

# Kristina Monakhova

POSTDOCTORAL FELLOW · COMPUTATIONAL IMAGING · MIT

✉ monakhova@berkeley.edu   🏠 kristinamonakhova.com

## Education

### University of California, Berkeley

PH.D. IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCES

- Advisor: Prof. Laura Waller
- Dissertation: Physics-Informed Machine Learning for Computational Imaging [pdf]

Berkeley, CA

Aug. 2022

### The State University of New York at Buffalo

BS, ELECTRICAL ENGINEERING, TECHNICAL GPA: 4.00 / 4.00

Buffalo, NY

May 2016

## Research Focus

My research involves combining computational imaging with machine learning to make small, cheap, and capable task-specific cameras. My work is at the intersection of signal processing, optics, optimization, compressive sensing, and machine learning. I have worked on physics-informed learning for lensless imaging, single-shot 3D microscopy, compressive hyperspectral imaging, and low light photography.

## Research Experience

|   |                   |
|---|-------------------|
| <b>MIT Research Laboratory of Electronics (RLE)</b> , Postdoctoral Fellow working with Prof. Sixian You and Prof. George Barbastathis on Computational Biophotonics | fall 2022-present |
| <b>Berkeley Artificial Intelligence Research (BAIR) Lab</b> , Graduate Research Assistant in Prof. Laura Waller's Computational Imaging group                       | 2017-2022         |
| <b>Intel Intelligent Systems Lab</b> , graduate research intern with Dr. Vladlen Koltun   | spring 2021       |
| <b>MIT Lincoln Laboratory</b> , Advanced Sensor Systems and Test Beds Intern  | summer 2016       |
| <b>University at Buffalo Nanosatellite Laboratory</b> , undergrad researcher with Dr. Crassidis   | 2012-2016         |
| <b>Carnegie Mellon Robotics Institute</b> , RISS REU with Dr. Red Whittaker   | summer 2014       |
| <b>NASA Marshall Space Flight Center</b> , NASA Robotics Academy summer researcher  | summer 2013       |

## Academic Honors & Awards

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| <b>MIT Postdoctoral Fellowship for Engineering Excellence</b> , fellowship to support postdoctoral research at MIT | 2022        |
| <b>UC Berkeley EECS Demetri Angelakos Memorial Achievement</b> , for department service and altruism               | 2021        |
| <b>UC Berkeley EECS Chairs' Graduate Award</b> , for organizing EE Visit Days                                      | 2020        |
| <b>UC Berkeley EECS Excellence Award</b>   | 2016        |
| <b>National Science Foundation Graduate Research Fellowship (NSF GRFP)</b>   | 2016        |
| <b>National Defense Science and Engineering Graduate Fellowship (NDSEG)</b> , (declined for NSF GRFP)              | 2016        |
| <b>Barry M. Goldwater Scholarship</b>  | 2015        |
| <b>University at Buffalo Presidential Scholarship</b> , four year full-ride scholarship                            | 2012 – 2016 |

# Teaching

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## GRADUATE TEACHING ASSISTANT, UC BERKELEY

### EE16A - Designing Information Devices and Systems I

Fall 2020

Discussion TA for large ~900 student introductory undergraduate class, led interactive discussion sections (~30-40 students) over Zoom, wrote exam question, held office hours, part of inclusion-team, held review sessions for students, ran an intro to research discussion.

### EE16A - Designing Information Devices and Systems I

Summer 2020

Content development - adapted a single-pixel imaging lab for remote instruction to allow students to build and analyze a single-pixel imager at home.

### EE290T - High dimensional data analysis with low dimensional models

Fall 2018

New graduate class on compressive sensing and low-rank models. Created jupyter notebook-based programming assignments and interactive lab discussions. Taught bi-weekly discussion section and one lecture.

# Publications

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\*indicates equal contribution

† indicates undergraduate researcher under my supervision

## JOURNAL AND JOURNAL EQUIVALENT PUBLICATIONS

1. Michael Hecht, Artur Yakimovich, **Kristina Monakhova**, Laura Waller, et al., “Roadmap on Machine Learning for Microscopy”, (in preparation for JPhys Photonics)
2. **Kristina Monakhova**, Stephan Richter, Laura Waller, Vladlen Koltun, “Dancing under the stars: video denoising in starlight,” CVPR 2022 (Oral, 4% acceptance rate), [pdf]
3. Kyrollos Yanny\*, **Kristina Monakhova\***, Richard W. Shuai, Laura Waller, “Deep learning for fast spatially-varying deconvolution,” Optica, 9 (1), 2022 [pdf]
4. **Kristina Monakhova\***, Vi Tran\*†, Grace Kuo, Laura Waller, “Untrained networks for compressive lensless photography,” Opt. Express 29, 20913-20929 (2021) [pdf]
5. **Kristina Monakhova\***, Kyrollos Yanny\*, Neerja Aggarwal, Laura Waller, “Spectral DiffuserCam: lensless snapshot hyperspectral imaging with a spectral filter array,” Optica, 7 (10), pp. 1298–1307, 2020 [pdf]
6. Kyrollos Yanny\*, Nick Antipa\*, William Liberti, Sam Dehaeck, **Kristina Monakhova**, Fanglin Lina Liu, Konlin Shen, Ren Ng, and Laura Waller, “Miniscope3D: optimized single-shot miniature 3D fluorescence microscopy,” Light: Science & Applications, 9 (171), 2020 [pdf]
7. **Kristina Monakhova**, Joshua Yurtsever†, Grace Kuo, Nick Antipa, Kyrollos Yanny, and Laura Waller, “Learned reconstructions for practical mask-based lensless imaging,” Opt. Express 27, 28075-28090 (2019) [pdf]

## CONFERENCE PUBLICATIONS

1. Christian Foley†, **Kristina Monakhova**, Kyrollos Yanny, Laura Waller, “Spectral DefocusCam: Hyperspectral Imaging Using Defocus and A Spectral Filter Array,” Imaging and Applied Optics Congress, CF2C, Optical Society of America, 2022. [pdf]
2. Neerja Aggarwal, Eric Markley, **Kristina Monakhova**, Kyrollos Yanny, Laura Waller, “Compact snapshot hyperspectral imager for fluorescence microscopy,” Focus on Microscopy, 2022 [pdf]
3. Richard W. Shuai\*, Kyrollos Yanny\*, **Kristina Monakhova**, Laura Waller, “MultiWienerNet: Deep Learning for Fast Shift-Varying Deconvolution,” Imaging and Applied Optics Congress, CTh5A.5, Optical Society of America, 2021.[pdf]
4. **Kristina Monakhova\***, Kyrollos Yanny\*, and Laura Waller, “Snapshot hyperspectral imaging using a random phase mask and spectral filter array,” Imaging and Applied Optics Congress, pp. JF2F.4, Optical Society of America, 2020. [pdf]
5. Grace Kuo, **Kristina Monakhova**, Kyrollos Yanny, Ren Ng, and Laura Waller, “Spatially-varying microscope calibration from unstructured sparse inputs,” Imaging and Applied Optics Congress, pp. CF4C.4, Optical Society of America, 2020. [pdf]
6. Ellin Zhao†, Nicolas Deshler†, **Kristina Monakhova**, Laura Waller, “Multi-sensor lensless imaging: synthetic large-format sensing with a disjoint sensor array.” Imaging and Applied Optics Congress, pp. CF2C.6, Optical Society of America, 2020. [pdf]

7. Kyrollos Yanny, Nick Antipa, William Liberti, Sam Dehaeck, **Kristina Monakhova**, Fanglin Lina Liu, Konlin Shen, Ren Ng, and Laura Waller, “Compressed Sensing Mask-based Miniature 3D Fluorescence Microscopy” Imaging and Applied Optics Congress, pp. CW4B.5, Optical Society of America, 2020. [pdf]
8. **Kristina Monakhova**, Nick Antipa, and Laura Waller, “Learning for lensless mask-based imaging,” in Computational Optical Sensing and Imaging, pp. CTu3A-2, Optical Society of America, 2019 [pdf]

## WORKSHOPS AND POSTERS

1. **Kristina Monakhova\***, Vi Tran<sup>\*†</sup>, Grace Kuo, Laura Waller, “Untrained networks for compressive lensless photography” in CVPR Computational Cameras and Displays (CCD) Workshop, June 2021 (spotlight talk)
2. **Kristina Monakhova\***, Kyrollos Yanny\*, Neerja Aggarwal, Laura Waller, “Spectral DiffuserCam: lensless snapshot hyperspectral imaging with a spectral filter array,” in CVPR Computational Cameras and Displays (CCD) Workshop, June 2020 (spotlight talk)
3. Grace Kuo, Fanglin (Linda) Liu, **Kristina Monakhova**, Kyrollos Yanny, Ren Ng, Laura Waller, “On-chip fluorescence microscopy with a random microlens diffuser,” in 2020 ICCP Conference, St. Louis, MO, Apr. 2020 (poster)
4. **Kristina Monakhova**, Joshua Yurtsever<sup>†</sup>, Grace Kuo, Nick Antipa, Kyrollos Yanny, Laura Waller, “Unrolled, model-based networks for lensless imaging,” 2019 NeurIPS Deep Inverse Workshop (poster)
5. **Kristina Monakhova**, Nick Antipa, Laura Waller, “Learning reconstructions for lensless imaging,” in 2019 Physics in ML Workshop, Berkeley, CA, May. 2019 (poster)
6. **Kristina Monakhova**, Kyrollos Yanny, Fanglin Linda Liu, Evan Shelhamer, Emrah Bostan, Laura Waller, “Deep Diffusers - machine learning for lensless imaging,” in 2018 ICCP Conference, Pittsburgh, PA, May. 2018 (poster)
7. Regina Eckert, **Kristina Monakhova**, Zachary F. Philips, Yongbing Zhang, Lei Tian, Laura Waller, “Advances in 3D Fourier Ptychography,” in 2017 ICCP Conference, Stanford, CA, May. 2017 (poster)

## Invited Talks

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| <b>MIT Media Lab Camera Culture Talk</b>   | summer 2022 |
| Talk: “Video denoising in starlight using a learned, physics-informed noise model”               |             |
| <b>Google Computational Imaging Workshop</b>   | summer 2022 |
| Talk: “Video denoising in starlight using a learned, physics-informed noise model”               |             |
| <b>CVPR Computational Cameras and Displays Workshop</b>  | summer 2022 |
| Talk: “Physics-informed machine learning for lensless computational cameras”                     |             |
| <b>Warren Grundfest Lectures in Computational Imaging</b>  | spring 2022 |
| Talk: “Video denoising in starlight using a learned, physics-informed noise model”               |             |
| <b>Harvard Computational Imaging Seminar</b>   | spring 2022 |
| Talk: “Physics-informed machine learning for compressive computational cameras”                  |             |
| <b>Berkeley Photobears Lightning Talk Series</b>   | fall 2020   |
| Talk: “Compressive snapshot hyperspectral Imaging using a diffuser and a spectral filter array”  |             |
| <b>Berkeley Center for Computational Imaging Seminar Series</b>                                  | fall 2019   |
| Talk: “Practical mask-based lensless imaging reconstructions based on physics and deep learning” |             |
| <b>Berkeley Artificial Intelligence Research Lab Seminar Series</b>                              | fall 2019   |
| Talk: “Using physics and deep learning for practical imaging without a lens”                     |             |

## Advising

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### GRADUATE RESEARCH

Yaying Zhao (UC Berkeley master’s student, now at Facebook) summer 2020

### UNDERGRADUATE RESEARCH

|   |                     |
|---|---------------------|
| Christian Foley (currently at UC Berkeley)                                      | fall 2021 - present |
| Shamus Li (currently at UC Berkeley)  | spring 2021 - 2022  |
| Mbalenhle Holt (BAIR REU, targeted at HBCUs)                                    | summer 2021         |
| Georgia Channing (SUPERB REU, now at Global Computing Laboratory)               | summer 2021         |
| Vi Tran (Transfer to Excellence REU, now at UC Berkeley)                        | summer/fall 2020    |
| Trisha Sanghal (now a Software Engineer at Orchard)                             | 2019-2020           |
| Jonathan Fung (now at Scale AI)   | fall 2019           |
| Kristie Diep (BioESP REU, now at Medtronic)                                     | summer 2019         |
| Ellin Zhao (now a PhD student at UCLA with Prof. Achuta Kadambi)                | 2018- 2020          |
| Joshua Yurtsever (now a Software Engineer at Google)                            | 2018-2020           |
| Nico Deshler (SUPERB REU, now a PhD student in Optics at University of Arizona) | 2018-2020           |

## Service & Mentoring

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| <b>UC Berkeley EECS Peer Mentor</b>  | 2019-2022   |
| Held regular office hours to discuss issues and support junior PhD students  |             |
| <b>Berkeley Artificial Intelligence Research Mentoring (BAIR) Program</b>  | 2018-2021   |
| Mentored undergraduate students from underrepresented groups interested in AI research   |             |
| <b>Equal Access for Application Assistance (EAAA) program</b>  | fall 2021   |
| Volunteer application material reviewer to support diverse applicants to PhD programs  |             |
| <b>BAIR REU</b>  | summer 2021 |
| Research mentor for REU program for undergraduates from underrepresented backgrounds at HBCUs interested in AI research.   |             |
| <b>WICSE 1st year mentoring program</b>  | 2017-2021   |
| Served as a mentor for 1st year female-identifying PhD students in the EECS Department   |             |
| <b>UC Berkeley Transfer-to-Excellence (TTE) REU</b>  | summer 2020 |
| Mentored an undergraduate researcher throughout summer REU program targeted at community college students coming from low-income backgrounds or underserved communities. Resulted in a journal paper for the student and the student successfully transferring to UC Berkeley.   |             |
| <b>EE Visit Days Coordinator</b>   | spring 2020 |
| Organized the first Virtual Visit Days for admitted EECS PhD students. Organized peer advising program, matching all admitted students with a current graduate student mentor. Coordinated with underrepresented minority groups to hold virtual panels and discussions for admits. Coordinated student volunteers to promote casual admit-student interaction in a virtual setting, including virtual tours and hangouts. |             |
| <b>UC Berkeley EECS PhD Admissions Committee</b>   | winter 2020 |
| Reviewed PhD applications for the Signal Processing track in the EECS department.  |             |
| <b>UC Berkeley Bioengineering Scholars Program (BioESP) Mentor</b>   | summer 2019 |
| Mentored bioengineering undergraduate researcher throughout summer research program.   |             |
| <b>UC Berkeley SUPERB REU Mentor</b>   | summer 2018 |
| Mentored undergraduate researcher during summer REU on a project involving thin, 3D cameras in array geometries. Student was selected to represent UC Berkeley at the 2018 REU Symposium.  |             |
| <b>Electrical Engineering Graduate Student Association</b>   | 2017-2018   |
| Served as social chair, worked to create inclusive and friendly environment for graduate students.   |             |
| <b>Women in Computer Science and Electrical Engineering (WICSE)</b>  | 2017-2018   |
| Organized events to promote diversity and inclusively within the EECS PhD program, including visit day events for female-identifying students, and mentorship program for 1st year PhD students  |             |

## Professional Activities

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### PROFESSIONAL HONORS

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| Selected Participant, Rising Stars in EECS                                  | 2020 |
| Selected Participant, NextProf Nexus Workshop                               | 2020 |
| Selected Participant, Future Digileaders, KTH Royal Institute of Technology | 2019 |

## PROGRAM COMMITTEES

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| CVPR Computational Cameras and Displays Workshop | 2021 |
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## PAPER REVIEWING

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| IEEE Transactions on Pattern Analysis and Machine Intelligence | 2020-present   |
| IEEE Transactions of Computational Imaging                     | 2018 - present |
| Optica - Continuum, Optics Letters, Optics Express             | 2019-present   |