# HAIYUN GUO

haiyunguo7.github.io
hg39@rice.edu

## ABOUT ME

Ph.D. candidate specializing in computational photography and optical imaging, focusing on end-to-end learning, physics-based neural networks and optimization algorithms.

Expertise in image restoration and reconstruction — including descattering, distortion correction, super-resolution of images/videos, and differentiable ray tracing.

Proficient in designing and building optical systems, versed in adaptive optics and holography.

Passionate about advancing imaging and display technologies through innovative computational methods and optical engineering, particularly for mobile and VR/AR applications.

## EDUCATION

**Rice University** **2021– present**
PhD in Electrical and Computer Engineering | Advisor: Ashok Veeraraghavan

**University of Dayton** **2019 – 2021**
M.S. in Electro-Optics and Photonics

**Huazhong University of Science and Technology** **2016 – 2020**
B.E. in School of Optical and Electronic Information

## EXPERIENCE

**CVML and Deep Optics Intern | Glass Imaging, Inc.** **May – Aug 2024**
Develop a differentiable ray tracing model for complex mobile lenses that matches Zemax accuracy with faster computation. Utilize a few calibration images and backpropagation through the physical model to detect hardware misalignments and optimize lens assembly design.

**Aberration Correction with Neural Representations | Science Advance** **2022**
Utilize neural signal representations with tailored positional encodings for objects, aberrations, and motions to correct dynamic wavefront aberrations. Build an optical system demonstrating the reconstruction of distorted, time-varying scenes to the diffraction limit.

**End-to-End Optimization of Wavefront Modulation Patterns | CVPR** **2023**
Use a lightweight proxy reconstruction network to learn optimal modulation patterns to recover scenes obscured by scattering. Optimized patterns enhance the imaging system's MTF, preserving more high-frequency information thus achieving a 3.9 dB improvement in reconstructions.

**Efficient Computational Microscopy via Physics-Based Network | Optica** **2023**
Combine implicit neural representations, efficient volume decomposition, and strategic optimization to efficiently solve Fourier Ptychographic Microscopy problems, reducing reconstruction time and data volume.

**Super-Resolution for Compressed Mid-Infrared Imaging** **2024**
Apply channel attention mechanisms and deep residual networks to reconstruct compressed images for cost-intensive mid-infrared cameras, and implement bidirectional optical flow and temporal modeling for videos.

**Super-Resolution Endoscopic Imaging via Aberration Redundancy Exploitation** **2024**
Develop a method leveraging the continuity and redundancy of dynamic aberrations caused by ultra-short-time fiber vibrations to estimate clear images, and jointly optimize warp parameters to locate captured views. Resolution limited by fiber cores is restored to the optical system’s diffraction limit.

## SKILLS

- Python | PyTorch (proficient)
- Lumerical FDTD Solutions
- 3D Printing
- MATLAB (proficient)
- Nanoscribe Lithography
- Laser Collimation
- Zemax (Optical Design)
- Laser Cut

## PUBLICATIONS

* denotes equal contribution.

- **WaveMo: Learning Wavefront Modulations to See Through Scattering.** ***CVPR 2024***
  H. Guo*, M. Xie*, B. Feng, L. Jin, A. Veeraraghavan, C. Metzler.
- **FPM-INR: Fourier ptychographic microscopy image stack reconstruction using implicit neural representations.** ***Optica (2023)***
  H. Zhou*, B. Feng*, H. Guo, S. Lin, M. Liang, C. Metzler, C. Yang.
- **NeuWS: Neural wavefront shaping for guidestar-free imaging through static and dynamic scattering media**. ***Science Advances (2023)***
  H. Guo*, B. Feng*, M. Xie, V. Boominathan, M. Sharma, A. Veeraraghavan, C. Metzler.
- **Use of structured light in 3D reconstruction of transparent objects.** ***Applied Optics (2022)***
  H. Guo, H. Zhou, P. Banerjee.
- **Non-recursive transport of intensity phase retrieval with the transport of phase.** ***Applied Optics (2022)***
  H. Zhou, H. Guo, P. Banerjee.
- **Single-shot digital phase-shifting Moiré patterns for 3D topography.** ***Applied Optics (2021)***
  H. Guo, H. Zhou, P. Banerjee.
- **Wavelength and power dependence on multilevel behavior of phase change materials.** ***AIP Advances (2021)***
  G. Sevison, J. Burrow, H. Guo, A. Sarangan, J. Hendrickson, I. Agha.
- **NeuWS: Neural Wavefront Shaping for Guidestar-Free Imaging Through Static and Dynamic Scattering Media.** *Asilomar Conference on Signals, Systems, and Computers. IEEE. (2023)*
  H. Guo*, B. Feng*, et al.
- **Neural Wavefront Shaping in the Photon-Starved Regime.** *Optica Imaging Congress COSI. (2023)*
  H. Guo*, B. Feng*, et al.
- **A Maskless Lithography System Based on Digital Micromirror Devices (DMD) and Metalens Arrays.** *CLEO: Applications and Technology. Optica Publishing Group. (2023)*
  S. Luo, K. Weber, H. Guo, W. Zhu, A. Agrawal, I. Agha.
- **Ptychographic coherent diffractive imaging, digital holography and structured light techniques for topographical 3D imaging.** *In Pattern Recognition and Tracking XXXII. SPIE. (2021).*
  M. Hussain, H. Guo, P. Banerjee. “