

## Curriculum Vitae

### Michael S. Lewicki

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& Computer Science  
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Born October 24th 1966, Oconto Falls, WI, USA

#### Education

- 2/96: Ph.D. in Computation and Neural Systems, California Institute of Technology, Pasadena, CA, Thesis: *Neural Representation of Auditory Temporal Structure*, Advisor: Prof. Masakazu Konishi
- 5/89: B.S. with honors in mathematics, double major in cognitive science, Carnegie Mellon University, Pittsburgh, PA

#### Academic positions

- 8/08-7/09: Invited fellow in the Scene Analysis Working Group in residence at the Wissenschaftskolleg zu Berlin (Institute for Advanced Study, Berlin), Berlin, Germany.
- 8/08-present: Visiting Associate Professor, Electrical Engineering and Computer Science Department, Case Western Reserve University, Cleveland, OH
- 7/08: Promoted to Associate Professor with tenure, Computer Science Department, Carnegie Mellon University, Pittsburgh, PA.
- 7/05-present: Associate Professor, Computer Science Department and Center for the Neural Basis of Cognition, Carnegie Mellon University, Pittsburgh, PA
- 7/99-6/05: Assistant Professor, Computer Science Department and Center for the Neural Basis of Cognition, Carnegie Mellon University, Pittsburgh, PA
- 1/99-6/99, Research Scientist, Center for the Neural Basis of Cognition, Carnegie Mellon University, Pittsburgh, PA
- 8/96-12/98, Howard Hughes Medical Institute Research Associate, Computational Neurobiology Laboratory, The Salk Institute for Biological Studies, La Jolla, CA, Supervisor: Prof. Terrence J. Sejnowski
- 2/96-7/96, Sloan Postdoctoral Fellow, Computational Neurobiology Laboratory, The Salk Institute for Biological Studies, La Jolla, CA, Supervisor: Prof. Terrence J. Sejnowski

## II. Publication List

### Books

- [1] R. P. N. Rao, B. A. Olshausen, and M. S. Lewicki, editors. *Probabilistic Models of the Brain: Perception and Neural Function*. MIT Press, Cambridge, MA, 2002.

### Book Chapters

- [2] M. S. Lewicki. Efficient coding of time-varying patterns using a spiking population code. In R. P. N. Rao, B. A. Olshausen, and M. S. Lewicki, editors, *Probabilistic Models of the Brain: Perception and Neural Function*, pages 223–234. MIT Press, Cambridge, MA, 2002.
- [3] T.-W. Lee and M. S. Lewicki. Image processing using ICA mixture models. In S. Roberts and R. Everson, editors, *Independent Component Analysis: Principles and Practice*, pages 234–253. Cambridge University Press, Cambridge, MA, 2001.

### Refereed Journal Papers (Published)

- [4] Y. Karklin and M. S. Lewicki. Emergence of complex cell properties by learning to generalize in natural scenes. *Nature*, 2008. Published online Nov. 19, 2008. Print version forthcoming.
- [5] S. Cavaco and M. S. Lewicki. Statistical modeling of intrinsic structures in impact sounds. *Journal of the Acoustical Society of America*, 121(6):3558–3568, 2007.
- [6] E. Doi, D. C. Balcan, and M. S. Lewicki. Robust coding over noisy overcomplete channels. *IEEE Transactions on Image Processing*, 16(2):442–452, 2007.
- [7] E. C. Smith and M. S. Lewicki. Efficient auditory coding. *Nature*, 439:978 – 982, 2006.
- [8] E. Smith and M. S. Lewicki. Efficient coding of time-relative structure using spikes. *Neural Computation*, 17(1):19–45, 2005.
- [9] Y. Karklin and M. S. Lewicki. Modeling non-stationary distributions with a hierarchical density component model. *Neural Computation*, 17(2):397 – 423, 2005.
- [10] Y. Karklin and M. S. Lewicki. Learning higher-order structures in natural images. *Network: Computation in Neural Systems*, 14:483–499, 2003.
- [11] M. S. Lewicki. Efficient coding of natural sounds. *Nature Neuroscience*, 5(4):356–363, 2002.
- [12] T.-W. Lee and M. S. Lewicki. Unsupervised classification, segmentation and enhancement of images using ICA mixture models. *IEEE Trans. Image Proc.*, 11(3):270–279, 2002.
- [13] T.-W. Lee, M. S. Lewicki, and T. J. Sejnowski. ICA mixture models for unsupervised classification of non-Gaussian sources and automatic context switching in blind signal separation. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 22(10):1078–1089, 2000.
- [14] M. S. Lewicki and T. J. Sejnowski. Learning overcomplete representations. *Neural Computation*, 12(2):337–365, 2000.
- [15] M. S. Lewicki and B. A. Olshausen. A probabilistic framework for the adaptation and comparison of image codes. *Journal of the Optical Society of America A*, 16(7):1587–1601, 1999.

- [16] T.-W. Lee, M.S. Lewicki, M. Girolami, and T.J. Sejnowski. Blind source separation of more sources than mixtures using overcomplete representations. *IEEE Signal Processing Letters*, 6(4):87–90, 1999.
- [17] M. S. Lewicki. A review of methods for spike sorting: the detection and classification of neural action potentials. *Network: Computation in Neural Systems*, 9(4):R53–R78, 1998.
- [18] M. S. Lewicki and B. J. Arthur. Hierarchical organization of auditory context sensitivity. *J. Neurosci.*, 16(21):6987–6998, 1996.
- [19] M. S. Lewicki. Intracellular characterization of song-specific neurons in the zebra finch auditory forebrain. *J. Neurosci.*, 16(18):5854–5863, 1996.
- [20] M. S. Lewicki and M. Konishi. Mechanisms underlying the sensitivity of songbird forebrain neurons to temporal order. *Proc. Natl. Acad. Sci. USA*, 92:5582–5586, 1995.
- [21] M. S. Lewicki. Bayesian modeling and classification of neural signals. *Neural Computation*, 6:1005–1030, 1994.

### **Refereed Conference/Workshop Papers**

- [22] E. Doi and M. S. Lewicki. A theory of retinal population coding. In *Advances in Neural Information Processing Systems*, volume 19, 2007.
- [23] E. Doi. and M. S. Lewicki. Population coding of natural images with sensory and channel noise. In *Computational and Systems Neuroscience*, 2006.
- [24] E. Doi, D. C. Balcan., and M. S. Lewicki. A theoretical analysis of robust coding over noisy overcomplete channels. In *Advances in Neural Information Processing Systems*, volume 18, 2006.
- [25] Y. Karklin and M. S. Lewicki. Is early vision optimized for extracting higher-order dependencies? In *Advances in Neural Information Processing Systems*, volume 18, 2006.
- [26] E. Smith and M. S. Lewicki. Learning efficient auditory codes using spikes predicts cochlear filters. In Lawrence K. Saul, Yair Weiss, and Léon Bottou, editors, *Advances in Neural Information Processing Systems*, volume 17, pages 377–384. MIT Press, 2005.
- [27] E. Doi and M. S. Lewicki. Sparse coding of natural images using an overcomplete set of limited capacity units. In Lawrence K. Saul, Yair Weiss, and Léon Bottou, editors, *Advances in Neural Information Processing Systems*, volume 17, pages 1289–1296. MIT Press, 2005.
- [28] E. Smith and M. S. Lewicki. Efficient coding of acoustic structure using a spike timing code. In *Computational and Systems Neuroscience*, 2004.
- [29] Y. Karklin and M. S. Lewicki. A model for learning variance components of natural images. In Suzanna Becker, Sebastian Thrun, and Klaus Obermayer, editors, *Advances in Neural Information Processing Systems*, volume 15, pages 1367–1374. MIT Press, 2003.
- [30] B. A. Olshausen, P. Sallee, and M. S Lewicki. Learning sparse images codes using a wavelet pyramid architecture. In Todd K. Leen, Thomas G. Dietterich, and Volker Tresp, editors, *Advances in Neural Information Processing Systems*, volume 13, pages 887–893. MIT Press, 2001.
- [31] T.-W. Lee, M. S. Lewicki, and T. J. Sejnowski. Unsupervised classification with non-Gaussian mixture models using ICA. In Michael J. Kearns, Sara A. Solla, and David A. Cohn, editors, *Advances in Neural Information Processing Systems*, volume 11, pages 508–514. MIT Press, 1999.

- [32] M. S. Lewicki and T. J. Sejnowski. Coding time-varying signals using sparse, shift-invariant representations. In Michael J. Kearns, Sara A. Solla, and David A. Cohn, editors, *Advances in Neural Information Processing Systems*, volume 11, pages 730–736. MIT Press, 1999.
- [33] M. S. Lewicki and B. A. Olshausen. Inferring sparse, overcomplete image codes using an efficient coding framework. In Michael I. Jordan, Michael J. Kearns, and Sara A. Solla, editors, *Advances in Neural Information Processing Systems*, volume 10, pages 815–821. MIT Press, 1998.
- [34] M. S. Lewicki and T. J. Sejnowski. Learning nonlinear overcomplete representations for efficient coding. In Michael I. Jordan, Michael J. Kearns, and Sara A. Solla, editors, *Advances in Neural Information Processing Systems*, volume 10, pages 556–562. MIT Press, 1998.
- [35] M. S. Lewicki and T. J. Sejnowski. Bayesian unsupervised learning of higher order structure. In Michael C. Mozer, Michael I. Jordan, and Thomas Petsche, editors, *Advances in Neural Information Processing Systems*, volume 9, pages 529–535. MIT Press, 1997.
- [36] M. S. Lewicki. Bayesian modeling and classification of neural signals. In Jack D. Cowan, Gerald Tesauro, and Joshua Alspector, editors, *Advances in Neural Information Processing Systems*, volume 6, pages 590–597. Morgan Kaufmann, 1994.

### **Unrefereed Conference/Workshop Papers**

- [37] E. Doi, D. C. Balcan, and M. S. Lewicki. Optimal filters under biological constraints predict population coding of retinal ganglion cells. In *Society for Neuroscience*, 2006.
- [38] E. Doi and M. S. Lewicki. Relations between the statistical regularities of natural images and the response properties of the early visual system. In *Japanese Cognitive Science Society, SIG P&P*, pages 1–8, 2005.
- [39] M. S. Lewicki. Learning efficient codes of natural sounds yields cochlear filter properties. In *International Conference on Neural Information Processing*, 2000.
- [40] M. S. Lewicki. Learning optimal codes for natural images and sounds. In A. Aldroubi, A. F. Laine, and M. A. Unser, editors, *Proc. SPIE Wavelet Applications in Signal and Image Processing Conference VIII*, volume 4119, pages 185–199. SPIE, 2000. invited paper.
- [41] T-W. Lee and M. S. Lewicki. Learning classes of efficient codes. In A. Aldroubi, A. F. Laine, and M. A. Unser, editors, *Proc. SPIE Wavelet Applications in Signal and Image Processing Conference VIII*, volume 4119, pages 453–458. SPIE, 2000. invited paper.
- [42] B. A. Olshausen, P. Sallee, and M. S. Lewicki. Learning sparse wavelet codes for natural images. In A. Aldroubi, A. F. Laine, and M. A. Unser, editors, *Proc. SPIE Wavelet Applications in Signal and Image Processing Conference VIII*, volume 4119, pages 200–207. SPIE, 2000. invited paper.
- [43] T-W. Lee, M.S. Lewicki, and T.J. Sejnowski. ICA mixture models for image processing. In *Sixth Joint Symposium on Neural Computation*. Institute for Neural Computation, 1999.
- [44] T.-W. Lee, M. S. Lewicki, and T. J. Sejnowski. ICA mixture models for unsupervised classification and automatic context switching. In *International Workshop on Independent Component Analysis (ICA'99)*, 1998.
- [45] M. S. Lewicki and B. J. Arthur. Sensitivity to auditory temporal context increases significantly from field l to hvc. In *Soc. Neurosci. Abstr.*, volume 21, page 958, 1995.

- [46] E. T. Vu and M. S. Lewicki. Intrinsic interactions between zebra finch HVC neurons involve NMDA-receptor mediated activation. In *Soc. Neurosci. Abstr.*, volume 20, page 166, 1994.
- [47] M. S. Lewicki. Bayesian modeling and classification of neural signals. In G. Heidbreder, editor, *Maximum Entropy and Bayesian Methods*, Santa Barbara, 1994. Kluwer.
- [48] M. S. Lewicki and A. J. Doupe. Synaptic activity of neurons in zebra finch song nucleus HVC in response to auditory stimuli. In *Soc. Neurosci. Abstr.*, volume 19, page 1016, 1993.

### **Patents and Invention Disclosures**

- [49] T.-W. Lee, M. S. Lewicki, and T. J. Sejnowski. Unsupervised adaptation and classification of multiple classes and sources for blind signal separation. 1999.

### **Software**

- [50] M. S. Lewicki. Software library for Bayesian spike sorting: optimal inference and classification of spike clusters and fast decomposition of overlapping action potentials. Available at <ftp://ftp.etho.caltech.edu/pub/sslib>, 1994.

## **III. Evidence of External Reputation**

### **Awards and Fellowships**

- NSF CAREER Award, 3/03
- Howard Hughes Medical Institute Research Associate, 8/96
- Sloan Foundation Postdoctoral Fellowship, 2/96

### **Invited Papers (cross-listed above)**

- [1] [E. Doi](#) and M. S. Lewicki. Relations between the statistical regularities of natural images and the response properties of the early visual system. In *Japanese Cognitive Science Society, SIG P&P*, pages 1–8, 2005. Invited paper.
- [2] M. S. Lewicki. Learning optimal codes for natural images and sounds. In A. Aldroubi, A. F. Laine, and M. A. Unser, editors, *Proc. SPIE Wavelet Applications in Signal and Image Processing Conference VIII*, volume 4119, pages 185–199. SPIE, 2000. Invited paper.
- [3] M. S. Lewicki. A review of methods for spike sorting: the detection and classification of neural action potentials. *Network: Computation in Neural Systems*, 9(4):R53–R78, 1998. Invited review paper.

### **Invited Talks**

- “Learning Hierarchical Representations of Natural Images”. Invited talk given at the Université de Montréal, Montréal, Québec, Canada, June 20, 2008.
- ”Learning Hierarchical Representations of Natural Images”. Invited talk given at the “First International Workshop on Cognitive Dynamic Systems and Their Applications” held at Niagara-on-the-Lake, Ontario, Canada, May 26-28, 2008.

- “Deducing Neural Codes and Brain Computations”. Invited talk given at Janelia Farm Research Campus, Ashburn, VA, May 22, 2008.
- “Computational goals and information processing in early vision”. Invited talk given at the CIAR (Canadian Institute for Advanced Research)- sponsored workshop on Neural Computation and Adaptive Perception held at University of California at Berkeley, Berkeley, CA, May 5 - 8, 2008.
- “Learning hierarchical representations of natural images ”. Invited talk given at the “Natural Environments, Tasks, and Intelligence” workshop held at the University of Texas at Austin, Austin, TX, March 28-30.
- “Learning to generalize over regions of natural images ” invited talk given at the “Beyond Simple Cells” workshop held at the Neural Information Processing Systems Conference, Whistler, BC, Canada, Dec. 7, 2008.
- “Sensory coding and hierarchical representations.” Invited tutorial given at the Neural and Information Processing Systems Conference, Vancouver, BC, Canada. Dec, 3, 2007.
- “Natural Sounds and Auditory Coding” Invited talk given at Univ. Maryland, College Park, MD. Oct. 26, 2007.
- “Neural coding of auditory signals” Invited talk given at Columbia University, New York, NY, June 1, 2007.
- “Information theoretic models of auditory coding.” Invited talk given at Cornell University, Ithaca, NY, April 20, 2007.
- Invited speaker at the “Functional Requirements of a Visual Theory” workshop, Park City, UT, Feb 28, 2007.
- “A theoretical approach to shape representation based on natural scene statistics.” Invited talk given at the workshop on Shape Coding in Higher-Level Visual Areas, Park City, UT, Feb 27, 2007.
- “Neural coding of natural signals: theory, computation, and data.” Invited talk given at the Computational and Systems Neuroscience Conference, Salt Lake City, UT, Feb 23, 2007.
- “Hierarchical statistical models for local and global structure in natural scenes.” Invited talk given at the Scene Understanding Symposium held at MIT, Cambridge, MA, Feb 2, 2007.
- “Information theoretic models of auditory coding”. Invited talk given at the “Advances in Models for Acoustic Processing” workshop held at the Neural Information Processing Systems workshop, Whistler, BC, Canada, Dec. 9, 2006.
- “Information theoretic models for optimal representation of natural signals.” Invited talk given at the ONR Bio-Inspired Scene Understanding Workshop, Arlington, VA, July 26, 2006.
- “Image statistics and cortical representation.” Invited lectures given at the Cold Spring Harbor Vision Course, Cold Spring Harbor, MA, Jun 21, 2006.
- “Information theoretic models of auditory coding.” Invited talk given at Johns, Hopkins University, Baltimore, MD, April 6, 2006.
- “Robust coding of natural images.” Invited talk given at the Neural Computation and Adaptive Perception meeting, Vancouver, BC, Dec. 3-5, 2005.

- “Information theoretic models of auditory coding.” Invited talk given at the Washington University Computational Neuroscience Seminar Series, St. Louis, MO, Nov 8, 2005.
- “Density component models for learning hierarchical structure in natural images” given at the Workshop on Neurobiological Vision held at the Mathematical Sciences Research Institute, Berkeley CA, Feb 7-11, 2005.
- “Learning optimal representations of natural sounds using spikes” given at the Neural Computation and Adaptive Perception meeting, Vancouver, BC, Dec. 11-12, 2004.
- “Theoretical models for the neural coding of natural sounds” given at the symposium on Object Formation in Audition and Vision at the International Neurosensory Science and Systems Graduate Summer School, Bad Zwischenahn, Germany, Aug 18 - 22, 2004.
- “Theoretical models for the neural coding of natural sounds”, given at the Telluride Workshop on Neuromorphic Engineering, Telluride, CO, June 27 - July 17, 2004.
- “The many components of spike sorting” given at the “Statistical Analysis of Neural Data” workshop, Pittsburgh, PA, May 21-22, 2004.
- “Learning higher-order structure in natural images” given at the “Learning to See” Workshop held in Vancouver, BC, Dec 6-8, 2003.
- “Efficient coding of natural sounds” given at the “Workshop on New Directions for Signal Processing in the 21st Century” held in Lake Louise, Alberta, Canada, Oct. 5-10, 2003.
- “Learning higher-order structures in natural images” given at the Redwood Neuroscience Institute, Menlo Park, CA, July 25, 2003.
- “Learning higher-order structures in natural images” given at the Sloan-Swarz Conference on Computational Neuroscience, held in Del Mar, CA, July 26, 2003.
- “Learning higher-order structures in natural images” given at the University of California, San Diego, July 28, 2003.
- “Toward invariant representations: Learning higher-order representations of natural images” given at the “Learning of invariant representations” workshop held at the Neural Information Processing Systems Conference, Whistler, BC, Canada. Dec. 2002.
- “Learning Efficient Auditory and Visual Representations” given at “The Role of Adaptation/Plasticity in Neuronal Coding” workshop held at the Neural Information Processing Systems Conference, Whistler, BC, Canada. Dec. 2002.
- “Efficient Coding of Natural Sounds” given at the McMaster-Gennum Workshop on Intelligent Hearing Aids, Kimberley, Ontario. Sep. 2002.
- “Efficient Coding of Natural Sounds” given at University of California at San Francisco, in the Formal Seminars in Neuroscience Series, May, 2002.
- Robotics Institute Seminar, Carnegie Mellon University, Nov., 2001.
- Goettingen Conference of the German Neuroscience Society, Gottingen Germany June, 2001.
- Special session on “Blind Deconvolution and Source Separation in Acoustics” at the Acoustical Society of America meeting, Newport Beach, CA, Dec. 2000.

- Special session on “Models of Natural Image Statistics” at the International Conference on Neural Information Processing, Taejon, Korea, Nov. 2000.
- ATR, JAPAN, Nov. 2000.
- RIKEN Brain Science Institute, JAPAN, Nov. 2000.
- “Natural Stimulus Statistics” meeting, Cold Spring Harbor, MA, Oct. 2000
- Johns Hopkins University, Sept. 2000
- University of California San Diego, Aug. 2000
- Special session on “Natural Image Modeling” at the 8th Annual SPIE Wavelet Applications in Signal and Image Processing Conference, Aug. 2000, San Diego, CA.
- “Population Coding” workshop held at the Neural Information Processing Systems Conference, Breckenridge, CO, Dec. 1998
- “Computational Neuroscience and Generative Models” workshop, University of Toronto, Feb. 1998
- University of California Irvine, May 1998
- University of California San Diego, Jan. 1998
- “Natural Scene Statistics” meeting, Hancock, MA, 1997
- Helmholtz Club, Irvine, CA, 1996
- NEC Research Institute, Princeton, NJ, 1995
- Bell Labs, Murray Hill, NJ, 1995
- “Neural Networks for Computing” conference, Snowbird, UT, 1994
- “Theoretical Neurobiology” workshop, Sante Fe Institute, 1992

## **IV. External Professional Activities**

### **Scientific Meetings**

- Invited participant for NSF Workshop on “Brain Science at the Interface of Biological, Physical and Mathematical Sciences, Computer Science, and Engineering: Analysis of New Opportunities”. Held at Westin Hotel, Arlington, VA, Mar 4-6, 2007.
- Co-chair for the Gordon Research Conference “Sensory Coding and the Natural Environment.” Held in Big Sky, Montana, Aug 27 - Sep 1, 2006.
- Co-vice chair for the Gordon Research Conference “Sensory Coding and the Natural Environment” held at The Queens College, Oxford, UK, Sep 5-10, 2004.
- Session chair on “Image statistics and Coding” for the Gordon Research Conference “Sensory Coding and the Natural Environment” held at The Queens College, Oxford, UK, Sep 5-10, 2004.
- Program Chair for Neuroscience track, Neural and Information Processing Systems Conference, Vancouver, Canada. Dec. 2003.
- Session Chair on “Auditory Coding”, Gordon Conference on “Sensory Coding and the Natural Environment”, Mount Holyoke College, South Hadley, MA. June 2002.



- Program committee member, Third International Conference on Independent Component Analysis and Signal Separation, San Diego, CA. Dec. 2001.
- Co-organizer, “Overcomplete Representations and Non-linear Approaches to Independent Component Analysis” workshop, held at the Neural Information Processing Systems Conference, Breckenridge, CO, Dec. 1999.
- Co-organizer, “Statistical Theories of Cortical Function” workshop, held at the Neural Information Processing Systems Conference, Breckenridge, CO, Dec. 1999.

## **Editorial and Reviewing activities**

- *Neural Computation*
- *Neural and Information Processing Systems Conference (NIPS)*, tracks: Neuroscience, Machine Vision, Biological Vision, Speech and Signal Processing, Algorithms and Architecture
- *Nature*
- *Nature Neuroscience*
- *Science*
- *Neuron*
- *Network: Computation in Neural Systems*
- *Journal of Computational Neuroscience*
- *Journal of Neuroscience*
- *Journal of Neurophysiology*
- *Journal of Neuroscience Methods*
- *IEEE Transactions on Biomedical Engineering*
- *Machine Learning*
- *Journal of Machine Learning*
- *Journal of the Royal Society*
- *Physical Review Letters*

## **V. Contract and Grant Support**

- CAREER grant “Representing Natural Auditory Scenes”, National Science Foundation. I am the sole PI. Award No. IIS-0238351. Total award amount: \$340,857 (direct costs) over five years: 3/1/03 - 2/28/08.
- Integrative Behavioral Science Center grant A framework for modeling cognition, National Institutes of Mental Health. Jay McClelland, center director. I am the lead investigator for project 8.2 of this grant. Total award amount (for my component): \$154,096 (direct costs) over 5 years: 7/1/02 - 6/30/06.
- Learning Natural Vision, National Geospatial-Intelligence Agency, Sensors and Image Science Broad Agency. I am the sole PI. Award No. HM1582-04-C-0053. Total award: \$138,490 (direct costs) for one year: 10/1/04 - 9/30/05. Awarded one year of additional funding. Total award \$127,584 for one year: 10/1/05 - 9/30/06.

- “Learning higher-order image and scene structure from natural image statistics”, National Science Foundation. I am the sole PI. Award No.IIS-0413152. Total award: \$198, 592 (direct costs) over 3 years: 1/1/05 - 12/31/07.
- “Integrating the Local and Global Structure of Natural Scenes”, National Science Foundation, I am the lead PI. Dr. Aude Oliva (MIT) is co-PI. Total award: \$647,282 (direct costs) over 3 years: 7/15/07 - 6/30/10.
- “From Individuals to Populations: Biologically-Informed Multi-Modal Situation Understanding with Sensor Networks.” Office of Naval Research. I am a co-PI. The lead PIs are Dr. Andrew Ng (Stanford) and Dr. Carlos Guestrin (CMU). Other PIs are Takeo Kanade and Jose Moura (both at CMU) and Drs. Leonidas Guibas, Daphene Koller, and Sebastian Thrun (all at Stanford). Total award amount \$1 million/year over 3 years, with 2 additional option years: 6/20/07 - 6/20/12.

## VI. Teaching

Semester	Course Number	Course Title	Number of Students	Joint Faculty	Course Units	FCE Score Instructor	FCE Score Course
Spring 2008	15-485/785	Computational Perception	4		12	N/A <sup>1</sup>	N/A
Spring 2007	15-381	Artificial Intelligence	66	Hebert	9	3.3	2.9
Spring 2006	15-485/785 85-485/785	Computational Perception and Scene Analysis	7 enrolled + auditors	none	9 undergrad 12 grad	ND <sup>2</sup>	ND
Spring 2005	15-780 16-731	Advanced AI Concepts Fund. AI for Robotics	13 18	Sandholm	12	2.6 2.1	3.2 2.2
Spring 2004	15-485/785 85-485/785	Computational Perception and Scene Analysis	9 enrolled + auditors	none	9 undergrad 12 grad	4.71	4.82
Spring 2003	15-485/785 85-485/785	Computational Perception and Scene Analysis	7 enrolled + auditors	none	9 undergrad 12 grad	4.67	5.00
Spring 2002	15-485/785 85-485/785	Computational Perception and Scene Analysis	15 enrolled + auditors	none	9 undergrad 12 grad	4.30	4.40
Spring 2001	15-491/783 85-491/791	Computational Perception and Scene Analysis	8 enrolled + 5 auditors	none	9 undergrad 12 grad	4.71	4.29
Fall 1999	15-211	Fundamental Structures of Computer Science I	249	Goldstein	12	3.38	3.86

## VII. Contributions to Education

Starting in the spring of 2001, I prepared and taught the new course “Computational Perception and Scene Analysis” which was selected for the Multidisciplinary Course Development Award by the Undergraduate Education Committee. This course is cross-listed in computer science and psychology and was developed to fill a gap in the existing curriculum.

The course description reads:

This course teaches advanced aspects of perception, scene analysis, and recognition in both the visual and auditory modalities, concentrating on the essential computational processes that

<sup>1</sup>Data not yet available.

<sup>2</sup>The new online faculty course evaluation system does not show scores if the number of responses is below a certain threshold.

allow us and animals to behave in natural, complex environments. The goal of this course is to teach how to reason scientifically about problems and issues in perception and scene analysis, how to extract the essential computational properties of those abstract ideas, and finally how to convert these into explicit mathematical models and computational algorithms. Throughout the course we examine important findings from perceptual science that have provided key insights into the function and organization of human and animal perceptual systems.

Specific topics include sensory coding, perceptual invariance, spatial vision and sound localization, visual and auditory scene segmentation, many aspects of attention, and approaches to recognition in natural visual and auditory scenes.

Mathematical topics covered include Bayesian inference, information theory, linear systems analysis, neural networks, independent component analysis, and selected algorithms in computational vision and audition.

Prerequisites: 15-385, 85-370, or premission of the instructor.

## **VIII. Student Advising**

### **Current Supervised students**

- Wooyoung Lee (Aug 2007 - present), First year Ph.D. student in Computer Science Department and Center for the Neural Basis of Cognition.
- Daniel Leeds (Aug 2006 - present), Second year Ph.D. student in the Robotics Institute and Center for the Neural Basis of Cognition.
- Doru Balcan (Aug 2002 - present), Sixth year Ph.D. student in the Computer Science Department.

### **Former Supervised students**

- Yan Karklin (Aug 2000 - Feb 2008): Ph.D student in Computer Science Department and the Center for the Neural Basis of Cognition. Graduated 11/2007.
- Sofia Cavaco (Jan 2003 - Aug. 2006), Ph.D. student in the Computer Science Department. Transferred to CMU from MIT where she was in her 2nd year of their PhD program. Graduated 8/2006.
- Eizaburo Doi (March 2003 - June 2006), Postdoctoral associate.
- Evan Smith (Aug 2001 - May, 2006. Co-advised with Jay McClelland): Ph.D. student in Psychology Department and the Center for the Neural Basis of Cognition. Graduated. 5/2006.
- Xuexing (Jing) Chen (Aug 2003 - Aug 2006, co-advised with Takeo Kanade), Ph.D. student in the Computer Science Department and Center for the Neural Basis of Cognition. Currently on leave of absence to pursue other interests.
- Mark Albert (Aug - Dec 2002), Ph.D. student in Computer Science Department and the Center for the Neural Basis of Cognition. Terminated from the Ph.D. program, Dec 2002.
- Pippin Whitaker (Aug 2001 - Dec 2001): M.S. student in Knowledge and Data Discovery. Withdrew from program in good standing to pursue other interests, Jan 2002.

### **Service on thesis committees**

- Armen Arevian, Ph. D. student in Department of Neuroscience, University of Pittsburgh and the Center for the Neural Basis of Cognition.
- Ning Hu, Ph. D. student in the Computer Science Department.
- Robert Malkin, Ph.D. student in the Language Technologies Institute. Graduated 12/2006.
- David McMahon: Ph.D. student in the Department of Neuroscience, University of Pittsburgh and the Center for the Neural Basis of Cognition. Graduated 12/2005.
- Dennis Strelow, Ph.D. student in the Computer Science Department. Graduated 11/2004.
- Stella Yu: Ph.D student in the Robotics Institute and the Center for the Neural Basis of Cognition. Graduated 5/2003.
- Randy Bruno: Ph.D. student in Neurobiology Department, University of Pittsburgh and the Center for the Neural Basis of Cognition. Graduated 11/2002.

### **IX. University Service**

- CNBC CMU co-director search committee, 2006-present.
- CSD admissions committee, 2006, 2007, 2008 (chair)
- CNBC executive committee, 1/99 - present.
- chair, CNBC computing committee, 8/00 - 7/01; 7/02 - present.
- Organizer, Annual Computer Science Department Reception (Login Ball), 9/02.
- Organizer, Computer Science Department Immigration Course, 2002.
- Organizer for the "AI Faculty Lunches," 9/99 - 12/01.
- Co-organizer for the 2000 CNBC Retreat.