646.
- Poplack, S. P., Young, C. A., Hagemann, I. S., Luo, J., Herman, C. R., Wiele, K., **Li, S.,** ... & Zhu, Q. (2021). Prospective assessment of adjunctive ultrasound-guided diffuse optical tomography in women undergoing breast biopsy: Impact on BI-RADS assessments. *European journal of radiology*, 145, 110029.
- Zhang, M., **Li, S.**, Zou, Y., & Zhu, Q. (2021). Deep learning-based method to accurately estimate breast tissue optical properties in the presence of the chest wall. *Journal of Biomedical Optics* 26 (10), 106004
- Zou, Y., Zeng, Y., **Li, S.,** & Zhu, Q. (2021). Machine learning model with physical constraints for diffuse optical tomography. *Biomedical Optics Express*, 12(9), 5720-5735.
- Zeng, Y., Chapman Jr, W. C., Lin, Y., **Li, S.,** Mutch, M., & Zhu, Q. (2021). Diagnosing colorectal abnormalities using scattering coefficient maps acquired from optical coherence tomography. *Journal of biophotonics,* 14(1), e202000276.

- Zhang, M., Uddin, K. S., **Li, S.**, & Zhu, Q. (2020). Target depth-regularized reconstruction in diffuse optical tomography using ultrasound segmentation as prior information. *Biomedical Optics Express*, 11(6), 3331-3345.
- Samanta, S., Jiang, J., Ye, D., Hutchinson, M., Zeng, Y., **Li, S.**, ... & Tai, Y. C. (2020). Point-of-Care PET/Ultrasound Imaging for Detection of Atherosclerotic Vulnerable Plaque: A Feasibility Study. *Journal of nuclear medicine* 61 (supplement 1), 310-310.
- Zeng, Y., Xu, S., Chapman, W. C., **Li, S.**, Alipour, Z., Abdelal, H., & Chatterjee, D. (2020). Real-time colorectal cancer diagnosis using PR-OCT with deep learning. *Theranostics,* 10(6), 2587.
- Zeng, Y., Nandy, S., Rao, B., **Li, S.**, Hagemann, A. R., Kuroki, L. K., ... & Zhu, Q. (2019). Histogram analysis of en face scattering coefficient map predicts malignancy in human ovarian tissue. *Journal of Biophotonics*, 12(11), e201900115.

Conference proceedings

- **Li, S.,** Malamut, M., Cherry, J., McKee, A., & Tian, L. (2025) NeuroPath: a vision foundation model for advancing neuropathological analysis. *Computational Optical Imaging and Artificial Intelligence in Biomedical Sciences II.* SPIE. (**Accepted**)
- Gray, A. J., Robinson, R., Novoseltseva, A., **Li, S.,** Berghol, S. A., Packard, L., Moore, T. L., Rosene, D. L., & Bigio, I. J. (2024). Quantifying myelin degradation using quantitative birefringence microscopy and deep learning. In *Biophotonics Congress: Biomedical Optics*. JM4A.34. Optica Publishing Group.
- Nie, H., Luo, H., Lamm, V., **Li, S.,** Thakur, S., & Zhu, Q. (2024, March). In vivo colorectal polyp evaluation using an optical coherence tomography catheter and deep learning: results of a feasibility study. In *Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XXVIII* (p. PC128302S). SPIE.
- Zhang, M. [†], **Li, S.** [†], Xue, M., Zhu, Q. (2023). Classification of breast lesions with deep learning combining diffuse optical tomography frequency-domain data and coregistered ultrasound images. In *Optical Tomography and Spectroscopy of Tissue* XV, PC1237609 **(Invited talk).** SPIE.
- Xue, M., Zhang, M., **Li, S.,** Zou, Y., & Zhu, Q. An automated clinical study pipeline for diffuse optical tomography of breast cancer (Conference Presentation). In *Optical Tomography and Spectroscopy of Tissue* XV, PC123760I. SPIE.
- **Li, S.** [†], Luo, H. [†], Zeng, Y., Cheema, H., Otegbeye, E., Chapman Jr, W. C., ... & Zhu, Q. (2022, March). Human colorectal cancer assessment using optical coherence tomography catheter system paired with ResNet. In *Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine* XXVI (p. PC1194808). SPIE.
- Luo, H., **Li, S.,** Kou, S., & Zhu, Q. (2022, March). Imaging human fallopian tube using optical coherence tomography catheters. In *Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine* XXVI (p. PC119480B). SPIE.
- Zhang, M., Zou, Y., **Li, S.,** & Zhu, Q. (2022, April). Auto encoder based deep learning reconstruction for diffuse optical tomography. In *Optical Tomography and Spectroscopy* (pp. OW4D-2). Optica Publishing Group.
- **Li, S.,** Zhang, M., Uddin, K. S., & Zhu, Q. (2021, March). Edge artifact removal in diffuse optical tomography using the heterogeneous VICTRE digital breast model. In *Optical Tomography and Spectroscopy of Tissue* XIV (Vol. 11639, p. 1163905). SPIE.
- Zou, Y., Zeng, Y., **Li, S.,** & Zhu, Q. (2021, March). Unsupervised machine learning model for DOT reconstruction. In *Optical Tomography and Spectroscopy of Tissue* XIV (Vol. 11639, pp. 23-36). SPIE.
- Luo, H., Zeng, Y., **Li, S.,** Zhou, C., & Zhu, Q. (2021, March). Colorectal cancer assessment using optical coherence tomography catheter and deep learning. In *Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine* XXV (Vol. 11630, p. 116300W). SPIE.
- Zeng, Y., Chapman Jr, W. C., Lin, Y., **Li, S.,** & Zhu, Q. (2021, March). Scattering coefficient maps acquired from optical coherence tomography aid in diagnosis of colorectal abnormalities. In *Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine* XXV (Vol. 11630, p. 116300V). SPIE.

- **Li, S.** [†], Zeng, Y. [†], Chapman, W. C., Erfanzadeh, M., Alipour, Z., Abdelal, H., ... & Zhu, Q. (2020, April). AdaBoost-based multi-wavelength spatial frequency domain imaging for human colorectal tissue assessment. In *Optical Tomography and Spectroscopy* (pp. SM2D-7). Optica Publishing Group.

- **Li, S.,** Zhang, M., Uddin, K. M. S., & Zhu, Q. (2020, April). Effect of Breast Contour and Optode Coupling Error on Ultrasound-guided Diffuse Optical Tomography. In *Clinical and Translational Biophotonics,* JTu3A. 10. Optica Publishing Group.

- Zhang, M., Uddin, K. M. S., **Li, S.,** & Zhu, Q. (2020, April). Shape-based reconstruction using ultrasound segmentation as prior in ultrasound-guided diffuse optical tomography. In *Optical Tomography and Spectroscopy*, JTh2A. 4. Optica Publishing Group.

- Zeng, Y., Xu, S., Chapman, W. C., **Li, S.,** Alipour, Z., Abdelal, H., & Chatterjee, D. (2020, April). Real-time colorectal cancer diagnosis using PR-OCT with deep learning. In *Optical Coherence Tomography*, 2020, OW2E.5. Optica Publishing Group.

- Zeng, Y., **Li, S.,** Erfanzadeh, M., Nandy, S., Chapman Jr, W., Alipour, Z. (2020, April). A multispectral hand-held spatial frequency domain imaging system for imaging human. In *Optical Tomography and Spectroscopy of Tissue* XIII, 10874, 91-93. SPIE.

INVITED TALKS

- Northeast Symposium on Biomedical Optics   2024
- SPIE Photonics West 2023   2023
- BME day, Department of Biomedical Engineering, WashU in St. Louis   2022
- Imaging Science Student Seminar Series, WashU in St. Louis   2021

TEACHING, MENTORING, & OUTREACH ACTIVITIES

Teaching Experience:

Assistant instructor for BME 444/544 – Biomedical Instrumentation (WashU, Spring 2020)

Mentorship Experience:

	Students' Affiliation	Projects
Two PhD students	BU BME	Quantifying myelin defects in BRM/qBRM using deep learning
Three master's students	WashU BME	Thin-film force sensor array for real-time probe contact monitoring
	WashU ESE	Miniaturized endoscopic SFDI system
	BU ECE	Self-supervised representation learning for neuropathology
Two undergraduate students	BU BME	Affine transformation for image registration
	BU ECE	Optimizing loss functions and regularizations in deep learning-based image registration

Outreach Activity:

High school science coach (Summer 2022)

PROFESSIONAL SERVICE

Ad Hoc Reviewer:

(11) Biomedical Optics Express   (10) Journal of Biomedical Optics

(4) Scientific Reports   (4) IEEE Transactions on Biomedical Engineering

(4) Journal of Electronic Imaging   (4) IEEE Transactions on Medical Imaging (**Distinguished Reviewer**)

(3) The Innovation   (3) International Journal of Imaging Systems & Technology

(2) Medical Physics   (2) Journal of the Optical Society of America A

(2) Optics Express   (2) Computer Methods in Biomechanics and Biomedical Engineering

(1) Optics Letters   (2) Computer Methods and Programs in Biomedicine

(1) BMC cancer

Professional membership:

Member, Optica

Member, SPIE

Member, Biomedical Engineering Society (BMES)