

Shuying Li

Current position:

Postdoctoral Associate
Department of Electrical & Computer Engineering,
Boston University (BU)
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 (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

RESEARCH EXPERIENCES

Research Interests:

Biomedical Imaging, Optical Imaging, Deep Learning, Computer-aided Diagnosis, Neurodegenerative Disease, Cancer

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 provided explainable attention maps.
- Used weakly-supervised learning to predict pathological staining density from structural staining.
- Employed a combination of multi-modal, multi-region, and multi-stain approaches to enhance the performance.
- Trained a 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

- Conducted deep learning-based registration of Polarization-Sensitive Optical Coherence Tomography (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 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

- 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 the national or international level), Department of Biomedical Engineering, WashU in St. Louis 2022
- 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., 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

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

- 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*, PC1237601
- 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:

- 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, *Scientific Reports*)

Manuscripts in preparation:

- **Li, S.**, Cherry, J., Malamut, M., McKee, A., & Tian, L. An Age-Informed Computational Pipeline for Predicting AT8 Density from LH&E Images in Repetitive Head Injury Patients.

INVITED TALKS

- Northeast Symposium on Biomedical Optics 2024
- SPIE Photonics West 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 |
|-------------------------------------|----------------------------------|--|
| • <u>Two</u> PhD students | BU BME | Quantifying myelin defects in BRM/qBRM using deep learning |
| • <u>Three</u> master's students | WashU BME WashU ESE BU ECE | Thin-film force sensor array for real-time probe contact monitoring Miniaturized endoscopic SFDI system Self-supervised representation learning for neuropathology |
| • <u>Two</u> undergraduate students | BU BME BU ECE | Affine transformation for image registration Optimizing loss functions and regularization 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 |
| (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, Biomedical Engineering Society (BMES)

REFERENCES

Dr. Lei Tian (Postdoc advisor)

Associate Professor,

Department of Electrical & Computer Engineering and Biomedical Engineering,

Boston University

8 St Marys St, RM 830, Boston, MA 02215

Phone: 617-353-1334

Email: leitian@bu.edu

Dr. Qing Zhu (Ph.D. advisor)

Edwin H. Murty Professor,

Department of Biomedical Engineering, Electrical and System Engineering, and Radiology

Washington University in St Louis

One Brookings Drive, Whitaker Hall 200F, St. Louis, MO 63130

Phone: 314-935-7519

Email: zhu.q@wustl.edu

Dr. Jonathan D. Cherry (Collaborator, neuropathologist)

Assistant Professor, Pathology & Laboratory Medicine

Boston University Chobanian & Avedisian School of Medicine

72 East Concord Street

Boston MA 02118

Phone: 585-752-4921

Email: jdcherry@bu.edu