



# David Cox

Curriculum Vitae (May 2009)

The Rowland Institute at Harvard  
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## Research Appointment

### The Rowland Institute at Harvard – 2007-present

Rowland Fellow; Principal Investigator, Visual Neuroscience Laboratory  
Harvard University, School of Engineering and Applied Sciences

## Education

### Massachusetts Institute of Technology – 2002-2007

Ph.D. in Neuroscience (major area of concentration in computational neuroscience)  
Advisor: James DiCarlo, M.D., Ph.D.

### Harvard University, Cambridge, MA – 1996-2000

A.B. Biology and Psychology  
Magna Cum Laude with Highest Honors in Biology and Psychology

## Research Summary

We recognize visual objects with such ease that it is easy to overlook what an impressive computational feat this represents. Any given object in the world can cast an effectively infinite number of different images onto the retina, depending on its position relative to the viewer, the configuration of light sources, and the presence of other objects in the visual field. In spite of this extreme variation, biological visual systems are able to effortlessly recognize at least hundreds of thousands of distinct object classes—a feat that no current artificial system can come close to achieving.

My laboratory seeks to understand the computational underpinnings of object recognition through a concerted effort on two fronts. First, we endeavor to understand the workings of biological visual systems using a variety of experimental techniques, ranging from microelectrode recordings to visual psychophysics. Second, we attempt to instantiate what we have learned into artificial object recognition systems, leveraging recent advances in parallel computing to build systems that begin to approach the scale of natural systems. By combining reverse- and forward-engineering approaches, we hope to accelerate progress in both domains.

## Publications

### Peer-Reviewed Publications

#### As an Independent Investigator (Harvard)

Pinto N, Doukhan D, DiCarlo JJ, and **Cox DD**. (2009) A High-Throughput Approach to Biologically-Inspired Object Recognition. *PLoS Computational Biology*. 5(11): e1000579. doi:10.1371/journal.pcbi.1000579.

Zoccolan, DF, Oertelt, N, DiCarlo, JJ, **Cox, DD**. (2009) A Rodent Model for the Study of Invariant Visual Object Recognition. *Proceedings of the National Academy of Sciences* doi:10.1073/pnas.0811583106

Pinto N, DiCarlo JJ, and **Cox DD**. (2009) How far can you get with a modern face recognition test set using only simple features? *IEEE Computer Vision and Pattern Recognition*



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Pinto N, DiCarlo JJ, **Cox DD** (2008) Establishing Good Baselines and Benchmarks for Face Recognition. *Proceedings of the Faces in Real Life Images Workshop, ECCV 2008*.  
oai:hal.inria.fr:inria-00326721\_v1

### Graduate Work (MIT)

**Cox DD**, DiCarlo JJ (2008) Does Learned Shape Selectivity in Inferior Temporal Cortex Automatically Generalize Across Retinal Position? *Journal of Neuroscience*, 28(40): 10045-10055.

**Cox DD**, Papanastassiou A, Oreper D, Andken B, DiCarlo JJ (2008) High-Resolution Three-Dimensional Microelectrode Brain Mapping Using Stereo Microfocal X-Ray Imaging. *Journal of Neurophysiology* 100(5):2966-76.

Li N, **Cox DD**, Zoccolan D, DiCarlo JJ (2009) What response properties do individual neurons need to underlie position and clutter "invariant" object recognition? *Journal of Neurophysiology* 102(1):360-76.

Mujica-Parodi L, Strey H, Frederick B, Savoy RL, **Cox DD**, Botanov Y, Tolkunov D, Rubin D, Weber J (2009) Chemosensory Cues to Conspecific Emotional Stress Activate the Amygdala in Humans. *PLoS ONE* 4(7):e6415

Pinto N\*, **Cox DD**\* (contributed equally), DiCarlo JJ. (2008) Why is Real World Object Recognition Hard? *PLoS Computational Biology* 4(1):e27

Balas B, **Cox DD**, Conwell E (2007) The Effect of Real-World Personal Familiarity on the Speed of Face Information Processing. *PLoS One* 2(11):e1223

DiCarlo JJ and **Cox DD**. (2007) "Untangling" Invariant Object Recognition. *Trends in Cognitive Science*, 11(8): 333-341.

**Cox DD**, Meier P, Oertelt N, DiCarlo JJ (2005) 'Breaking' Position-Invariant Object Recognition. *Nature Neuroscience*, 8: 1145-1147.

Zoccolan DF\*, **Cox DD**\* (contributed equally), DiCarlo JJ (2005) Multiple object response normalization in monkey inferotemporal cortex. *Journal of Neuroscience*, 25(36): 8150-8164.

**Cox D**, Meyers E, Sinha P (2004) Contextually Evoked Object-Specific Responses in Human Visual Cortex. *Science* 304:115-117.

### Prior to Graduate School

**Cox DD** & Savoy RL (2003) Functional Magnetic Resonance Imaging (fMRI) "Brain Reading:" Detecting and Classifying Distributed Patterns of fMRI Activity in Human Visual Cortex. *NeuroImage* 19: 261-270.

### Patents

Cox DD, DiCarlo JJ, Device and Method for Tracking Eye Gaze Direction. (US Serial No: 60/664,593) Filed March 2006.

### Selected Conference Presentations

Cox DD (2008) Untangling Invariant Visual Object Representations. COSYNE 08 Workshops



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Cox DD, Pinto N, Doukhan D, Corda B, DiCarlo JJ (2008) A High-Throughput Screening Approach to Discovering Good Forms of Visual Representation. COSYNE 08

Li N, Cox DD, Zoccolan D, DiCarlo JJ (2006) Flexible and robust object recognition supported by neurons with limited position and clutter tolerance. Society for Neuroscience Annual Meeting. Atlanta, GA

Cox DD, DiCarlo JJ (2005) Is the Binding Problem Really a Problem in Inferotemporal Cortex? Society for Neuroscience Annual Meeting. Washington D.C.

Cox DD, DiCarlo JJ (2004) The Effect of Visual Experience on the Position Tolerance of Primate Object Representations. Society for Neuroscience Annual Meeting. San Diego, CA.

Cox DD, Savoy RL (2002) A Statistical Pattern Recognition Approach to fMRI. Annual Meeting of the Organization for Human Brain Mapping, Sendai, Japan.

Cox DD, Savoy RL (2001) Detecting and Classifying Distributed Patterns of Activity in Human Visual Cortex. Society for Neuroscience Annual Meeting. San Diego, CA.

## Awards, Honors, and Fellowships

Rowland Junior Fellowship, Harvard University – 2007-present

National Defense Science and Engineering Graduate Fellowship – 2003-2006

Harvard Committee on Undergraduate Education Certificate of Distinction in Teaching – 2000, 2001

## Teaching

Guest Lecture (“Parallel Computing for Biologically-Inspired Vision”) CS 264: Massively Parallel Computing (Harvard), Fall 2009.

Keynote Lecture, NCSA / Great Lakes Consortium for Petascale Computation Summer School: Many-Core Processors for Science and Engineering Applications, 2009

Guest Lecture (“Unlocking Biologically-Inspired Computer Vision: A High-Throughput Approach”), 6.963: CUDA@MIT (MIT), 2009

Guest Lecture (“Resampling Statistics”), 9.07: Introduction to Statistical Methods (MIT) – Spring 2006

Teaching Assistant, 9.02: Brain Laboratory (MIT) – Spring 2006

Invited Speaker, Advanced Training Institute in Functional MRI (American Psychological Association) – 2005

Teaching Assistant, 9.011 Systems Neuroscience (MIT) – Fall 2004

Teaching Assistant, 9.00 Introduction to Psychology (MIT) – Fall 2003

Teaching Assistant, Functional MRI Visiting Fellowship Program (Massachusetts General Hospital) – 2000-2006

Teaching Assistant, Psychology 1251, Introduction to Functional Neuroimaging Methods (Harvard) – Fall 2000, 2001



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## Professional Service

Reviewer for NSF, *IEEE Transactions in Medical Imaging*, *Cortex*, *Cerebral Cortex*, *Cognitive Science*, *NeuroImage*, *Human Brain Mapping*, *Neural Processing Letters*, *Trends in Cognitive Science*, and *Brain and Behavioral Sciences*