

Shuying Li

Postdoctoral Associate
Department of Electrical & Computer Engineering,
Boston University
8 St.Mary's St, Room 501
Boston, MA 02215

shyli@bu.edu
734-239-0168
Personal website: shy-li.github.io
LinkedIn: www.linkedin.com/in/shuying--li
ORCID iD: [0000-0003-3253-6304](https://orcid.org/0000-0003-3253-6304)

EDUCATION

Washington University in St. Louis	St. Louis, US
Ph.D., Biomedical Engineering	05.2023
<i>Thesis:</i> 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 (<i>Outstanding graduates of Zhejiang</i>)	06.2016

RESEARCH EXPERIENCES

Research Interests:

Biomedical Imaging, Optical Imaging, Digital Neuropathology, Computer-aided Diagnosis, Deep Learning

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 effectively classify stages of Chronic Traumatic Encephalopathy (CTE).
- Used weakly-supervised learning to predict pathological staining density from structural staining.
- Employed a combination of multi-region and multi-stain approaches to enhance the performance.
- Trained a visual foundation model for neuropathology.

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

- Conducted deep learning registration of Polarization-Sensitive Optical Coherence Tomography (PS-OCT) and quantitative Birefringence Microscopy (qBRM) images.
- Involved in 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 a multilayer-perceptron (MLP) 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.

Master's Student, Optical Imaging Laboratory

Advisor: Dr/ Xueding Wang & Dr.Xinmai Yang

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

- PhD Outstanding Research Awards (recognizing independent research that gained recognition at the national or international level), Department of Biomedical Engineering, Washington University in St. Louis 2022
- Best Poster Award (top 5), Siteman Cancer Center Research Forum 2020
- Rackham Graduate Student Research Grants (\$1500), Rackham graduate school, University of Michigan 2018
- Outstanding Graduates (given to top 4% undergraduate graduates), Zhejiang Province, China 2017
- 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

First or co-first[†] authored

- 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)**
- 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)**
- 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.

Co-authored

- 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),

Conference proceedings

- 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**)
- 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
- **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.

Submitted Manuscripts:

- Xue, M., **Li, S.**, & Zhu, Q. Improving diffuse optical tomography imaging quality using APU-net: an attention-based physical U-net model. (revised manuscript in review in *Journal of Biomedical Optics*)
- 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. (in review in *Scientific Reports*)

Manuscripts in preparation:

- **Li, S.**, Cherry, J., Malamut, M., McKee, A., & Tian, L. Predicting AT8 Density in Repetitive Head Injury Patients from LH&E Images Using Age-Informed Weakly-Supervised Learning.

TEACHING & MENTORING ACTIVITIES

Teaching Experience:

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

Mentorship Experience:

PhD students	<ul style="list-style-type: none"> • Alexander Gray & Anna Novoseltseva (BU BME) 	Quantifying myelin defects using qBRM and deep learning
Master's students	<ul style="list-style-type: none"> • Kexin Huang (WashU BME) • Xiyan Li (WashU ESE, admitted by PhD program at WashU) • Maxwell Malamut (BU ECE) 	Thin-film force sensor array for real-time DOT probe contact monitoring Miniaturized endoscopic SFDI system Self-supervised representation learning for neuropathology
Undergraduate students	<ul style="list-style-type: none"> • Siara Patel (BU BME) • Nikhil Krishna (BU ECE) 	Affine transformation for image registration between qBRM and OCT images Optimizing loss functions and regularization in deep learning-based image registration

SERVICE & OUTREACH

Outreach Activity:

High school science coach (Summer 2022)

Ad Hoc Reviewer:

(11) Biomedical Optics Express

(9) Journal of Biomedical Optics

- | | |
|-----------------------------|---|
| (4) Journal of Biophotonics | (4) IEEE Transactions on Biomedical Engineering |
| (4) Scientific Reports | (4) Journal of Electronic Imaging |
| (3) The Innovation | (2) Journal of the Optical Society of America A |
| (2) Medical Physics | (2) Computer Methods in Biomechanics and Biomedical Engineering |
| (2) Optics Express | (3) International Journal of Imaging Systems & Technology |
| (1) Optics Letters | (1) Journal of Innovative Optical Health Sciences |
| (1) BMC cancer | (2) Computer Methods and Programs in Biomedicine |