Jason Holloway

Post Doctoral Researcher
450 Mudd Hall
500 W 120 Street
Computer Science Department
Columbia University
New York, NY 10027

Phone: 802-999-8551
Email: jason@jrholloway.com
Website: www.jrholloway.com

Research interests

Computational Photography, Computational Imaging, and Computer Vision.

Research focus: I am currently exploring adapting imaging systems to enable distributed, passive, monitoring platforms on a single monolithic sensor. My Ph.D. work was to resolve features below the diffraction limit in long-range photography using Fourier ptychography.

Prior research projects: At Rice University I have previously worked on (i) super-resolution via Fouirer ptychography (ii) generalized assorted camera arrays and cross-channel image registration (iii) focal sweep for extended depth-of-field time of flight imaging (iv) hyperspectral image classification (v) visible light communication using smartphones (vi) compressive sampling and recovery of high speed video and (vii) blind deblurring of single images with spatially varying blur kernels.

Education

2010–2016	Ph.D.—Rice University, Houston, TX. Advisor: Ashok Veeraraghavan Ph.D. in Electrical Engineering received September 2016 Master of Science degree in Electrical Engineering received May 2013
2006–2010	BS—Clarkson University, Potsdam, NY. Bachelor of Science degrees with honors in Electrical Engineering and Physics

Publications

Graduate Publications

S. Honnungar, J. Holloway, A. K. Pediredla, A. Veeraraghavan, and K. Mitra, "Focal-Sweep for Large Aperture Time-of-Flight Cameras," in *2016 IEEE International Conference on Image Processing (ICIP)*, pp. 953–957, Sept 2016.

J. Holloway, M. S. Asif, M. K. Sharma, N. Matsuda, R. Horstmeyer, O. Cossairt, and A. Veeraraghavan, "Toward Long Distance, Sub-diffraction Imaging Using Coherent Camera Arrays," *IEEE Transactions on Computational Imaging*, vol. 2, pp. 251–265, Sept 2016.

J. Holloway, K. Mitra, S. Koppal, and A. Veeraraghavan, "Generalized assorted camera arrays: Robust cross-channel registration and applications," *Image Processing, IEEE Transactions on*, vol. 24, pp. 823–835, March 2015.

R. Latimer, J. Holloway, A. Veeraraghavan, and A. Sabharwal, "SocialSync: Sub-Frame Synchronization in a Smartphone Camera Network," in *ECCV 2014: Workshop on Light Fields for Computer Vision*, 2014.

R. LiKamWa, D. Ramirez, and J. Holloway, "Styrofoam: A Tightly Packed Coding Scheme for Camera-based Visible Light Communication," in *ACM MobiCom 2014: 1st ACM Workshop on Visible Light Communication Systems*, 2014.

J. Holloway, T. Priya, A. Veeraraghavan, and S. Prasad, "Image Classification in Natural Scenes: Are A Few Selective Spectral Channels Sufficient?," in *Image Processing (ICIP), 2014 21st IEEE International Conference on*, Oct 2014.

J. Holloway, A. C. Sankaranarayanan, A. Veeraraghavan, and S. Tambe, "Flutter Shutter Video Camera for Compressive Sensing of Videos," in *IEEE International Conference on Computational Photography*, (Seattle, WA), April 2012.

Undergraduate Publications

A. Luttman, E. Bollt, and J. Holloway, "An Optical Flow Approach to Analyzing Species Density Dynamics and Transport," *Journal of Computational Mathematics*, vol. 30, no. 3, pp. 249–261, 2012.

J. Holloway and C. Navasca, "Recovering Tensor Data From Incomplete Measurement Via Compressive Sampling," in *Signals, Systems and Computers, 2009 Conference Record of the Forty-Third Asilomar Conference on*, pp. 1310–1314, Nov. 2009.

Ph.D. Dissertation

2016

Synthetic Apertures for Visible Imaging Using Fourier Ptychography
Advisor- Ashok Veeraraghavan

Abstract: In long-range imaging, spatial resolution is predominantly limited by diffraction blur. Diffraction blur is a fundamental limit that is determined by the diameter of the lens used in the imaging system. In principle, the diameter of a lens can be increased to circumvent diffraction. In reality, cost and manufacturing limitations place a limit on the maximum diameter that can be achieved. Therefore, computational methods are required to super-resolve the observed, blurry image and recover spatial resolution lost to diffraction.

Macroscopic Fourier ptychography is proposed as a practical means to create a synthetic aperture for visible imaging to achieve sub-diffraction limit spatial resolution. In this thesis, two principle barriers to implementing Fourier ptychography are addressed and resolved. First, a prototype imaging system is introduced to recover high-resolution long distance images in a reflection imaging geometry. Second, an image space regularization technique is developed to reconstruct optically rough surfaces that exhibit speckle. Experimental results demonstrate, for the first time, a macroscopic Fourier ptychography imaging system to achieve sub-diffraction resolution of optically rough objects in a reflection geometry. Spatial resolution is increased six-fold over any single captured image.

Master's Thesis

2013

Increasing Temporal, Structural, and Spectral Resolution in Images Using Exemplar–Based Priors
Advisor- Ashok Veeraraghavan

Abstract: In the past decade, camera manufacturers have offered smaller form factors, smaller pixel sizes (leading to higher resolution images), and faster processing chips to increase the performance of consumer cameras. However, these conventional approaches

have failed to capitalize on the spatio-temporal redundancy inherent in images, nor have they adequately provided a solution for finding 3D point correspondences for cameras sampling different bands of the visible spectrum. We pose the following question: Given the repetitious nature of image patches, and appropriate camera architectures, can statistical models be used to increase temporal, structural, or spectral resolution?

We propose a two-stage solution to facilitate image reconstruction; 1) design a linear camera system that optically encodes scene information and 2) recover full scene information using prior models learned from statistics of natural images. By leveraging the tendency of small regions to repeat throughout an image or video, we are able to learn prior models from patches pulled from exemplar images. The quality of this approach will be demonstrated for two application domains, using low-speed video cameras for high-speed video acquisition and multi-spectral fusion using an array of cameras. We also investigate a conventional approach for finding 3D correspondence that enables a generalized assorted array of cameras to operate in multiple modalities, including multi-spectral, high dynamic range, and polarization imaging of dynamic scenes.

Professional Experience

Research Experience

2016–present Postdoctoral Fellow—Columbia University, New York, NY. Advisor: Shree Nayar

2010–2016 Research Asst.—Rice University, Houston, TX. Advisor: Ashok Veeraraghavan

Summer 2015 Research Asst.—Northwestern University, Evanston, IL. Advisor: Oliver Cossairt

Work Experience

2014 Consultant—Light, Palo Alto, CA.
Consulted on early computational photography stages with the flagship product

2013 Research Intern—Adobe Systems, Inc., San Jose, CA.
Summer intern working in the Imagination Lab of Adobe Research under the guidance of Sunil Hadap

2012 Research Intern—Texas Instruments, Dallas, TX.
Summer intern working in the Imaging Branch of the R&D center under the guidance of Umit Batur

Professional Service

2015, 2016 Media Chair—ICCP Conference, Rice University and Northwestern University
2016 Program Committee—CCD Workshop at CVPR conference
2014-2016 Reviewer—TCI, ICCV, ICIP, CVPR

Teaching Experience

2012 Teaching Asst.—ELEC 241-Fundamentals of Electrical Engineering, Rice University
Independently organized and ran a weekly 2-hour review session for 50 students, kept independent office hours for student questions, helped organized and coordinate 11 undergraduate course assistants and 5 graduate graders

2009-2010 Teaching Asst.—PH131-Physics I/PH132-Physics II, Clarkson University
Ran a 2-hour lab and recitation section for 20 students and provided 2 hours of office hour support weekly. Graded homework for my section and helped grade exams for 500 students.

Awards

2016	Inaugural ECE Distinguished Student Service Award—Rice ECE
2015	Best PhD Presenter Award—Rice ECE Department Affiliate's Day
2012	SCREECH 2nd place overall—Rice Engineering research pitch competition
2012	SCREECH 1st place entrepreneurship—Rice Engineering research pitch competition
2012	Ken Kennedy Institute 4th place—Rice Engineering one-slide research contest
2011	NSF Graduate Student Fellowship—Honorable Mention
2010	Distinguished TI Fellowship—Awarded to promising incoming PhD students
2010	Frederica Clarkson Award—Valedictorian Award, Clarkson University
2009	Exemplary Presentation Award—MathFest '09
2009	Kristin Bandy Craig Memorial Scholarship—Clarkson University

Professional Society Membership

IEEE, AAAS, Tau Beta Pi

Extracurricular Activities

2012–2015	Member ECE Mentoring Committee Organize peer mentoring for first year graduate students in ECE at Rice which lasts through their qualifying research project
2011–2012	Resident Assistant at Rice Graduate Apartments Primary responsibility is to ensure a smooth transition for incoming graduate students into their academic career at Rice
2009–2015	Referee for high school soccer Officiate for all levels of high school soccer including varsity playoff games