

Zachary Burns

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ABOUT ME

I am a PhD candidate who researches the use of **machine learning for computational imaging** and **optical inverse design**. I am currently open to **full-time jobs** in industry.

EXPERIENCE:

Meta (Reality Labs Research)

Research Scientist Intern

Sunnyvale, CA
June '24 – Sep. '24

- Contributed to the advancement of display technology for augmented reality (AR) devices
- Employed Rigorous Coupled Wave Analysis (RCWA) to simulate the optical responses of diffractive structures
- Trained neural network surrogate models to reduce simulation times by 3 orders of magnitude
- Developed a new workflow utilizing generative AI to optimize the geometry of diffractive optical structures
- Leveraged distributed computing techniques to parallelize optical simulations and reduced run times by 50x
- Demonstrated improvements in multiple AR device KPIs through the application of a newly developed optimization methodology

Element Biosciences

Associate Data Scientist I

San Diego, CA
Nov. '22 – Jan. '24

- Worked in R&D team focused on developing new computer vision algorithms for spatial multi-omics
- Used deep learning to improve recall and precision of genomics-related image analysis
- Experience working with Amazon Web Services to train models via cloud computing
- Optimized models to minimize size, decrease inference time, and deploy quantized versions to edge devices

Zhaowei Liu Research Group

Graduate Student Researcher

La Jolla, CA
Sep. '19 - Present

Untrained, Physics-Informed Neural Networks for Super Resolution Microscopy

- Built a differentiable optics pipeline using the imaging model for structured illumination microscopy
- Demonstrated 2x – 3x resolution improvement without the need for training data
- Improved image reconstruction in low signal-to-noise environments using the deep image prior concept
- Implemented open-source Jupyter Notebook demos using TensorFlow and hosted on GitHub for public use

Algorithm Unrolling for Blind Structured Illumination Microscopy

- Developed an unrolled neural network for structured illumination imaging with unknown illumination patterns
- Used physics-based, self-supervised learning to train without the need for ground truth data
- Improved resolution by 2x while increasing image reconstruction speed by 2 orders of magnitude
- Built a prototype microscopy system using a DMD for synchronized illumination patterns.
- Demonstrated improved generalization capabilities on out-of-distribution data and eliminated hallucinations

Data-Driven Off-Axis Metasurface Design

- Designed a metasurface deflector for imaging at off-axis sensor planes in compact settings
- Trained a differentiable surrogate model to simulate off-axis diffraction during the optimization process
- Optimized optical system point-spread functions with tandem neural-network to decrease aberrations and outperformed Zemax-based global optimization

EDUCATION:

University of California, San Diego

Doctor of Philosophy (Ph.D.) in Electrical Engineering
NSF Graduate Research Program Fellow

La Jolla, CA
2019 – 2025 (ABD)

University of Michigan

Bachelor of Science in Electrical Engineering
Bachelor of Science in Engineering Physics

Ann Arbor, MI
2015 - 2019
Summa Cum Laude

SKILLS:

Programming:	Python, MATLAB, C++
Frameworks:	PyTorch, JAX, Tensorflow, OpenCV, Sklearn, NumPy, Git, Jupyter, Amazon Web Services (AWS)
Optics and Imaging:	Fourier Optics, Diffractive Optics, Super Resolution, Microscopy, Camera Systems, RCWA, FDTD, FDFD, Computational Imaging
Algorithms:	Deep learning, Convex Optimization, Physics-Informed ML, Signal Processing, ADMM, Unrolled Algorithms, Explainable AI, Image Processing, Computer Vision

Publications: <https://scholar.google.com/citations?user=BB7j9iwAAAAJ&hl=en&oi=ao>