

# David Borts

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[DavidBorts.github.io](https://github.com/DavidBorts)

## STATEMENT

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My goal is to leverage deep learning methods to reconstruct information about the real world from noisy signals. I'm generally interested in neural inverse rendering and reconstruction, optimizing sensors and optical systems, and applications of machine learning to signal processing.

## EDUCATION

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### Princeton University

*Bachelor of Arts, Computer Science*

*Minor: Neuroscience*

*Departmental GPA: 3.82/4.0*

*Princeton, NJ*

*May 2023*

**Relevant Coursework:** Computer Vision, Neural Rendering, Foundations of Deep Learning, Theoretical Machine Learning, Computer Graphics, Foundations of Modern Optics, Natural Language Processing, Dynamics of Cognition, Computational Neuroscience, Algorithmic Game Theory

## RESEARCH EXPERIENCE

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### Princeton Computational Imaging Lab

*Advised by Prof. Felix Heide*

May 2022 - Present

- Led a collaborative project, co-advised by Professor Luc Van Gool at ETH Zurich, on neural geometry reconstruction and novel view synthesis from radar data. We derived a physical model of radar sensing, from which we could disentangle separate neural fields for scene occupancy and specular effects. We are submitting our work to SIGGRAPH 2024, with a preprint available on Arxiv.
- Currently leading a project on using deep learning methods to optimize holographic optical element (HOE) design. We developed a novel architecture for predicting point scatter functions (PSFs) from HOE optical parameters, and are integrating it into a differentiable optimization loop.
- Led a project on optimizing digital camera image signal processors (ISPs) with learned neural proxies. I built an open-source toolkit for training neural ISPs, released online as **DarkProxies**. [\[code\]](#)

### Princeton Lab for Quantitative and Computational Systems Neuroscience

*Advised by Prof. Carlos Brody*

Nov. 2023 - Present

- Currently leading a project to improve unsupervised learning methods for inferring low-dimensional neural circuit dynamics. We are developing a novel recurrent architecture, leveraging transformers to capture temporal relationships in neuronal data.

### Princeton New Instrument Research Lab

*Advised by Jeff Snyder*

Jan. 2022 - Present

- Collaborated extensively with Jeff on audio signal processing algorithms and standalone software instruments, including a library of audio-visual processing tools that rely on algorithms of emergent intelligence.
- Ongoing project on developing virtual instruments inspired by current models of neuron firing and connectivity.

## PROJECTS

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- **DarkProxies**, an open-source toolkit for training neural ISPs. Implemented with built-in support for Darktable, a popular photo-finishing application for photographers. Used by the Darktable community to unlock downstream computer vision and optimization tasks. [\[code\]](#)
- **Lerffusion**, a framework for editing object geometry in NeRF-based novel view synthesis under natural language instructions. Proposed a novel training paradigm that relies on language-grounding to localize objects and generatively inpaint them, while maintaining view consistency through an iterative dataset update procedure. [\[report\]](#)

- **Modular Video Synthesizer**, a virtual modular synthesis platform for custom video rendering. Hosted online, with a custom interactive frontend and signal processing backend, using graph algorithms to mimic the performance of equivalent hardware systems. [\[website\]](#) [\[tutorial and video demos\]](#) [\[code\]](#)
- **Emergence**, an open-source repository of canonical emergent swarm intelligence algorithms, all implemented in Max, a language for audio and image signal processing. Presented at Princeton's House of Sound 2022. [\[code\]](#)

## WORK EXPERIENCE

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**Researcher** Princeton Computational Imaging Lab June 2023 - Present

- Working as a full-time researcher, closely mentored by professor Felix Heide in deep learning and computer vision techniques, signal processing, as well as optics and holography.
- Led multiple research projects, ranging from geometry reconstruction to ISP and lens optimization.

**Teaching Assistant** Princeton Department of Computer Science Spring 2022

- Graded programming assignments for COS226 (Data Structures and Algorithms), providing feedback and guidance to students.