Yongyi Zhao

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Introduction: My research interests lie at the intersection between 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 both top tier journals, such as IEEE TPAMI, and conferences such as 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**
Master of Science in Electrical and Computer Engineering — **Mar 2021**
Doctor of Philosophy in Electrical and Computer Engineering — **Dec 2023** (Expected)
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**

Research Projects

Metalens Ray Tracer — **Aug 2022 – Present**
- ❖ Implemented a differentiable ray tracer for metalens design in Pytorch
- ❖ Implemented differentiable RCWA module and spline parameterization of Metasurface structures

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

Optically Asymmetric Plume Design — **Sep 2022 – Present**
- ❖ Developing 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**
- ❖ Simulates 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., 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).
Notable Paper: ICCP Conference Best-Paper Runner-Up

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. 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; $25,320 stipend and partial tuition support

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

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

Professional Experience

Research intern at Samsung Research America **Plano, TX**
- AI Researcher on the Mobile Processor Innovations (MPI) team **May 2023 – Aug 2023**

Software Development Engineer Intern at Amazon.com **Seattle, WA**
- Working on Amazon AWS, Elastic Compute Cloud Team **May 2017 – Aug 2017**
- Designing and implementing container service

Skills

Programming/Computing:
- **Strong:** Python (including PyTorch, OpenCV, Numpy libraries), Matlab
- **Proficient:** C/C++, Cuda, Linux, Mitsuba, Blender
- **Working understanding:** Version Control (Git), SolidWorks, Mitsuba (physics-based renderer)

Experimental:
- Optical system design (constructed scanning and fiber-based time domain diffuse optical imaging system)
- Conducted imaging experiments on model organisms (mice, sheep)

Volunteer / Service

Teaching Assistant (TA)
- TA for six semesters for ECE courses including signal processing, computer architecture, and deep learning
- Performed TA tasks including grading, office hours, and supplemental lectures

Research Mentor **Jan 2019 – May 2021**
- Mentored three Rice University undergraduate students in research on imaging through scattering media
- Mentored 6 middle-high school teachers in Houston ISD as part of PATHS-UP RET program