

Christopher Kanan

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INTERESTS	Task-driven Image and Video Understanding; Lifelong Machine Learning; Computer Vision; Machine Learning; Computational Neuroscience; Active Vision	
EDUCATION	Ph.D. , Computer Science, 2013, University of California, San Diego , La Jolla, CA M.S. , Computer Science, 2006, University of Southern California , Los Angeles, CA B.S. , Philosophy and Computer Science, 2004, Oklahoma State University , Stillwater, OK	
POSITIONS HELD	<i>Assistant Professor</i> , Chester F. Carlson Center for Imaging Science Rochester Institute of Technology , Rochester, NY	2015 – Present
	<i>Research Technologist</i> , Maritime and Aerial Perception Group NASA's Jet Propulsion Laboratory , Pasadena, CA	2014 – 2015
	<i>Caltech Postdoctoral Scholar</i> California Institute of Technology , Pasadena, CA	2013 – 2014
	<i>Graduate Student Researcher</i> University of California San Diego , La Jolla, CA	2007 – 2013
	<i>Research Intern</i> , Brain Inspired Cognitive Architecture Team HRL Laboratories , Malibu, CA	2005 – 2007
EXTERNAL GRANTS	Co-PI, <i>MediSphere</i> . PAR Government System Corporation (Prime: DARPA) - 005264-003. 6/2/2016 – 6/1/2017, \$305,508. PI, <i>Periscope Imagery Ship Classification Project</i> . Scientific Systems Company, Inc. (Prime: ONR) N66604-13-C-1404/NA. 5/9/2016 – 9/25/2016, \$16,453. PI, <i>Perception System for Autonomous Sea Surface Ships</i> . Jet Propulsion Laboratory (Prime: NASA) – HE NNN12AA01C/1541689. 12/18/2015 - 12/14/2016, \$64,994. Co-PI, <i>Object Cueing using Biomimetic Approaches to Visual Information Processing</i> . Scientific Systems Company, Inc. (Prime: NAVAIR) Phase 1 STTR FY2014A – Topic N14A-T008. 09/14/2014 – 04/14/2015. Co-PI, <i>Inter-Science of Learning Centers Conference</i> . NSF SMA 1212288, 03/01/2012 – 02/28/2013, \$115,797.	
INTERNAL GRANTS	PI, <i>Deep Learning for Active Vision</i> . Rochester Institute of Technology, College of Science FEAD. 7/1/2017 – 2/1/2018, \$5,500. Co-PI, <i>Data Driven Methods for Event Detection in Eye Tracking Signals</i> . Rochester Institute of Technology, College of Science DRIG. 11/1/2016 – 8/31/2017, \$15,000	
AWARDS & HONORS	<i>Scholarship for Cornell Uni. Faculty Leadership and Professional Development Program</i>	2017
	<i>RIT College of Science Rising Star Award</i>	2016
	<i>TDLC Junior Investigator Award</i>	2013
	<i>University of California President's Dissertation Year Fellowship</i>	2012 – 2013
	<i>San Diego Diversity Fellowship</i>	2010 – 2012
	<i>NSF Integrative Graduate Education and Research Traineeship</i>	2007 – 2009
	<i>Eugene Cota-Robles Fellowship</i>	2007 – 2009
	<i>Oklahoma State University Continuing Student Scholarship</i>	2002 – 2004
	<i>Oklahoma State University Regents' Scholarship</i>	2002 – 2004

**REFEREED
PUBLICATIONS**

- Kafle, K., Kanan, C. (2017) An Analysis of Visual Question Answering Algorithms. In: *International Conference on Computer Vision (ICCV-2017)*.
- Kafle, K., **Kanan, C.** (2017) Visual Question Answering: Datasets, Algorithms, and Future Challenges. *J. Computer Vision and Image Understanding (CVIU)*. doi:10.1016/j.cviu.2017.06.005
- Kumra, S., **Kanan, C.** (2017) Robotic Grasp Detection using Deep Convolutional Neural Networks. In: *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS-2017)*.
- Kafle, K., Yousefhusien, M., **Kanan, C.** (2017) Data Augmentation for Visual Question Answering. *International Natural Language Generation conference (INLG-2017)*.
- Kemker, R., **Kanan, C.** (2017) Self-Taught Feature Learning for Hyperspectral Image Classification. *IEEE Transactions on Geoscience and Remote Sensing (TGRS)*, 55(5): 2693 – 2705.
- Kafle, K., **Kanan, C.** (2016) Answer-Type Prediction for Visual Question Answering. In: *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR-2016)*. [30% accept rate]
- Yousefhusien, M., Browning, N.A., **Kanan, C.** (2016) Online Tracking using Saliency. In: *Proc. IEEE Winter Applications of Computer Vision Conference (WACV-2016)*. [34% accept rate]
- Wang, P., Cottrell, G., **Kanan, C.** (2015) Modeling the Object Recognition Pathway: A Deep Hierarchical Model Using Gnostic Fields. In: *Proc. 36th Annual Conference of the Cognitive Science Society (CogSci-2015)*.
- Zhang, M.M., Choi, J., Daniilidis, K., Wolf, M.T., **Kanan, C.** (2015) VAIS: A Dataset for Recognizing Maritime Imagery in the Visible and Infrared Spectrums. In: *Proc of the 11th IEEE Workshop on Perception Beyond the Visible Spectrum (PBVS-2015)*.
- Kanan, C.**, Bseiso, D., Ray, N., Hsiao, J., & Cottrell, G. (2015) Humans Have Idiosyncratic and Task-specific Scanpaths for Judging Faces. *Vision Research*. doi:10.1016/j.visres.2015.01.013
- Kanan, C.** (2014) Fine-Grained Object Recognition with Gnostic Fields. *IEEE Winter Applications of Computer Vision Conference (WACV-2014)*. doi:10.1109/WACV.2014.6836122
- Kanan, C.**, Ray, N., Bseiso, D., Hsiao, J., & Cottrell, G. (2014) Predicting an Observer's Task Using Multi-Fixation Pattern Analysis. *ACM Symposium on Eye Tracking Research and Applications (ETRA-2014)*. doi: 10.1145/2578153.2578208
- Khosla, D., Huber, D.J., & **Kanan, C.** (2014) A Neuromorphic System for Visual Object Recognition. *Biologically Inspired Cognitive Architectures*, 8: 33-45.
- Kanan, C.** (2013) Active Object Recognition with a Space-Variant Retina. *ISRN Machine Vision*, 2013: 138057. doi:10.1155/2013/138057
- Kanan, C.** (2013) Recognizing Sights, Smells, and Sounds With Gnostic Fields. *PLoS ONE*, 8(1): e54088. doi:10.1371/journal.pone.0054088
- Birmingham, E., Meixner, T., Iarocci, G., **Kanan, C.**, Smilek, D., & Tanaka, J. (2012) The Moving Window Technique: A Window into Age-Related Changes in Attention to Facial Expressions of Emotion. *Child Development*, 84: 1407-1424. doi:10.1111/cdev.12039
- Kanan, C.** & Cottrell, G. W. (2012) Color-to-Grayscale: Does the Method Matter in Image Recognition? *PLoS ONE*, 7(1): e29740. doi:10.1371/journal.pone.0029740
- Kanan, C.** & Cottrell, G. W. (2010) Robust Classification of Objects, Faces, and Flowers Using Natural Image Statistics. In: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR-2010)*, pp. 2472-2479. [26.4% Accept Rate]
- Kanan, C.**, Flores, A., & Cottrell, G. (2010) Color Constancy Algorithms for Object and Face Recognition. *Lecture Notes in Computer Science*, 6453 (ISVC-2010): 199-210.
- Kanan, C.**, Tong, M. H., Zhang, L., & Cottrell, G. W. (2009) SUN: Top-down Saliency Using Natural Statistics. *Visual Cognition*, 17:979-1003.

PATENTS

- Khosla, D., **Kanan, C.**, Huber, D., Chelian, S., & Srinivasa, N. (2012) Visual Attention and Object Recognition System. *U.S. Patent No. 8,165,407*. Washington, DC: U.S.

- INVITED TALKS**
- Kanan, C.** (2017) An Analysis of Visual Question Answering Algorithms. *Center for Nonlinear Studies, Los Alamos National Laboratories.*
- Kanan, C.** (2016) An Analysis of Visual Question Answering Algorithms. *Department of Computer Science, University of Rochester.*
- Kanan, C.** (2016) An Analysis of Visual Question Answering Algorithms. *Western NY Image and Signal Processing Workshop (WNYISPW-2016).*
- Kanan, C.** (2016) Deep Learning: Overview & Applications. *Kodak Alaris.*
- Kanan, C.** (2015) Gnostic Fields for Image Recognition, Active Vision, and Tracking. *Xerox PARC.*
- Kanan, C.** (2014) Gnostic Fields for Object Classification. *NASA Jet Propulsion Laboratory.* [Job Talk]
- Kanan, C.** (2014) Image Recognition and Active Vision in Humans and Machines. *Rochester Institute of Technology.* [Job Talk]
- CONTRIBUTED TALKS**
- Kanan, C.** (2012) Recognizing Sights, Smells, and Sounds with Gnostic Fields. *25th Meeting of the Perceptual Expertise Network, Austin, TX.*
- Kanan, C.** (2011) Recognizing Objects, Faces, and Flowers using Fixations. *Vision Sciences Society Annual Meeting (VSS 2011), Naples, FL.*
- Kanan, C.** (2010) Image Recognition Using Fixations. *The 2010 Inter-Science of Learning Conference, Boston, MA.*
- Kanan, C.** (2010) Recognizing Objects Using Fixations. *Kavli Institute for Brain and Mind Symposium, San Diego, CA.*
- Kanan, C.** (2009) SUN: Top-down saliency using natural statistics. *The 2009 Inter-Science of Learning Conference, Seattle, WA.*
- ABSTRACTS & POSTERS WITHOUT PROCEEDINGS**
- Kafle, K., Kanan, C. (2017) An analysis of visual question answering algorithms. *CVPR-2017 Workshop on Language and Vision.*
- Kafle, K., Kanan, C. (2017) An analysis of visual question answering algorithms. *CVPR-2017 Workshop on Visual Question Answering.*
- Diaz, G., Bailey, R., Kanan, C., Lipson, M., Pelz, J., Kothari, R. (2017) Data-driven Gaze Event Classification for the Analysis of Eye and Head Coordination By Natural Task. *ECEM-2017.*
- Binaee, K., Starynska, Kothari, R., **Kanan, C.**, Pelz, J., Diaz, G. (2017) Modeling hand-eye movements in a virtual ball catching setup using a deep recurrent neural networks. *Vision Sciences Society (VSS-2017).*
- Kothari, R., Binaee, K., Bailey, R., **Kanan, C.**, Diaz, G., Pelz, J. (2017) Gaze-in-world movement classification for unconstrained head motion during natural tasks. *Vision Sciences Society (VSS-2017).*
- Kafle, K. & **Kanan, C.** (2016) Answer-Type Prediction for Visual Question Answering. *CVPR-2016 Visual Question Answering Workshop.*
- Kanan, C.** & Kafle, K. (2016) Answer-Type Prediction for Visual Question Answering. *Vision Sciences Society Annual Meeting (VSS 2016).*
- Kanan, C.**, Bseiso, D., Ray, N., Hsiao, J., & Cottrell, G. (2014) Predicting an Observer's Task Using Multi-Fixation Pattern Analysis. *21st Joint Symposium on Neural Computation. UC Irvine.*
- Kanan, C.** (2013) Image, Sound, and Odor Classification with Gnostic Fields. *Society for Neuroscience (SFN 2013).*
- Chukoskie, L., **Kanan, C.**, Albrecht, K., Wiles, J., Townsend, J. (2013) Comparing Saccade Sequences in Typical and Autistic Children. *Society for Neuroscience (SFN 2013).*
- Kanan, C.** (2013) Recognizing Sights, Smells, and Sounds With Gnostic Fields. *17th International Conference on Cognitive and Neural Systems (ICONS). Boston University.*
- Kanan, C.** (2013) Recognizing Sights, Smells, and Sounds With Gnostic Fields. *20th Joint Symposium on Neural Computation. Caltech.*

- Kanan, C.** (2013) Recognizing Sights, Smells, and Sounds With Gnostic Fields. *Jacobs Research Expo 2013*. [Semi-Finalist in Best Poster Competition]
- Kanan, C.** & Cottrell, G. W. (2012) A Neural Network Model of the Primate Visuo-Motor System. *Computational and Systems Neuroscience (COSYNE 2012)*.
- Chukoskie, L., Miller, M., **Kanan, C.**, Dorai, M., Townsend, J., & Trauner, D. (2012) Did you see that change? A study of dyspraxia, eye movement, and visual perception in autism. *International Meeting for Autism Research (IMFAR-2012)*.
- Kanan, C.** (2011). A Training Program in Grantsmanship. *NSF Science of Learning Center 2011 PI Meeting*.
- Kanan, C.**, Chukoskie, L., & Sejnowski, T. (2011) Shifting from a Stimulus-driven to a Task-driven Saccadic Policy. *18th Joint Symposium on Neural Computation*.
- Kanan, C.** & Cottrell, G. W. (2011) Robust Classification of Objects, Faces, and Flowers Using Natural Image Statistics. *Jacobs Research Expo 2011*. [Semi-Finalist in Best Poster Competition]
- Kanan, C.** & Cottrell, G. W. (2010) Robust Classification of Objects, Faces, and Flowers Using Natural Image Statistics. *Society for Neuroscience (SFN 2010)*.
- Cottrell, G. & **Kanan, C.** (2010) Robust Object and Face Recognition Using a Biologically Plausible Model. *Vision Sciences Society Annual Meeting (VSS 2010)*.
- Kanan, C.** & Cottrell, G. W. (2009) Robust Classification of Objects, Faces, and Flowers Using Natural Image Statistics. *NSF Science of Learning Center 2009 PI Meeting*.
- Tong, M.H., **Kanan, C.**, Zhang, L., & Cottrell, G. (2009) Task-driven Saliency Using Natural Statistics. *Vision Sciences Society Annual Meeting (VSS 2009)*.
- Tong, M.H., **Kanan, C.**, Zhang, L., & Cottrell, G.W. (2009) Task-driven Saliency Using Natural Statistics (SUN). *MIT Scene Understanding Symposium*.
- Tong, M. H., **Kanan, C.**, Zhang, L., & Cottrell, G. W. (2009) Task-driven saliency using natural statistics (SUN). *Computational and Systems Neuroscience (COSYNE 2009)*.
- Kanan, C.**, Tong, M. H., Zhang, L., Cottrell, G. W. (2008) SUN: Top-down saliency using natural statistics. *NSF Science of Learning Center 2008 PI Meeting*.

OTHER PUBLICATIONS

Kanan, C. (2012) Turing: Beyond the original concept. *Nature*, 483: 275.

PHD STUDENTS ADVISED

- Kushal Kafle**, Ph.D. (in progress), Imaging Science, RIT 2015-Present
Project: Algorithms for Visual Question Answering
- Ronald Kemker**, Ph.D. (in progress), Imaging Science, RIT 2015-Present
Project: Low Shot non-RGB Semantic Segmentation using Deep Learning

MS STUDENTS ADVISED

Tania Kleynhans, M.S., Imaging Science, RIT 2016-2017
Project: Deep Learning for Predicting Top-of-Atmosphere Thermal Radiance

SENIOR PROJECTS SUPERVISED

- Adam Casson**, B.S., Imaging Science, RIT 2016-2017
Project: Creating a New Dataset and Algorithms for Video Question Answering
- Bijia Chen**, B.S., Imaging Science, RIT 2016-2017
Project: Active Vision for Visual Question Answering

**INTERN &
NON-THESIS
PROJECTS
SUPERVISED**

Total Interns and Non-Thesis Students Supervised: 18

Rochester Institute of Technology

Lifelong Machine Learning in Deep Neural Networks, 2017-Present
Students Supervised: Marc McClure, Angelina Abitino

Accelerating Visual Question Answering, 2015-Present
Students Supervised: Justin Namba, Ramesh Nair, Utkarsh Deshmukh

Deep Reinforcement Learning for Control, 2016-Present
Student Supervised: Rodney Sanchez

Predicting which Images are Interesting, 2015
Student Supervised: Arjun Raj Rajanna

NASA's Jet Propulsion Laboratory

Evaluation of tracking algorithms in aerial imagery, 2015
Intern Supervised: Maya Rau-Murthy

Smooth Pursuit - Vehicle Tracking in Aerial Video, 2015
Interns Supervised: Victor Kwak, Homam Chamas, Samuel Munoz, Emelie Oiknine

Multi-Modal Object Recognition: Transfer Learning from RGB to IR Imagery, 2014
Interns Supervised: Mabel Zhang, Jean Choi

Segmenting Land, Sky, and Sea in Maritime Imagery, 2014
Intern Supervised: Juan Diego Palomino

University of California at San Diego (UCSD)

Eye tracking analysis using Multi-Fixation Pattern Analysis, 2012-2013
Interns Supervised: Dina Bseiso, Nicholas Ray

Scene classification using active vision, 2012-2013
Intern Supervised: Felix Schüler

TEACHING

IMGS 789 @ RIT – **Deep Learning for Vision** Fall 2016, Fall 2017

- The first half of the course covers basic and advanced topics in deep learning, including CNNs, RNNs, transfer learning, regularization, etc. The second half of the class is a seminar style course designed to help students prepare papers for top publication venues, e.g., NIPS and CVPR.

IMGS 682 @ RIT – **Image Processing and Computer Vision** Spring 2016, Spring 2017

- Basics of supervised machine learning (nearest neighbor, linear classifiers, SVM, neural networks, etc.), unsupervised learning (PCA, k-means, mean shift, etc.) image processing, and computer vision (convolutional neural networks, image recognition, object detection, homographies, image stitching, target tracking, activity recognition in video, segmentation, semantic segmentation, etc.).

REVIEWER

Cerebral Cortex	Journal of Machine Learning Research (JMLR)
Journal of Vision (JoV)	IEEE Trans Pat. Analysis Machine Intelligence (TPAMI)
Neural Information Processing Systems (NIPS)	IET Image Processing
PLoS ONE	Cognitive Science Society (CogSci)
Visual Cognition	Journal of Imaging Science and Technology
Optics and Lasers in Engineering	IEEE Winter Applications of Computer Vision (WACV)
Physical Review Letters	Eye Tracking Research and Applications (ETRA)
Biological Cybernetics	AAAI
Neural Networks	

PROFESSIONAL & CONFERENCE SERVICE	<p>Organizing Committee, ICCV-2017 Workshop on Mutual Benefits of Cognitive and Computer Vision</p> <p>Area Chair, IEEE International Conference on Image Processing, 2017 (ICIP-2017)</p> <p>Program Committee, AAAI-2017</p> <p>Organizing Committee, Western NY Image and Signal Processing Workshop (WNYISPW-2016), 2016</p> <p>Program Committee, 3rd Workshop on EgoCentric Vision at CVPR-2014, 2014</p> <p>General Chair, Fifth NSF Inter-Science of Learning Center Conference (iSLC-2012)</p> <p>Fellow & Trainee Chair, NSF Temporal Dynamics of Learning Center, 2009-2012</p> <p>Workshop Chair, NSF Inter-Science of Learning Center Conferences, 2009-2011</p>	
PROMOTION OF DIVERSITY	<p>NSF LSAMP/McNair Scholars Programs at RIT</p> <p>Helped revise curriculum and training for underrepresented students to enhance their research opportunities and skills in order to help them get into PhD programs and excel once admitted. Supervising two disadvantaged undergraduate students from underrepresented groups in machine learning projects.</p> <p>California Forum for Diversity in Graduate Education</p> <p>Invited to speak with underrepresented minorities attending California colleges about how to get accepted into and succeed in graduate school.</p> <p>Preuss School Internship Supervisor</p> <p>Supervised and mentored research projects conducted by three students from the Preuss School, a charter school devoted to preparing low-income students for college. All three students went to college, and one of them is now a Ph.D. candidate at Stanford University.</p> <p>Going for the Goal</p> <p>Mentored English as a second language (ESL) students at Camino Nuevo, a middle school in downtown Los Angeles. Encouraged them to attend college by alleviating their misconceptions and anxieties.</p> <p>University of Southern California Parkside Area Government</p> <p>Created a student program called "Small World" aimed at breaking cultural stereotypes. "Small World: Afghanistan" was awarded Best Diversity Program of October 2005.</p>	<p>2015-Present</p> <p>2009, 2010, 2011, 2012, 2013</p> <p>2008 – 2009</p> <p>2005 – 2006</p> <p>2004 – 2006</p>
MEMBERSHIP	<p>Institute of Electrical and Electronics Engineers (IEEE)</p> <p>Society for Neuroscience (SFN)</p> <p>Vision Sciences Society (VSS)</p> <p>NSF Temporal Dynamics of Learning Center (TDLC)</p> <p>Perceptual Expertise Network (PEN)</p>	<p>2010 – Present</p> <p>2010 – Present</p> <p>2010 – Present</p> <p>2007 – 2013</p> <p>2007 – 2013</p>
CITIZENSHIP	<p>United States of America</p>	