Alankar Kotwal | alankarkotwal13@gmail.com | alankarkotwal.me

Research Summary

I work in computational imaging, where we combine illumination, cameras and computation in innovative ways to sense the environment in a way that traditional cameras can't. I build optical imaging systems to realize these capabilities. My current work applies the principles of computational imaging to improve visual feedback in neurosurgery.

My previous work involved using wave nature of light to achieve exciting capabilities like seeing through scattering media and micron-scale shape acquisition, with applications in biomedical imaging and fabrication. Some of these were possible only in the lab now: We brought them out in the open!

Education

Carnegie Mellon University — Aug 2017 - Dec 2022
PhD in Robotics
Advisor: Prof. Ioannis Gkioulekas

Indian Institute of Technology Bombay — Jul 2016 - Jun 2017
Master of Technology in Electrical Engineering
Thesis advisor: Prof. Ajit Rajwade

Indian Institute of Technology Bombay — Jul 2012 - Jun 2016
Bachelor of Technology in Electrical Engineering
Research advisors: Prof. Ajit Rajwade and Prof. Suyash Awate

Professional Positions

Research Scientist — June 2024 - present
Department of Neurosurgery, University of Texas Medical Branch
Advisor: Dr. Pablo Valdés

Postdoctoral Researcher — May 2023 - May 2024
Department of Neurosurgery, University of Texas Medical Branch
Advisor: Dr. Pablo Valdés

Visiting Researcher — June 2023 - present
Department of Electrical and Computer Engineering, Rice University
Advisor: Prof. Ashok Veeraraghavan

Postdoctoral Researcher — Feb 2023 - Apr 2023
Robotics Institute, Carnegie Mellon University
Advisor: Prof. Ioannis Gkioulekas

Graduate Research Assistant — Aug 2017 - Jan 2023
Robotics Institute, Carnegie Mellon University
Advisor: Prof. Ioannis Gkioulekas

Visiting PhD Student in Radiology — May 2019 - Aug 2019
Neuroradiology, Massachusetts General Hospital
Advisor: Dr. Rajiv Gupta

Research Assistant — Aug 2016 - Aug 2017
Department of Electrical Engineering, Indian Institute of Technology Bombay
Advisor: Prof. Ajit Rajwade

Publications

Hyperspectral imaging in neurosurgery: a review of systems, computational methods and clinical applications
To appear in the Journal of Biomedical Optics
A. Kotwal, V. Saragadam, J. D. Bernstock, A. Sandoval, A. Veeraraghavan and P. Valdés

Lightfield Snapshot Hyperspectral Imaging for Quantitative Fluorescence-guided Neurosurgery
Annual Meeting of the Congress of Neurological Surgeonss (2024)
A. Kotwal, A. Sandoval, A. LeBlanc, V. Saragadam, A. Veeraraghavan and P. Valdés

Affordable Surgical Microscope with Fluorescence Capabilities for Low- and Middle-Income Countries
Annual Meeting of the Congress of Neurological Surgeons (2024)
A. Sandoval, **A. Kotwal**, A. Veeraraghavan and P. Valdés

Passive micron-scale time-of-flight with sunlight interferometry
Computer Vision and Pattern Recognition (2023), highlight paper [paper]
A. Kotwal, A. Levin and I. Gkioulekas

Swept-angle synthetic wavelength interferometry
Computer Vision and Pattern Recognition, 2023 [paper]
Computational Cameras and Displays Spotlight, 2023
A. Kotwal, A. Levin and I. Gkioulekas

Interferometric transmission probing with coded mutual intensity
ACM Transactions on Graphics, 2020 [paper, video]
A. Kotwal, A. Levin and I. Gkioulekas

Joint desmoking, specularity removal, and denoising of laparoscopy images via graphical models and Bayesian inference
International Symposium on Biomedical Imaging, 2017 [paper]
A. Baid, **A. Kotwal**, R. Bhalodia, S. Merchant and S. Awate

Joint desmoking and denoising of laparoscopy images
International Symposium on Biomedical Imaging, 2016 [paper]
A. Kotwal, R. Bhalodia and S. Awate

Designing constrained projections for compressed sensing: mean errors and anomalies with coherence
GlobalSIP, 2018 [paper]
D. Shah, **A. Kotwal** and A. V. Rajwade

Signal sensing and reconstruction for a novel multi-source static computed tomography system
ICASSP, 2020 [paper]
A. Kotwal, A. Cramer, D. Wu, K. Yang, W. Krull, I. Gkioulekas and R. Gupta

Invited Talks and Courses

"**Computational Interferometric Imaging**" | ACM SIGGRAPH course | Jul 2023

"**Swept-Angle Synthetic Wavelength Interferometry**" | Computational Cameras and Displays Workshop at the IEEE/CVF Conference on Computer Vision and Pattern Recognition | Jun 2023

"**Computational Interferometric Imaging**" | University of California at San Diego – Pixel Cafe | May 2023

"**Computational Interferometric Imaging**" | Camera Culture | Massachusetts Institute of Technology Media Lab | Jan 2023

"**Computational Interferometric Imaging**" | Wellman Center for Photomedicine, Massachusetts General Hospital | Jan 2023

"**Computational Interferometric Imaging**" | Photonics Center, Boston University | Jan 2023

"**Computational Interferometric Imaging**" | Robotics Institute seminar, Carnegie Mellon University | Dec 2022

"**Computational Interferometry**" | Samsung AI Center in Toronto | Oct 2022

"**Computational Interferometry**" | University of California at Los Angeles Grundfest Lectures in Computational Imaging | Jul 2022

"**Interferometric Transmission Probing with Coded Mutual Intensity**" | ACM SIGGRAPH | Aug 2020

"**Interferometric Transmission Probing with Coded Mutual Intensity**" | CVPR CCD | Jun 2020

Theses

Computational interferometric imaging

Doctoral Dissertation, Robotics Institute, Carnegie Mellon University, 2023 [link]

Optimizing sensing matrices for compressed sensing recovery

Master's Thesis, Electrical Engineering, Indian Institute of Technology Bombay, 2017 [link]

Academic Service

Reviewer, Conference on Neural Information Processing Systems (NeurIPS), 2024

Reviewer, IEEE/CVF European Conference on Computer Vision (ECCV), 2024

Reviewer, IEEE Transactions on Computational Imaging (TCI), 2024

Reviewer, ACM SIGGRAPH, 2023

Reviewer, IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2023

Reviewer, IEEE/CVF International Conference on Computer Vision (ICCV), 2023

Reviewer, International Conference on Computational Photography (ICCP), 2022-2023

Reviewer, Conference on Information Processing in Computer-Assisted Interventions (IPCAI) + International Journal of Computer Assisted Radiology and Surgery (IJCARS), 2018

Awards

Undergraduate Research Award for Master's thesis, Indian Institute of Technology Bombay, 2017

Gold medal at the 6^{th} International Olympiad on Astronomy and Astrophysics, representing India

Bronze medal at the 5^{th} International Earth Sciences Olympiad, representing India

KVPY Scholarship 2011 by the Government of India for students interested in basic sciences

NTSE Scholarship 2010 by the Government of India to identify and nurture the talented students by providing them scholarships

Other information

Citizenship: Indian

Languages: English (fluent), Marathi (native), Hindi (fluent)