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)**
❖ Developing algorithms for PolarID: secure face ID authentication   **Feb 2024 – Present**

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

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

Research Projects

Metalens Ray Tracer   **Aug 2022 – Jan 2024**
❖ Implementing a differentiable ray tracer for metalens design in Pytorch
❖ Implementing a differentiable RCWA module and spline parameterization of Metasurface structures

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

Optically Asymmetric Plume Design   **Sep 2022 – Jan 2024**
❖ Developing a differentiable renderer for end-to-end optimization of asymmetric plumes (a plume that selectively degrades image quality based on viewing direction)
❖ Testing 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 network in Pytorch for DOT inverse solver
❖ Demonstrated high resolution image reconstruction on simulated/experimental CW/ToF-DOT datasets

Physics-based renderer for densely scattering media (Code **link**)   **Aug 2019 – Mar 2023**
❖ Simulated light propagation and Jacobian matrix for arbitrary scattering media, parallelized in Cuda C++
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

Selected Publications and Patents

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

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

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).

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

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

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).

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.

[*]Indicates authors contributed equally

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 six semesters (e.g. signal processing, computer architecture, and deep learning)
- ❖ Performed TA tasks including grading, office hours, and supplemental lectures

Research Mentor
- ❖ Mentored three Rice University undergraduate students in research on imaging through scattering media
- ❖ Mentored six middle and high school teachers in Houston ISD for PATHS-UP RET program (Summer 2019)