

Ryan D. Kennedy

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Education

University of Pennsylvania 2009-2015
Ph.D. Computer and Information Science
Area of study: Computer Vision, Machine Learning
Advisor: Camillo J. Taylor

University of Colorado 2005-2009
B.S. Computer Science and Applied Mathematics
Summa cum laude. GPA: 3.974

Academic Experience

Ph.D. Student September 2009 - May 2015
Advisor: Camillo J. Taylor University of Pennsylvania
Performed research in the fields of computer vision and machine learning as work toward a doctoral thesis. The research has included contour detection in images, real-time structure from motion, segmentation, network localization, and optical flow. Thesis topic: optical flow.

Teaching Assistant: Artificial Intelligence Spring 2011
Professor: Mitch Marcus University of Pennsylvania
Held office hours, wrote exam questions and graded.

Teaching Assistant: Machine Learning Fall 2010
Professor: Ben Taskar University of Pennsylvania
Taught recitations, held office hours, wrote exam questions and graded.

Research Assistant October 2007 - September 2009
Rob Knight, Manuel Lladser University of Colorado
Built statistical discrimination techniques for the analysis of RNA and the multivariate composition space where functions are found. Written entirely in Python.
Used machine learning methods (SVMs, random forests, unsupervised clustering) to predict function based on information concerning cis-regulatory modules in systems such as RNA transcription and alternative splicing.
Developed TopiaryTool, and graphical application for the analysis of phylogenetic trees and their associated metadata.

Research Assistant January 2008 - May 2008
Michael Mozer University of Colorado
Researched neural networks and their use in temporal analysis, especially focusing on deep belief networks and their applicability to time series involving co-dependencies with long time gaps.

Work Experience

Technologist, Computer Vision Group April 2015 - Present
NASA's Jet Propulsion Laboratory (JPL) Pasadena, CA
Supervisor: Larry Matthies
Developed convolutional neural networks for the automated classification of Martian terrain. Terrain classes were subsequently correlated with wheel slip data to build models of slip on different terrain types. These models are used to more safely plan paths for the Curiosity Mars Rover by accurately predicting slip. This software is currently deployed in MSL operations.

Researched the feasibility of applying terrain classification algorithms on-board future planetary rovers. Included work on the feasibility of running convolutional neural networks on extremely constrained hardware platforms.

Developed algorithms for autonomous navigation of quadrotor drones. This work included state estimation, stereo correspondence (including the use of IR cameras), and obstacle detection using the limited resources available on quadrotors.

Engineering Intern in Computer Vision

July 2013 - September 2013

Google

Venice, CA

Supervisor: Florian Schroff

Worked as part of the Google Goggles team on object recognition. Implemented a Hough Forests algorithm for keypoint detection of cars in images.

Computer Vision Intern

June 2011 - August 2011

Howard Hughes Medical Institute (Janelia Farm)

Supervisor: Dmitri Chklovskii

Developed image segmentation algorithms for segmenting neurons in electron microscopy images. Focused on agglomerative image segmentation and the effect of merge order on the final segmentation quality.

Development Intern

May 2010 - November 2010

Aeshen (Intel)

Implemented algorithms in computer vision and machine learning, including background subtraction using Gaussian mixture models, the Hough transform, Otsu's thresholding algorithm and Gabor filtering.

Quantitative Analyst Intern

September 2008 - September 2009

Q Capital Management

Boulder, CO

Developed a genetic programming system - written in MATLAB and C - for the automated evolution of trading systems. The system involved using CUDA and NVIDIA graphics cards for massively-parallel computing.

Software Development Intern

June 2007 - January 2008

BoulderLabs

Boulder, CO

Refactored SyncTool, an application for remote synchronization of file structures. Written entirely in C++ with use of MFC and the Boost C++ libraries. Other work included extensive development using Linux.

Java Developer for MVT

February 2007 - October 2007

The University of Colorado

Boulder, CO

Developer for the Mathematical Visualization Toolkit (MVT), a mathematical software package written in Java and maintained by students of the University of Colorado.

Publications

Hierarchically-Constrained Optical Flow. R. Kennedy and C. J. Taylor. *CVPR*, 2015.

Optical Flow with Geometric Occlusion Estimation and Fusion of Multiple Frames. R. Kennedy and C. J. Taylor. *EMMCVPR*, 2015.

Online Completion of Ill-conditioned Low-Rank Matrices. R. Kennedy, C. J. Taylor, and L. Balzano. *GlobalSIP*, 2014.

Network Localization from Relative Bearing Measurements. R. Kennedy and C. J. Taylor. *IROS*, 2014.

Graph-Based Active Learning of Agglomeration (GALA): A Python Library to Segment 2D and 3D Neuroimages. J. Nunez-Iglesias, R. Kennedy, S. M. Plaza, A. Chakraborty, and W. T. Katz. *Front. Neuroinform.*, 2014.

Online Algorithms for Factorization-Based Structure from Motion. R. Kennedy, L. Balzano, S. J. Wright, and C. J. Taylor. *WACV*, 2014.

Machine Learning of Hierarchical Clustering to Segment 2D and 3D Images. J. Nunez-Iglesias, R. Kennedy, T. Parag, J. Shi, and D. Chklovskii. *PLoS ONE*, 2013.

Identifying Maximal Rigid Components in Bearing-Based Localization. R. Kennedy, K. Daniilidis, O. Naroditsky, and C.J. Taylor. *IROS*, 2012.

TopiaryExplorer: Visualizing Large Phylogenetic Trees with Environmental Metadata. M. Pirrung, R. Kennedy, J.G. Caporaso, J. Stombaugh, D. Wendel, and R. Knight. *Bioinformatics*, 2011.

Contour Cut: Identifying Salient Contours in Images by Solving a Hermitian Eigenvalue Problem. R. Kennedy, J. Gallier, and J. Shi. *CVPR*, 2011.

Natural and Artificial RNAs Occupy the Same Restricted Region of Sequence Space. R. Kennedy, M. Lladser, Z. Wu, C. Zhang, M. Yarus, H. DeSterck, and R. Knight. *RNA*, 2010.

Information, Probability, and the Abundance of the Simplest RNA Active Sites, R. Kennedy, M. Lladser, M. Yarus, R. Knight, *Frontiers in Bioscience*, 2008.

Low-rank matrix completion. R. Kennedy. Written Preliminary Exam II, University of Pennsylvania. 2013.

Calculating RNA Motif Probabilities and Recognizing Patterns in Sequence Data. R. Kennedy. Senior Thesis, University of Colorado. 2009.

Conference Presentations

A framework for pattern recognition in molecular biology data. R. Kennedy, SIAM Front Range Student Conference, March 14, 2009. Oral Presentation.

Confidence intervals for probabilistic pattern matching. R. Kennedy, SIAM Front Range Student Conference, March 1, 2008. Oral Presentation.

Honors and Awards

- Distinguished Senior Award in the Department of Applied Mathematics, University of Colorado, 2009.
- Frank J. LaRocca Memorial Scholarship, 2008. Merit-based scholarship in the College of Engineering.
- Applied Math Undergraduate Scholarship, 2008.
- Astronaut Scholarship, 2008.
- Received a scholarship to attend NASA International Summer School of Astrobiology, held in Santander, Spain, June 2008.
- Robert C. Byrd Memorial Scholarship, The University of Colorado, 2005.
- Norlin Scholar, The University of Colorado, 2005.