Joseph F. Murray

CONTACT INFORMATION

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EDUCATION

University of California, San Diego

Ph.D. Electrical and Computer Engineering, September 2005

- Thesis: "Visual Recognition, Inference and Coding using Learned Sparse Representations"
- Advisor: Kenneth Kreutz-Delgado
- Committee: Virginia de Sa, Robert Hecht-Nielsen, Terrence J. Sejnowski, Mohan M. Trivedi

M.S. Electrical and Computer Engineering, May 2000

University of Oklahoma, Norman

B.S. Electrical Engineering with Computer Option, Minor in Physics, May, 1998

RESEARCH INTERESTS

Neural computation	Biologically-guided computer vision
Statistical neural networks	Sparse overcomplete coding
Image processing	Machine learning
Parallel processing	Ocean tides and waves

HONORS AND AWARDS

- 2002-2005 ARCS Foundation Fellowship. University of California, San Diego.
- 1998-1999 Powell Foundation Fellowship. University of California, San Diego.
- 1994 President's Honor Roll, University of Oklahoma (4.0 GPA).
- 1993-1998 National Merit Scholar. Full scholarship to the University of Oklahoma.

RESEARCH EXPERIENCE

Massachusetts Institute of Technology/Howard Hughes Medical Institute

Postdoctoral Scholar, Brain and Cognitive Sciences Department **January 2006 - Present**

Computer vision and neural networks research in Sebastian Seung's laboratory. Developed new image segmentation algorithm based on convolutional networks, with neuroscience applications in the reconstruction of 3d structure from serial-section electron micrographs. Other research topics include sparse image coding and hierarchical recurrent neural networks. Managed the the procurement and deployment of a Linux computational cluster.

Scripps Institution of Oceanography, UCSD Integrative Oceanography Division

Postdoctoral Scholar **October 2005 - January 2006**

Studied wind and wave interaction off the central California coast, ran and compared numerical wave model (WaveWatch III) to buoy observations, statistical analysis. Advisor: Ron Flick.

University of California, San Diego Electrical and Computer Engineering Department

Graduate Student **September 1998 - September 2005**

Developed new visual inference algorithm for recurrent hierarchical networks using the techniques from probabilistic generative modeling and sparse coding. Research in machine learning, biologically-guided computer vision, statistical neural networks, and hard-drive failure prediction. Advisor: Kenneth Kreutz-Delgado.

Scripps Institution of Oceanography, UCSD Integrative Oceanography Division

Student Researcher **June 1999 - September 2005**
Studied tide range changes over past 100 years in North America, statistical analysis, Matlab coding.

University of Pennsylvania Center for Sensor Technology

Summer Undergraduate Fellowship in Sensor Technology (SUNFEST) **Summer 1997**
Implemented learning algorithms for pattern recognition on a parallel neurocomputer.

Massachusetts Institute of Technology Haystack Observatory

NSF Research Experience for Undergraduates (REU) **Summer 1996**
Circuit design and simulation to improve read performance of high-speed magnetic tape drives.

University of Southern Mississippi Department of Computer Science

NSF Research Experience for Undergraduates (REU) **Summer 1995**
Vision and robotics research, developed software for object detection and robot arm motion planning.

JOURNAL PUBLICATIONS

J. F. Murray and K. Kreutz-Delgado. "Visual Recognition and Inference Using Dynamic Overcomplete Sparse Learning", to appear in *Neural Computation*, 2007 (accepted Nov. 20, 2006).

J. F. Murray and K. Kreutz-Delgado. "Learning Sparse Overcomplete Codes for Images", *Journal of VLSI Signal Processing*, Dec. 2006.

J. F. Murray, G. F. Hughes and K. Kreutz-Delgado. "Machine Learning Methods for Predicting Failures in Hard Drives: A Multiple-Instance Application", *Journal of Machine Learning Research*, vol. 6, pp. 783-816, 2005.

G. F. Hughes and J. F. Murray. "Reliability and Security of RAID Storage Systems and D2D Archives Using SATA Disk Drives", *ACM Transactions on Storage*, vol. 1, pp. 95-107, Dec. 2004.

K. Kreutz-Delgado, J. F. Murray, B. D. Rao, K. Engan, T.-W. Lee and T. J. Sejnowski, "Dictionary Learning Algorithms for Sparse Representation", *Neural Computation*, vol. 15, pp. 349-396, 2003.

R. Flick, J. F. Murray and L. Ewing. "Trends in U.S. Tidal Datum Statistics and Tide Range", *American Society of Civil Engineers (ASCE) Journal of Waterway, Port, Coastal and Ocean Engineering*, vol. 129, no. 4, Jul. 2003, pp. 155-164.

G. F. Hughes, J. F. Murray, K. Kreutz-Delgado and C. Elkan, "Improved Disk-Drive Failure Warnings", *IEEE Transactions on Reliability*, vol. 51, pp. 350-357, Sep. 2002.

CONFERENCE PUBLICATIONS

J. F. Murray and K. Kreutz-Delgado. "Sparse Image Coding Using Learned Overcomplete Dictionaries", IEEE International Workshop on Machine Learning for Signal Processing (MLSP 2004), Sep. 2004, Sao Luis, Brazil.

J. F. Murray, G. F. Hughes and K. Kreutz-Delgado, "Hard Drive Failure Prediction Using Non-parametric Statistical Methods", Proceedings of International Conference on Artificial Neural Networks (ICANN/ICONIP 2003), Jun. 2003, Istanbul, Turkey.

J. F. Murray and K. Kreutz-Delgado, "An Improved FOCUSS-Based Learning Algorithm for Solving Sparse Linear Inverse Problems", 35th Asilomar Conference on Signals, Systems and Computers IEEE, Nov. 2001.

PAPERS IN PREPARATION

S. C. Turaga, J. F. Murray, V. Jain, F. Roth, M. Helmstaedter, K. Briggman, W. Denk, and H. S. Seung. "Learning to generate affinity graphs for image segmentation by convolutional networks" *submitted to* International Conference on Computer Vision (ICCV 2007).

J. F. Murray and R. Flick. "Wave Modeling in Coastal Waters and Consequences for Small-Craft Boating."

PROFESSIONAL ORGANIZATIONS

- IEEE Computer Society Member
- ACM Member

PROFESSIONAL ACTIVITIES

- Reviewer: Neural Computation, IEEE Transactions on Signal Processing, IEEE Transactions on Neural Networks, Journal of VLSI Signal Processing, Neural Information Processing - Letters and Reviews, ICANN

COMPUTER SKILLS

- Languages: C/C++, Matlab, Maple, Python, Unix shell scripts, IBM Datastar parallel supercomputer, OpenMP parallel processing library.