KRISH KABRA

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RESEARCH FOCUS

My primary research mission is to develop <u>responsible computer vision</u> systems. I investigate novel methods to evaluate black-box vision models, with an emphasis on conducting <u>causal analyses</u> of learned feature representations and model outputs.

EDUCATION

Doctor of Philosophy, Electrical and Computer Engineering   Expected June 2026
Rice University
- <u>GPA</u>**:** 4.00/4.00
- <u>Advisor</u>: Prof. Guha Balakrishnan

Master of Science, Electrical and Computer Engineering   June 2021
University of California, Los Angeles
- <u>GPA</u>**:** 4.00/4.00
- <u>Advisor</u>: Prof. Achuta Kadambi
- <u>Thesis</u>: Diverse R-PPG: Contactless Smartphone Camera-based Heart Rate Estimation for Diverse Skin Tones and Scenes

Bachelor of Science, Physics   June 2019
University of California, Los Angeles
- <u>GPA</u>**:** 3.78/4.00, Cum Laude

RESEARCH EXPERIENCE

Graduate Student Researcher   August 2021 – Present
Department of Electrical & Computer Engineering, Rice University
- <u>Advisor</u>: Prof. Guha Balakrishnan
- Researching methods to better understand and evaluate deep learning-based computer vision systems.
- Utilized state-of-the-art image generation models to synthetically create facial image counterfactual pairs for causal analysis of perceptual evaluation metrics.
- Developed an automatic framework that combines large language models and vision-language models to reveal visual biases in datasets and image generation models.

AI/ML Research Intern   May 2024 – August 2024
Adobe (Location: San Jose)
- <u>Mentors</u>: Zhoutong Zhang, Yuting Yang

Graduate Student Researcher   April 2020 – June 2021
Department of Electrical & Computer Engineering, University of California, Los Angeles
- <u>Advisor</u>: Prof. Achuta Kadambi
- Constructed and compiled the world's first telemedicine-focused remote vital signs dataset, named VITAL, containing a large and diverse subject population in collaboration with UCLA Health
- Developed camera-based vital sign monitoring technology with focus on mitigating skin-tone performance bias, resulting in 22% enhancement of heart rate estimates for dark skin-tone subjects in the VITAL dataset
- Led weekly group meetings, journal club and coffee social hours, which included mentoring fellow research students, and creating a positive and productive social work environment

Undergraduate/Graduate Student Researcher   May 2017 – March 2020
Department of Physics & Astronomy, University of California, Los Angeles
- <u>Advisor</u>: Professor Pietro Musumeci
- Investigated laser shaping tools, such as spatial light modulators, for ultrafast electron photoinjector beamlines
- Conceptualized and conducted the world's first electron ghost imaging experiment, which utilized a computational imaging and compressive sensing framework
- Gained technical expertise with operating with ultrafast lasers, building table-top optics, and simulating experimental designs with MATLAB, Mathematica, and Zemax

SKILLS

<u>Programming languages:</u> Experienced: Python (NumPy, Matplotlib, Pandas, Scikit-Learn, OpenCV, PyTorch, PyTorch Lightning, Transformers, Diffusers, OpenAI API, Tensorflow, Keras), MATLAB | Basic: C++, R
<u>Software:</u> Git, Docker, Linux (Ubuntu), Label Studio
<u>Hardware:</u> Arduino, Raspberry Pi, Oscilloscopes, Soldering, Ultra-fast lasers, Spatial Light Modulators, Optical table-top prototyping

TEACHING EXPERIENCE

Teaching Assistant   Spring 2023, Spring 2024
COMP/ELEC 447/546: Introduction to Computer Vision (Rice University)
- <u>Instructor</u>: Prof. Guha Balakrishnan

D2K Fellow Mentor   Spring 2022, Spring 2023
COMP 449/549 DSCI 435/535: Applied Machine Learning and Data Science Projects (Rice University)
- <u>Instructor</u>: Dr. Arko Barman, Dr. Xinjie Lan
- <u>Sponsor organization</u>: Houston Audubon
- <u>Project</u>: Development of Machine Learning Algorithms for Precision Waterbird Monitoring

Undergraduate Teaching Assistant   Fall 2018, Winter 2019
Physics 117: Electronics for Physics Measurements (University of California, Los Angeles)
- <u>Instructor</u>: Dr. Christian Schneider

PREPRINTS & PUBLICATIONS

- **K. Kabra,** K. M. Lewis, G. Balakrishnan (2023). GELDA: A generative language annotation framework to reveal visual biases in datasets. *arXiv preprint arXiv: 2311.18064*
- **K. Kabra,** G. Balakrishnan (2023). F?D: On understanding the role of deep feature spaces on face generation evaluation. *arXiv preprint arXiv: 2305.20048*
- **K. Kabra**, A. Xiong, W. Li, M. Luo, W. Lu, R. Garcia, D. Vijay, J. Yu, M. Tang, T. Yu, H. Arnold, A. Vallery, R. Gibbons, A. Barman (2022). Deep object detection for waterbird monitoring using aerial imagery. 2022 21st IEEE International Conference on Machine Learning and Applications (ICMLA). IEEE, 2022.
- P. Chari, **K. Kabra**, D. Karinca, S. Lahiri, D. Srivastava, K. Kulkarni, T. Chen, M. Cannesson, L. Jalilian, A. Kadambi (2020). Diverse R-PPG: Camera-Based Heart Rate Estimation for Diverse Subject Skin-Tones and Scenes. *arXiv preprint arXiv:2010.12769.*
- **K. Kabra**, S. Li, F. Cropp, Thomas J. Lane, P. Musumeci, D. Ratner (2020). Mapping photocathode quantum efficiency with ghost imaging. *Phys. Rev. Accel. Beams, 23(2)*. doi:10.1103/PhysRevAccelBeams.23.022803
- S. Li, F. Cropp, **K. Kabra**, Thomas J. Lane, G. Wetzstein, P. Musumeci, D. Ratner (2018). Electron Ghost Imaging. *Phys. Rev. Lett., 121(11)*. doi:10.1103/PhysRevLett.121.114801

SERVICE

Electrical & Computer Engineering Graduate Student Association (Rice University)   January 2024 – Present
President
- Represented the interests of the ECE department graduate students (~100-200), primarily by organizing events, surveying graduate student wellbeing, and communicating with department faculty and staff.

Upsilon Lab (UCLA)   April 2018 – June 2019
President & Project Manager
- Taught undergraduate students digital electronics and microcontrollers through different projects. Led organization by ensuring the steady progress of projects and access to department resources.

Society of Physics Students (UCLA)   September 2017 – June 2018
Vice President
- Coordinated weekly meetings for undergraduates, including professor talks, student panels, social activities, and study halls.