Kristina Monakhova

Postdoctoral Fellow · Computational Imaging · MIT
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Education

University of California, Berkeley *Berkeley, CA*
Ph.D. in Electrical Engineering and Computer Sciences *Aug. 2022*

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

The State University of New York at Buffalo *Buffalo, NY*
BS, Electrical Engineering, Technical GPA: 4.00 / 4.00 *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

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

Academic Honors & Awards

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

Teaching

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 to promote student engagement, held review sessions for students, organized 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

TA for 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 guest lecture.

Publications

*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*†, 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†, 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

Cornell Artificial Intelligence Seminar fall 2022
Talk: Physics-informed machine learning for computational imaging

MIT Media Lab Camera Culture Talk summer 2022
Talk: "Video denoising in starlight using a learned, physics-informed noise model"

Google Computational Imaging Workshop summer 2022
Talk: "Video denoising in starlight using a learned, physics-informed noise model"

CVPR Computational Cameras and Displays Workshop summer 2022
Talk: "Physics-informed machine learning for lensless computational cameras"

Warren Grundfest Lectures in Computational Imaging spring 2022
Talk: "Video denoising in starlight using a learned, physics-informed noise model"

Harvard Computational Imaging Seminar spring 2022
Talk: "Physics-informed machine learning for compressive computational cameras"

Berkeley Photobears Lightning Talk Series fall 2020
Talk: "Compressive snapshot hyperspectral Imaging using a diffuser and a spectral filter array"

Berkeley Center for Computational Imaging Seminar Series fall 2019
Talk: "Practical mask-based lensless imaging reconstructions based on physics and deep learning"

Berkeley Artificial Intelligence Research Lab Seminar Series fall 2019
Talk: "Using physics and deep learning for practical imaging without a lens"

Advising

Graduate students

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

Undergraduate students

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 Univ. of Arizona) 2018-2020

Service & Mentoring

UC Berkeley EECS Peer Mentor 2019-2022
Held regular office hours to discuss issues and support junior PhD students

Berkeley Artificial Intelligence Research Mentoring (BAIR) Program 2018-2021
Mentored undergraduate students from underrepresented groups interested in AI research

Equal Access for Application Assistance (EAAA) program fall 2021
Volunteer application material reviewer to support diverse applicants to PhD programs

BAIR REU summer 2021
Research mentor for REU program for undergraduates from underrepresented backgrounds at HBCUs interested in AI research.

WICSE 1st year mentoring program 2017-2021
Served as a mentor for 1st year female-identifying PhD students in the EECS Department

UC Berkeley Transfer-to-Excellence (TTE) REU 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.

EE Visit Days Coordinator 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.

UC Berkeley EECS PhD Admissions Committee winter 2020
Reviewed PhD applications for the Signal Processing track in the EECS department.

UC Berkeley Bioengineering Scholars Program (BioESP) Mentor summer 2019
Mentored bioengineering undergraduate researcher throughout summer research program.

UC Berkeley SUPERB REU Mentor 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.

Electrical Engineering Graduate Student Association 2017-2018
Served as social chair, worked to create inclusive and friendly environment for graduate students.

Women in Computer Science and Electrical Engineering (WICSE) 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

Professional Honors

Selected Participant, Rising Stars in EECS, UC Berkeley 2020
Selected Participant, NextProf Nexus Workshop, University of Michigan 2020
Selected Participant, Future Digileaders, KTH Royal Institute of Technology 2019

Program Committees

CVPR Computational Cameras and Displays Workshop 2021

Paper Reviewing

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