Iksung Kang
275D Li Ka Shing Center, Berkeley, CA 94720, USA
Email : iksung.kang@berkeley.edu
Mobile : +1-617-449-8969

Research Interests

(Machine Learning + Physics) × High-resolution, Non-invasive Imaging
⟶ Physics-based Intelligent Imaging Platform

Employment

Postdoctoral Fellow, University of California - Berkeley — Berkeley, CA
Department of Neuroscience (Advisors: Na Ji, Stella X. Yu) — *Jul 2022 - June 2025*

(ML + Physics) × Optical Microscopy

- Developed ML-based adaptive optics for fluorescence microscopy using differentiable rendering (e.g., neural fields).
- Integrated with widefield and two-photon fluorescence microscopy systems to enable high-resolution imaging.
- Conducted *in vivo* structural and functional imaging of the mouse brain, imaging processing, and data analysis.
- Independently initiated projects on ML-based adaptive optics for fluorescence microscopy.

Graduate Research Assistant, Massachusetts Institute of Technology — Cambridge, MA
Department of Mechanical Engineering (Advisor: George Barbastathis) — *Jan 2019 – May 2022*

(ML + Physics) × Micro/Nanoscale Imaging

- Built coherent imaging systems for 2D (phase retrieval, holography) and 3D (limited-angle tomography) imaging.
- Designed algorithms using transformers, CNNs, and RNNs for inverse problems in multi-dimensional phase imaging.
- Conducted high-resolution structural imaging of μm-scale phase samples, image processing, and data analysis.
- Collaborated with national laboratories in U.S. and Switzerland on 3D nanoscale X-ray imaging of integrated circuits.
- Worked with the government agency (IARPA) to meet their milestones in integrated circuit imaging.

Undergraduate Researcher — Seoul, South Korea
Seoul National University, Electrical and Computer Engineering (Advisor: Jongho Lee) — *2016*

Undergraduate Research Intern — Seoul, South Korea
Seoul National University, Graduate School of Convergence Science and Technology — *2014*

Education

Massachusetts Institute of Technology — Cambridge, MA
Doctor of Philosophy, Department of Electrical Engineering and Computer Science — *2020 – 2022*

Massachusetts Institute of Technology — Cambridge, MA
Master of Science, Department of Electrical Engineering and Computer Science — *2017 – 2020*

Seoul National University — Seoul, South Korea
Bachelor of Science, Department of Electrical and Computer Engineering (as class valedictorian) — *2011 – 2017*

Peer-reviewed Journal

11. **Kang I**, Zhang Q, Yu SX, Ji N, "Coordinate-based neural representations for computational adaptive optics in widefield microscopy," ***Nature Machine Intelligence*** **(2024)** 6, 714-725. (IF: 18.8 (2023), Springer Nature). https://doi.org/10.1038/s42256-024-00853-3.

10. **Kang I**, Jiang Y, Holler M, Guizar-Sicairos M, Levi AFJ, Klug J, Vogt S, Barbastathis G, "Accelerated deep self-supervised ptycho-laminography for three-dimensional nanoscale imaging of integrated circuits," ***Optica*** **(2023)** 8, 1000-1008. (IF: 8.4 (2023), Optica Publishing Group). https://doi.org/10.1364/OPTICA.492666.

9. **Kang I**, Wu Z, Jiang Y, Yao Y, Klug J, Vogt S, Barbastathis G, "Attentional Ptycho-Tomography (APT) for three-dimensional nanoscale X-ray imaging with minimal data acquisition and computation time," ***Light: Science & Applications*** **(2023)** 12(131). (IF: 20.6 (2023), Springer Nature). https://doi.org/10.1038/s41377-023-01181-8.

8. Wu Z*, **Kang I***, Yao Y, Jiang Y, Deng J, Klug J, Vogt S, Barbastathis G, "Three-dimensional nanoscale imaging via deep neural networks and multi-angle ptychography (RAPID)," ***eLight*** **(2023)** 3(7). (*: co-first authors, IF: 27.2 (2023), Springer Nature). https://doi.org/10.1186/s43593-022-00037-9.

7. **Kang I**, de Cea M, Xue J, Li Z, Barbastathis G, Ram R, "Simultaneous spectral recovery and CMOS micro-LED holography with an untrained deep neural network," ***Optica*** **(2022)** 9(10), 1149-1155. (IF: 8.4 (2023), Optica Publishing Group). https://doi.org/10.1364/OPTICA.470712.

6. **Kang I**, Goy A, Barbastathis G, "Dynamical machine learning volumetric reconstruction of objects' interiors from limited angular views," ***Light: Science & Applications*** **(2021)** 10(74). (IF: 20.6 (2023), Springer Nature). https://doi.org/10.1038/s41377-021-00512-x.

5. **Kang I**, Pang S, Zhang Q, Fang N, Barbastathis G, "Recurrent neural network reveals transparent objects through scattering media," ***Optics Express*** **(2020)** 29(4), 5316-5326. (IF: 3.2 (2023), Optica Publishing Group). https://doi.org/10.1364/OE.412890.

4. Allan G*, **Kang I***, Douglas E, Barbastathis G, Cahoy K, "Deep residual learning for low-order wavefront sensing in high-contrast imaging systems," ***Optics Express*** **(2020)** 28(18), 26267-26283. (*: co-first authors, IF: 3.2 (2023), Optica Publishing Group). https://doi.org/10.1364/OE.397790.

3. Deng M, Li S, Zhang Z, **Kang I**, Fang N, Barbastathis G, "On the interplay between physical and content priors in deep learning for computational imaging," ***Optics Express*** **(2020)** 28(16), 24152-24170. (IF: 3.2 (2023), Optica Publishing Group). https://doi.org/10.1364/OE.395204.

2. **Kang I**, Zhang F, Barbastathis G, "Phase Extraction Neural Network (PhENN) with Coherent Modulation Imaging (CMI) for phase retrieval at low photon counts," ***Optics Express*** **(2020)** 28(15), 21578-21600. (IF: 3.2 (2023), Optica Publishing Group). https://doi.org/10.1364/OE.397430.

1. Deng M, Li S, Goy A, **Kang I**, Barbastathis G, "Learning to synthesize: Robust phase retrieval at low photon counts," ***Light: Science & Applications*** **(2020)** 9(36). (IF: 20.6 (2023), Springer Nature). https://doi.org/10.1038/s41377-020-0267-2.

Preprints

2. **Kang I**, Kim H, Natan R, Zhang Q, Yu SX, Ji N, "Adaptive optical correction for in vivo two-photon fluorescence microscopy with neural fields," ***bioRxiv*** **(2024)** 2024.10.20.619284. https://doi.org/10.1101/2024.10.20.619284 (minor revision at *Nature Methods*).

1. Kim S, Ko G, **Kang I**, Tian H, Fan LZ, Li Y, Cohen AE, Wu J, Dai Q, Choi MM, "Optical segmentation-based compressed readout of neuronal voltage dynamics," ***bioRxiv*** **(2023)** 2023.11.10.566599. https://doi.org/10.1101/2023.11.10.566599 (minor revision at *Nature Communications*).

Conference Proceedings & Presentations

11. Zhu J, Natan R, Zhong J, **Kang I**, Ji N, "Aberration measurement and correction for ultrafast two-photon fluorescence imaging," ***SPIE Photonics West*** **(2025)**. https://doi.org/10.1117/12.3041375.

10. **Kang I**, Zhang Q, Yaeger C, Pham T, Yu SX, Harnett M, Ji N, "Computational adaptive optics for in vivo two-photon fluorescence microscopy using coordinate-based neural representations," ***SPIE Photonics West*** **(2024)** 12851-9. https://doi.org/10.1117/12.3008468.

9. Barbastathis G, Pang S, **Kang I**, Wu Z, Liu Z, Guo Z, Zhang F, "On the use of deep learning for three-dimensional computational imaging," ***SPIE Photonics West*** **(2023)** 12445. https://doi.org/10.1117/12.2655261.

8. **Kang I**, Zhang Q, Ji N, "Deep self-supervised learning for computational adaptive optics in widefield microscopy," ***SPIE Photonics West*** **(2023)** 12388-34. https://doi.org/10.1117/12.2658934.

7. Kim S, Wu J, **Kang I**, Ko G, Tian H, Fan LZ, Li Y, Cohen AE, Dai Q, Choi MM, "Optical segmentation for compressed readout on sub-millisecond neuronal circuit dynamics – Diffractive Multisite Optical Segmentation Assisted Image Compression: DeMOSAIC)," ***Frontiers in Neurophotonics (FiNs)*** **(2022)**.

6. Wu Z, **Kang I**, Zhou T, Coykendall V, Ge B, Cherukara MJ, Barbastathis G, "Photon-starved X-ray Ptychographic Imaging using Spatial Pyramid Atrous Convolution End-to-end Reconstruction (PtychoSPACER)," ***Computational Optical Sensing and Imaging*** **(2022)** CF1D.6. https://doi.org/10.1364/COSI.2022.CF1D.6.

5. Kim S, Wu J, **Kang I**, Li Y, Tian H, Fan LZ, Cohen AE, Dai Q, Choi MM, "Adaptive image segmentation for crosstalk-free high-speed compressive imaging," ***Focus on Microscopy (FOM)*** **(2022)**.

4. **Kang I**, Yao Y, Deng J, Klug J, Vogt S, Honig S, Barbastathis G, "Three-dimensional reconstruction of integrated circuits by single-angle X-ray ptychography with machine learning," ***Computational Optical Sensing and Imaging*** **(2021)** CTu6A.4. https://doi.org/10.1364/COSI.2021.CTu6A.4.

3. **Kang I**, Barbastathis G, "Probability of error as an image metric for the assessment of tomographic reconstruction of dense-layered binary-phase objects," ***SPIE Photonics West*** **(2021)** 116530T. https://doi.org/10.1117/12.2577264.

2. Allan G, **Kang I**, Douglas E, N'Diaye M, Barbastathis G, Cahoy K, "Deep neural networks to improve the dynamic range of Zernike phase-contrast wavefront sensing in high-contrast imaging systems," ***SPIE Astronomical Telescopes + Instrumentation*** **(2020)** 1144349. https://doi.org/10.1117/12.2562927.

1. **Kang I**, "A portable, low-cost, 3D-printed main magnetic field system for magnetic imaging," ***IEEE Engineering in Medicine and Biology Society*** **(2017)**. https://doi.org/10.1109/EMBC.2017.8037619.

Patents

1. **Adaptive optical correction in two-photon fluorescence microscopy with neural fields**
   U.S. Patent Application No. 63/707,628, filed October 15, 2024
   Co-inventors: **Kang I**, Ji N.

Awards, Honors & Certifications

Reviewer Certificate Program 2024
Optica Publishing Group *United States*

Reviewer Recognition Certificate 2024
Optica Publishing Group *United States*

Ph.D. Study-Abroad Scholarship 2017–2022
Korea Foundation for Advanced Studies (KFAS) *South Korea*

Kaufman Teaching Certificate Program (KTCP) 2022
Massachusetts Institute of Technology *Cambridge, MA*

Biophysics Program Certificate 2019
Massachusetts Institute of Technology *Cambridge, MA*

Summa Cum Laude Award 2017
Seoul National University *Seoul, South Korea*

Eminence Scholarship 2015, 2016
Seoul National University *Seoul, South Korea*

Merit-Based Scholarship 2012, 2015
Seoul National University *Seoul, South Korea*

Superior Academic Performance Scholarship 2011
Seoul National University *Seoul, South Korea*

Professional Memberships

Member 2021–2024
SPIE (Society For Optics & Photonics) *United States*

Member 2024
Society for Neuroscience *United States*

Reviewer Activities

Light: Science & Applications, Scientific Reports
Nature Portfolio, United Kingdom

Optica, Optics Letter, Optics Express, Applied Optics
Optica Publishing, United States

IEEE Transactions on Medical Imaging
IEEE, United States

Mentoring Experience

Course Project Mentor Spring 2022
Massachusetts Institute of Technology *Cambridge, MA*

- **Physical Systems Modeling and Design Using Machine Learning**: Mentored a student group of **3 graduate students** for their end-term project on the image segmentation of noisy ultrasonic images.
- **Mentored graduate students**: April Marie Anlage, Yiwen Huang, Itay Fayer.

Course Project Mentor Spring 2020
Massachusetts Institute of Technology *Cambridge, MA*

- **Learning Machines**: Mentored a student group of **7 undergraduate and graduate students** in total for their end-term projects on (1) the reaction modeling to facilitate pharmaceutical process development using machine learning; and (2) the control of autonomous ocean vehicles using reinforcement learning.
- **Mentored undergraduate/graduate students**: (1) Natalie Suzanne Eyke, Benjamin David Russell, Robyn Wen-Yi Lee; and (2) Timothy Samuel Fountain, Warner A. McGee, HongSeok Cho, Bouke K. Edskes.

Volunteer Feb 2018
Korea Foundation for Advanced Studies Overseas Program *Kingdom of Cambodia*

- Participated as a volunteer in the Kingdom of Cambodia for a week, teaching children physics and building homes for the residents.

Teaching Experience

Kaufman Teaching Certificate Program (KTCP) Spring 2022
Teaching & Learning Laboratory, Massachusetts Institute of Technology *Cambridge, MA*

- **Workshop**: Completed seven workshops to develop teaching skills as part of the teaching certificate program. A major part of the program involved introducing students to relevant research in teaching and learning and laying out future teaching models.
- **Microteaching sessions**: Presented two microteaching sessions that were videotaped, where I received feedback on my performance regarding my teaching and provided feedback to other participants.

Teaching Assistant Spring 2020
Massachusetts Institute of Technology *Cambridge, MA*

- Mentored course research projects, contributed to curriculum design, conducted after-hour office hours, and graded assignments. Class taught totaled around **40 undergraduate/graduate students** and comprised course research projects on the connection between machine learning and physical systems.

Leadership

Group Leader 2019 – 2020
EECS Korean Graduate Students Society, Massachusetts Institute of Technology *Cambridge, MA*

- Organized social gatherings and networking to foster cohesion among EECS Korean graduate students.

Founder & Group Leader 2019 – 2021
Korean Graduate Students Swimming Club, Massachusetts Institute of Technology *Cambridge, MA*

- Organized a swimming session twice a week and held social events among swimming club members.

Event Officer 2018 – 2019
Korean Graduate Students Association, Massachusetts Institute of Technology *Cambridge, MA*

- Planned and organized social events to facilitate networking among Korean graduate students.

Group Leader 2018
Sidney-Pacific Inter-Cultural Exchange Program (SPICE), Massachusetts Institute of Technology *Cambridge, MA*

- Organized social gatherings for networking among group members from diverse backgrounds living in Sidney-Pacific graduate residence.

Event Chair Summer 2018
EECS Graduate Students Association, Massachusetts Institute of Technology *Cambridge, MA*

- Organized and led weekly coffee hours to facilitate social gathering and networking among international EECS students.

Student Ambassador 2018
Kakao Ventures *Seoul, South Korea*

- Contributed to the creation of a startup ecosystem on/off campus in Cambridge and worked as a liaison to Kakao Ventures in South Korea.

Sergeant Feb 2013 – Nov 2014
Korean Augmentation to the U.S. Army (KATUSA) *South Korea*

- Worked as the Information Assurance Security Officer and a deputy of Information Assurance Manager (IAM) / Systems Administrator (SA) in accordance with AR 25-2 in Information Management Office, 8th Army NCO Academy and KATUSA Training Academy.

Invited Talks & Seminars

Invited Talk Apr 2025
Molecular Biophysics & Integrated Bioimaging Annual Meeting *Lawrence Berkeley National Laboratory, Berkeley, USA*

Invited Talk Apr 2025
Neuro-Instrumentation & Computational Analysis Lab *KAIST, South Korea*

Guest Lecture Mar 2025
PHYSICS H190 - AI for Optical Microscopy *University of California, Berkeley, USA*

Invited Talk Mar 2025
AI Graduate School Seminar *Ulsan National Institute of Science and Technology, South Korea*

Invited Talk Nov 2024
Center for Adaptive Optics Fall Science Retreat *University of California, Los Angeles, USA*

Invited Talk Apr 2024
Graduate School of Data Science, Seoul National University *Seoul, South Korea*

Guest Speaker in Mini-symposium – Computational Imaging in Neurophotonics Jan 2023
Seoul National University *Seoul, South Korea*

Speaker in Photobears Lightning talk series Sep 2022
University of California, Berkeley *Berkeley, CA*

Invited Talk Apr 2022
Aerospace Controls Laboratory (ACL), Massachusetts Institute of Technology *Cambridge, MA*

Research seminar Oct 2021
Computational Imaging Lab, Princeton University *Online*

Invited Talk Oct 2021
CRISP (Computation, Representation, and Inference in Signal Processing) Group, Harvard University *Cambridge, MA*

Research seminar Sep 2021
University of California, Los Angeles *Online*

Research seminar Sep 2021
Ji Lab, University of California, Berkeley *Online*

Invited Talk Feb 2021
Neurophotonics Lab, Seoul National University *Seoul, South Korea*

List of Recommenders / Referees

George Barbastathis
Ph.D advisor
Professor of Mechanical Engineering at Massachusetts Institute of Technology
Singapore Professor of Optics, Singapore-MIT Alliance for Research and Technology (SMART)
Email: gbarb@mit.edu (admin: derek978@mit.edu)

Na Ji
Postdoc advisor
Professor of Physics and Neuroscience at University of California, Berkeley
Email: jina@berkeley.edu (admin: georgelu@berkeley.edu)

Stella X. Yu
Postdoc advisor
Professor of Electrical and Computer Engineering at University of Michigan, Ann Arbor
Email: stellayu@umich.edu

Stefan Vogt
Collaborator & Thesis committee member, he/his/him
Associate Division Director at Argonne National Laboratory
Email: svogt@anl.gov