Alankar Kotwal | askotwal@andrew.cmu.edu | alankarkotwal.github.io

Research Interests

My research interests lie in developing computational imaging techniques for medical applications. I currently work on developing optical imaging systems that exploit the wave nature of light to extract information from the environment that a traditional camera cannot. The goal of my research is using this information to see deep inside tissue using visible light (details here). I am also interested in developing computational algorithms to ease or automate the understanding of images thus collected.

In the future, I would like to explore the clinical aspect of research in medical imaging techniques.

Education

Carnegie Mellon University *August 2017 – present*
Doctor of Philosophy Program, The Robotics Institute

Indian Institute of Technology Bombay *July 2012 – June 2017*
Dual Degree (Bachelor & Master of Technology), Electrical Engineering
Specialization in *Communication and Signal Processing*. CPI: 9.16/10.00
Awarded the *undergraduate research award* for an exceptional final year project

Relevant Publications

- Baid, A., Kotwal, A., Bhalodia, R., Awate, S., *Joint desmoking, specularity removal, and denoising of laparoscopy images via graphical models and Bayesian inference*. Proc. of the 14th International Symposium on Biomedical Imaging (2017). Paper here.
- Kotwal, A.*, Bhalodia, R.*, Awate, S., *Joint desmoking and denoising of laparoscopy images*, Proc. of the 13th International Symposium on Biomedical Imaging (2016). Paper here.
- Shah, D.*, Kotwal, A.* and Rajwade, A. V., *Designing constrained projections for compressed sensing: mean errors and anomalies with coherence*, accepted for presentation at the 6th IEEE Global Conference on Signal and Information Processing (2018).
- Kotwal, A. and Rajwade, A. V., *Optimizing matrices for compressed sensing using existing goodness measures: negative results, and an alternative*, arXiv:1707.03355 [cs.IT].
- Kotwal, A., Rajwade, A. V., *Optimizing codes for source separation in compressed video recovery and color image demosaicing*, arXiv:1609.02135 [cs.CV].

Relevant Research Projects

Coded coherence imaging for seeing through tissue
Advisor: Prof. Ioannis Gkioulekas, Robotics, Carnegie Mellon *August 2017 – present*

- Exploring optical imaging with coded coherence properties and its relationship to structured light
- Working with a team of computational imaging experts across the US on a new method, called Computational Photo-Scatterography, to solve large-scale inverse problems in bioimaging, impacting medical and wellness applications ranging from wearables to non-invasive point-of-care devices.

A Bayesian framework for removing surgical smoke from laparoscopic images
Advisor: Prof. Suyash Awate, CSE, IIT Bombay *January 2015 – June 2017*

- Developed a Bayesian inference problem for jointly undoing the effect of surgical smoke, specularities and noise on laparoscopy images for better contrast and post-processing (like instrument tracking)
- Tested this method extensively on simulated and real images yielding significant improvement over state of the art dehazing algorithms in terms of numerical and perceptual accuracy

Optimizing sensing for fast image acquisition *Master's Thesis*
Advisor: Prof. Ajit Rajwade, CSE, IIT Bombay *December 2015 – June 2017*

- Worked on optimizing fast image acquisition models for compressive cameras
- Found a case where conventional coherence-based optimization techniques make recovery worse, and proposed and successfully tested a new optimization criterion
- Such acquisition techniques can significantly speed up medical imaging modalities like MR and CT

Coursework

Medical Image Analysis, Digital Image Processing, Computer Vision, Computer Graphics, Machine Learning, Convex Optimization, Information Theory

References

Prof. Ioannis Gkioulekas, Robotics
Carnegie Mellon | E–Mail | Webpage

Prof. Suyash Awate, CSE
IIT Bombay | E–Mail | Webpage

Prof. Ajit Rajwade, CSE
IIT Bombay | E–Mail | Webpage

Dr. Aniket Sule, Astronomy
TIFR | E–Mail | Webpage