Yongyi Zhao

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Introduction: My research is in computational imaging and machine learning for end-to-end hardware and algorithm co-design. I have worked on several projects spanning data-driven biomedical optical imaging, neural rendering, polarimetric imaging, metasurface design, and AI mobile processing. My research has been published in top tier journals (Optica, TPAMI) and conferences (ECCV, ICCP). I am fluent in scripting languages (Python, Matlab), machine learning frameworks (Pytorch), and experienced with system-level languages (C/C++, Cuda), and rendering/3D design software (Blender, Solidworks, Mitsuba).

Education

Rice University	**Houston, TX**
Doctor of Philosophy in Electrical and Computer Engineering	**Jan 2024**
Master of Science in Electrical and Computer Engineering	**Mar 2021**
Adviser: Professor Ashok Veeraraghavan	
Carnegie Mellon University	**Pittsburgh, PA**
Bachelor of Science in Electrical and Computer Engineering	**Dec 2017**
With University Honors; **GPA: 3.93/4.00**	

Professional Experience

Computer Vision Engineer at Metalenz — **Boston, MA (remote)**, **Feb 2024 – Present**
- ❖ Developing algorithms for PolarID: secure face ID authentication

Research intern at Samsung Research America — **Plano, TX**, **May 2023 – Aug 2023**
- ❖ Worked in Mobile Processor Innovations (MPI) team
- ❖ Developed AI algorithm for mobile image processing

Software Development Engineer Intern at Amazon.com — **Seattle, WA**, **May 2017 – Aug 2017**
- ❖ Worked on Amazon AWS, Elastic Compute Cloud Team
- ❖ Designed and implemented a container service

Research Projects

Metalens for Privacy Preserving Imaging — **Jan 2023 – Jan 2024**
- ❖ Designed/implemented a differentiable metalens simulator for end-to-end optimization in privacy-preservation

Optically Asymmetric Plume Design — **Sep 2022 – Jan 2024**
- ❖ Developed a differentiable renderer for end-to-end optimization of asymmetric plumes (a plume that selectively degrades image quality based on viewing direction), using implicit neural representations
- ❖ Tested results on both simulated (rendered) and experimental measurements in VIS and IR

Computational Imaging through Dense Scatterers (Links to **JBO** and **TPAMI** papers) — **Aug 2019 – Mar 2023**
- ❖ Implemented FISTA/ADMM solvers in Matlab and unrolled neural network in Pytorch for DOT inverse solver
- ❖ Demonstrated high resolution image reconstruction on simulated/experimental CW/ToF-DOT datasets
- ❖ Simulated light propagation and Jacobian matrix for arbitrary scattering media, parallelized in Cuda (Code **link**)

Neural Renderer for Polarimetric Imaging (Link to **ECCV** paper) — **Oct 2021 – Mar 2022**
- ❖ Designed and implemented polarimetric neural rendering pipeline using implicit neural representations
- ❖ Demonstrated performance on inverse rendering tasks (i.e. diffuse-specular separation) on experimental data

Publications

Peer reviewed journal and conference papers

[10] Raghuram A.[*] **Zhao Y.**[*] "GDOT: Time-Gated Diffuse Optical Tomography." *Journal of Biomedical Optics*. In preparation.

[9] Tasneem Z., **Zhao Y.**, et al. "Privacy-aware Meta-Optics for Person Detection." *ACS Photonics*. Under Review.

[8] Guo Z., **Zhao Y.**, "Noninvasive monitoring of fetal tissue oxygenation level using time-domain NIRS." *Journal of Biomedical Optics.* (2025).

[7] **Zhao Y.**[*], Farrell S.[*], et al. "SCREEN: SCatteREr ENabled optical asymmetry." *Optica*. (2025).

[6] Guo Z., Yang Y., **Zhao Y.**, et al. "High spatial resolution diffuse optical tomography with directional information." *Optics Letters.* (2025).

[5] Wang F., Kim H. K., Zhao Y., et al. "High-Speed Time-Domain Diffuse Optical Tomography With a Sensitivity Equation-Based Neural Network." *IEEE Transactions on Computational Imaging*. (2023).

[4] **Zhao Y.**, Raghuram A., et al. "Unrolled-DOT: An Interpretable Deep Network for Diffuse Optical Tomography." *Journal of Biomedical Optics*. (2023).

[3] Dave A., **Zhao Y.**, Veeraraghavan A. "PANDORA: Polarization-Aided Neural Decomposition Of Radiance." *European Conference on Computer Vision (ECCV)*. (2022).

[2] Kim H. K., **Zhao Y.**, et al. Ultrafast and Ultrahigh-Resolution Diffuse Optical Tomography for Brain Imaging with Sensitivity Equation based Noniterative Sparse Optical Reconstruction (SENSOR). *JQSRT*. (2021).

[1] **Zhao Y.**[*], Raghuram A.[*], et al. "High Resolution, Deep Imaging Using Confocal Time-of-flight Diffuse Optical Tomography." *IEEE Transactions on Pattern Analysis and Machine Intelligence*. (2021).

[*]Indicates authors contributed equally

Patents

[1] **Zhao Y.**, Raghuram A., et al. "GDOT: Gated Diffuse Optical Tomography," US20230233085A1. Patent Pending.

Book chapters

[1] Raghuram A., **Zhao Y.**, et al. "Measuring Physiological Parameters Under the Skin Using Visible/NIR Light." Encyclopedia of Sensors and Biosensors 4, pp. 133-142. (2023) Book Chapter.

Posters and presentations

[2] Kim H. K., Raghuram A., **Zhao Y.** et al. "Ultrahigh spatiotemporal resolution fluorescence molecular tomography with a sparsity constrained dimensional reduction reconstruction model." *High-Speed Biomedical Imaging and Spectroscopy VII.* (2022). Poster.

[1] **Zhao Y.** "Real-time Algorithms for Non-Invasive Imaging Through the Skull." *NLM Informatics Research Training Conference.* 2021. Oral Presentation.

Fellowships and Awards

National Library of Medicine Fellowship in Bioinformatics and Data Science   **Jan 2021 – Dec 2022**
- ❖   2-year fellowship with $25,320 stipend and partial tuition support

Best Paper Runner-Up at IEEE ICCP for Confocal ToF-DOT paper   **May 2021**

John Clark Jr. Fellowship Award   **Aug 2018**
- ❖ Fellowship supporting first-year graduate studies at Rice University

Frank J. Marshall Scholar Award   **May 2018**
- ❖ Annual award for one graduating CMU ECE undergraduate for academics and research

Skills

Programming/Computing:
- ❖ **Strong:** Python (including PyTorch, OpenCV, Numpy libraries), Matlab
- ❖ **Proficient:** C/C++, Cuda, Linux, Blender, Rapid prototyping (SLA and FDM 3D printing)
- ❖ **Working understanding:** Version Control (Git), SolidWorks, Mitsuba (physics-based renderer), Laser cutting

Experimental:
- ❖ Optical system design (i.e. constructing scanning and fiber-based time domain diffuse optical imaging system)
- ❖ Imaging on model organisms (e.g. mice, sheep)

Volunteer / Service

Teaching Assistant (TA)
- ❖ Served as an ECE TA for 9 semesters (3 during undergraduate; 6 during PhD); courses included: signal processing, computer architecture, digital logic design, introductory programming, and deep learning
- ❖ Performed TA tasks including teaching recitations, special topic lectures, grading, and office hours

Research Mentor
- ❖ Mentored 3 Rice University undergraduate students (for 7 semesters total) in computational imaging research
- ❖ Mentored six middle and high school teachers in Houston ISD for PATHS-UP RET program (Summer 2019)