Shiqi Xu

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Expertise

- 8 years of research and development experience in computational imaging, with 20+ peer-reviewed publications, 800+ citations, and four issued patents.
- Specializing in high-resolution volumetric imaging systems.
- Expertise in developing image processing and analysis algorithms and solving inverse reconstruction problems.
- Hands-on skills in prototyping optical setups and verifying performance.

Education

Duke University *Durham, NC* *2019–2023*
- Ph.D. in Biomedical Engineering; Advisor: Dr. Roarke Horstmeyer

Washington University in St Louis *St. Louis, MO* *2017–2019*
- M.S. in Electrical Engineering Advisor: Dr. Ulugbek Kamilov

University of Illinois at Urbana-Champaign *Urbana-Champaign, IL* *2013–2016*
- B.S. in Electrical Engineering Advisor: Dr. Michael Oelze

Industrial Experience

ZEISS Research Microscopy Solutions *Dublin, CA* *2023–*
- Senior Algorithm Scientist in Advanced Design and Development team, Product Center X-ray Microscopy
  i) Led the design and development of deep learning-enabled reconstruction and calibration workflows for high-resolution high-throughput computed tomography. Presentation
  ii) Led the algorithm and system design of a lab-based hard X-ray plenoptic imaging system for high-resolution, high-contrast tomographic phase and scattering imaging of low-absorption materials.
- ZEISS Global Expert Ladder - Senior
  i) Help with technology roadmapping, innovation strategy, and intellectual property creation; collaborate with stakeholders in business and marketing.

Meta, Reality Labs Research *Redmond, WA* *2022*
- Optical Scientist Intern in Eye Tracking and Optics & Display Research team
  i) Developed an estimation theory-based method to quantify the achievable performance of eye-tracking systems. Design and prototype a miniaturized FMCW-LiDAR-based eye-tracking system based on the theoretical guidance.

Academic Experience

Duke University *Durham, NC* *2019–2023*
- Graduate research assistant in the Computational Optics Lab Advisor: Dr. Roarke Horstmeyer
  i) Developed computational optical microscopy systems to create polarization-sensitive tomographic phase images of unlabeled cells and tissue samples. Related publications: [8][15]
  ii) Developed image processing pipelines for analyzing microorganism behavior in gigapixel-per-frame brightfield and fluorescence microscope videos. Downstream image analysis tasks included segmentation, object detection, and pose estimation. [12][10]
  iii) Developed SPAD array-based high-sensitivity, high-frame-rate optical systems for non-invasive monitoring of cerebral blood flow. [17][21]

Washington University in St Louis *St. Louis, MO* *2017–2019*
- Graduate research assistant in the Optical and Ultrasound Imaging Lab; Advisor: Dr. Quing Zhu
  i) Developed deep-learning based image analysis algorithms for real-time colorectal cancer diagnosis using endoscopic optical coherence tomography (OCT). [23]
  ii) Developed a sensor fusion algorithm to improve the diffuse optical tomographic reconstruction of breast tumors. [24]
- Graduate research assistant in the Computational Imaging Group; Advisor: Dr. Ulugbek Kamilov
  i) Developed compressive reconstruction algorithm for imaging of unlabeled living cell cultures. [25]

Technical Skills

- **Scientific programming:** Fluent in Python (Pytorch, Tensorflow, Hugging Face, OpenCV, Scikit-Image), Matlab. Comfortable with C/C++.
- **Hardware skills:** Experienced at optical imaging system prototyping. Comfortable with optical design tools such as Zemax.

Issued Patents

1. Tensorial tomographic Fourier Ptychography. US18/677,131
2. Method and System of polarization microscope imaging. US18/073,759
3. Ultrasound-guided sparse regularization to improve accuracy of optical tomography US16/948,261
4. Spatially varying artifact removal method for computed tomography. U.S.19/034,996.

Peer-reviewed publications

1. Guo, Z., **Xu, S.**, Majlan, K., Zhou, Z., Xu, M., Andreyev, A., ... (2025). The Role of Pretraining in High-Throughput Laminography Restoration. Microscopy and Microanalysis, 31. Link
2. Zhou, K.C., Cook, C., Chakraborty, A., Bagwell, J., Jönsson, J., Lee, K.C., ... High-speed 4D fluorescence light field tomography of whole freely moving organisms. *Optica* 12(5), 674-484 (2025) . Link
3. Kreiss, L., Wu, M., Wayne, M., **Xu, S.**, ... Beneath the surface: revealing deep-tissue blood flow in human subjects with massively parallelized diffuse correlation spectroscopy. (2025) Neurophotonics, 12(2), pp.025007-025007. Link
4. Kim, K., Chaware, A., Cook, C. B., **Xu, S.**, ... & Horstmeyer, R. (2024). Rapid 3D imaging at cellular resolution for digital cytopathology with a multi-camera array scanner (MCAS). npj Imaging 2.1 (2024): 39. Link
5. **Xu, S.**, Candell, S., Case, T., Goehnermeier, A., ... 2024, October. Self-supervised deep image restoration for x-ray computed laminographic tomography. In Developments in X-Ray Tomography XV (Vol. 13152, p. 131520T). Link
6. Andrew, M., Andreyev, A., Yang, F... 2024, October. X-ray reconstruction using synthetic prior image restoration, with application to noise and artefact removal. In Developments in X-Ray Tomography XV (Vol. 13152, p. 131520E). Link
7. Lee, K.C., Chae, H., **Xu, S.**, Lee, K., Horstmeyer, R., Lee, S.A. and Hong, B.W., 2024. Anisotropic regularization for sparsely sampled and noise-robust Fourier ptychography. Optics Express, 32(14), pp.25343-25361. Link
8. **Xu, S.**, Dai, X., Ritter, P., Kreiss, L., ... & Horstmeyer, R., 2023. Tensorial tomographic Fourier Ptychography with applications to muscle tissue imaging. Advanced Photonics. Link
9. Kreiss, L., Jiang, S., Li, X., **Xu, S.**, Zhou, K.C., Mühlberg, A., Lee, K.C., Kim, K., Chaware, A., Ando, M. and Barisoni, L., Digital staining in optical microscopy using deep learning - a review. PhotoniX 4, 34 (2023). Link
10. Harfouche, M., Kim, K., ... & Horstmeyer, R., 2022. Multi-scale gigapixel microscopy using a multi-camera array microscope. *Optica* 10(4), 471-480 (2023) . Link
11. Yang, X., Harfouche, M., Zhou, K.C., Kreiss, L., **Xu, S.**, Kim, K., Horstmeyer, R., 2022. Multi-modal imaging using a cascaded microscope design. *Optics Letter*,48 (7), 1658-1661. Link
12. Thomson, E., Harfouche, M., Konda, P., Seitz, C.W., Kim, K., Cooke, C., **Xu, S.**, Blazing, R., Chen, Y., Jacobs, W.S. and Park, J., 2022. Gigapixel imaging with a novel multi-camera array microscope. *eLife*,11,e74988. Link
13. Ayaz, H., Baker, W. B., Blaney, G., Boas, D. A., Bortfeld, H., Brady, K., ... & Zhou, W., 2022. Optical imaging and spectroscopy for the study of the human brain: status report. *Neurophotonics*. Link
14. Cooke, C.L., Kim, K., **Xu, S.**, Chaware, A., ..., 2021. A multiple instance learning approach for detecting COVID-19 in peripheral blood smears. *PLOS Digital Health*. Link
15. **Xu, S.**, Dai, X., Yang, X., Zhou, K.C., Kim, K., Pathak, V., Glass, C., Horstmeyer, R., 2022. Tensorial tomographic differential phase-contrast microscopy. *2022 International conference on computational photography (ICCP)*. Link
16. **Xu, S.**, Liu, W., ... & Horstmeyer, R., 2022. Transient motion classification through turbid volumes via parallelized single-photon detection and deep contrastive embedding. *Front. Neurosci*, 908770. Link
17. **Xu, S.**, Yang, X., Liu, W., Jonsson, J., Qian, R., ..., R., 2022. Imaging dynamics beneath turbid media via parallelized single-photon detection. *Advanced Science*, 10.1002. Link
18. **Xu, S.**, Dai, X., Yang, X., Zhou, K.C., Glass, C., Konda, P.C. and Horstmeyer, R., 2021. Quantitative Jones matrix imaging using vectorial Fourier ptychography. *Biomedical optics express*, 13(3), pp.1457-1470. Link. *__Editor's pick__
19. Yao, X., Pathak, V., Xi, H., Chaware, A., Cooke, C., Kim, K., **Xu, S.**, Li, Y., Dunn, T., Konda, P.C. and Zhou, K.C., 2021. Increasing a microscope's effective field of view via overlapped imaging and machine learning. Optics express, 30(2), pp. 1745-1761. *Biomedical optics express*, 13(3), pp.1457-1470. Link
20. Yang, X., Konda, P.C., **Xu, S.**, Bian, Liheng, and Horstmeyer, R., 2021. Quantized Fourier ptychography with binary images from SPAD cameras. *Photonics research*, 9.10 (2021): 1958-1969.. Link
21. Liu, W., Qian, R., **Xu, S.**, Konda, P.C., Harfouche, M., Borycki, D., Jonsson, J., Berrocal, E., Cooke, C., Sinclair, A. and Wang, H., 2020. Fast and sensitive diffuse correlation spectroscopy with highly parallelized single photon detection. *APL Photonics*, 6(2), 026106. Link. *__2021 APL Photonics best paper__
22. Konda, P.C., Loetgering, L., Zhou, K.C., **Xu, S.**, Harvey, A.R. and Horstmeyer, R., 2020. Fourier ptychography: current applications and future promises. *Optics Express*, 28(7), pp.9603-9630. Link
23. **Xu, S.**, Zeng, Y., Chapman Jr, W.C., Li, S., Alipour, Z., Abdelal, H., Chatterjee, D., Mutch, M. and Zhu, Q., 2020. Real-time colorectal cancer diagnosis using PR-OCT with deep learning. *Theranostics*, 10(6), p.2587. Link
24. **Xu, S.**, Uddin, K.S. and Zhu, Q., 2019. Improving DOT reconstruction with a Born iterative method and US-guided sparse regularization. *Biomedical optics express*, 10(5), pp.2528-2541. Link.
25. Sun, Y., **Xu, S.**, Li, Y., Tian, L., Wohlberg, B. and Kamilov, U.S., 2019, Regularized Fourier ptychography using an online plug-and-play algorithm. *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)* (pp. 7665-7669). IEEE. Link

Conference presentations

1. Optica Imaging Congress, 2025: High-Resolution Multimodal Tomography with a Plenoptic Hard X-Ray Laboratory System [Oral]

2. Microscopy and Microanalysis, 2025: Roles of Pretraining in High-throughput X-ray Computed Laminography Image Restoration [Oral]
3. Gorden Research Conference - Tissue Microstructure Imaging, 2025: High-Resolution Tomographic Imaging of Microstructure with a Plenoptic Laboratory Hard X-Ray System [Poster]
4. Tomography for Scientific Advancement - North America, 2025: A laboratory system for high-resolution X-ray phase tomography [Poster]
5. SPIE Optics and Photonics, 2023: Self-supervised deep image restoration for X-ray computed laminographic tomography [Oral]
6. Optica Computational Optical Sensing and Imaging, 2023: Multi-Scale Speckle-Plethysmography With a Multi-Camera Array Microscope [Oral]
7. Optica Computational Optical Sensing and Imaging, 2023: Anisotropic Intensity Diffraction Tomography [Oral]
8. SPIE Photonics West, 2023: Unsupervised deep image restoration for gigapixel microscopy [Oral]
9. IEEE International Conference on Computational Photography, 2022: Tensorial tomographic differential phase contrast microscopy [Oral]
10. OSA Biophotonics congress, 2022: Speckle contrast diffuse correlation spectroscopy with parallelized single photon detection [Oral]
11. SPIE Optical Systems Design, 2021: Imaging anisotropy with vectorial Fourier ptychography. [Oral]
12. IEEE International Conference on Computational Photography, 2021: Imaging deep within dynamic scattering media via SPAD array detection. [Oral]
13. OSA Biophotonics congress, 2021: Rapid imaging of deep-tissue motion with parallelized diffuse correlation spectroscopy. [Oral]
14. SPIE Photonics West, 2021: Imaging decorrelation via deep learning and SPAD array detection. [Oral]
15. OSA Computational Optical Sensing and Imaging, 2020: Classifying decorrelation events hidden beneath scattering media via SPAD array detection. [Oral]
16. SPIE Photonics West, 2019: Ultrasound-guided diffuse optical tomography using iterative Born approximation with sparse regularization. [Oral]

Book chapters

1. Kreiss, L., Zhou, K.C., Cook, C.B., Xu, S., Chaware, A. and Horstmeyer, R., 2024. Innovations in signal/image processing and data analysis in optical microscopy. In Biophotonics and Biosensing (pp. 349-389). Elsevier.

Professional services

- Reviewers of Advanced Science, Advanced Photonics Nexus, Applied Optics, Light Science & Applications, Optics Communications, Optics Express, Optics Letters, Photonics Research, Transactions on Computational Imaging, Journal of OSA-A, and Journal on Imaging Sciences.

Honors and Award

- 2020 Duke Theo Pilkington Fellowship in Biomedical Engineering
- 2019 Duke Biomedical Engineering Scholar Award

Teaching

- Spring 2022: Teaching assistant of BME548 Machine Learning and Imaging at Duke University
- Fall 2022: Teaching assistant of BME671 Signal Processing and Applied Mathematics at Duke University

Supervised students

- Zijing Guo: Previous summer intern at Zeiss; currently pursuing Ph.D. in nano-neurotechnology at Rice University.
- Xiang Dai: Previous M.S. student in Computational Optics Lab at Duke University; currently pursuing Ph.D. in computer vision at the University of California, San Diego.
- Xing Yao: Previous M.S. student in Computational Optics Lab at Duke University; currently pursuing Ph.D. in medical imaging analysis at Vanderbilt University.