

# Antonio Torralba

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## CURRENT POSITION

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2005 – present Research Scientist,  
MIT, Computer Science and Artificial Intelligence Laboratory.  
Advisor: Prof. William T. Freeman

## RESEARCH INTERESTS

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My research is in the areas of computer vision, machine learning, computer graphics and human visual perception.

## EDUCATION

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- 1999 Ph.D. in Signal-Image-Speech (Summa Cum Laude).  
Institut National Polytechnique, Grenoble, France.  
Thesis: Analogue architectures for vision: cellular neural networks and neuromorphic circuits.  
Advisor: Prof. Jeanny Hérault.
- 1996 M.Sc. in Signal-Image-Speech Processing, Institut National Polytechnique, Grenoble, France.  
Awarded with highest honors (ranked first among 80 students).  
Advisor: Prof. Jeanny Hérault.
- 1995 B.Sc. and M.Sc. in Telecommunications Engineering. Universitat Politecnica de Catalonia,  
Barcelona, Spain. Awarded with high honors (ranked third among 351 students).

## RESEARCH EXPERIENCE

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- 2005 – present Research Scientist, MIT, Computer Science and Artificial Intelligence Laboratory.
- 2002 – 2005 Postdoctoral associate, MIT, Computer Science and Artificial Intelligence Laboratory.  
Developing algorithms for object recognition and contextual reasoning.  
Advisor: Prof. William T. Freeman
- 2000 – 2002 Postdoctoral associate, MIT, Dept. Brain and Cognitive Sciences.  
Developed models of human attention and studied face processing in humans.  
Advisor: Prof. Pawan Sinha
- 1996 – 1999 Research assistant. Institut National Polytechnique, Grenoble, France.  
Developed low-level vision algorithms suited for real-time hardware implementation.
- 1995 Research assistant. Institut fur Physikalische Chemie, Freiberg, Germany.  
Study of signal processing techniques for noise removal for high precision calorimetry.
- 1993 – 1996 Research assistant. Laboratory CIRG, Department of Applied Physics. Universitat Politecnica de  
Catalonia, Barcelona, Spain.  
Construction of high precision calorimetric systems.

## TEACHING EXPERIENCE

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Lecturer and teaching assistant at the University Joseph Fourier, Grenoble, France. Position awarded by the Center for Introduction to Higher Education, Grenoble Academy, France.

- 1998           Lecturer in material modeling, and signal processing (20 hours). Undergraduate course.
- 1997 – 1998   Lecturer in introduction to signal processing (24 hours). Graduate and undergraduate course.
- 1997           Lecturer in control theory (72 hours). Undergraduate lab course.
- 1996           Teaching assistant in Introduction to Programming (48 hours). Undergraduate lab course.
- 1996           Teaching assistant in Industrial Electronics (48 hours). Undergraduate lab course.

## AWARDS

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- 2005           Best Short Course Award, International Conference on Computer Vision (ICCV)
- 2004           Best Poster Award, Conference on Computer Vision and Pattern Recognition (CVPR)
- 1996           Center for Introduction to Higher Education Fellowship, Grenoble, France.
- 1996           Graduate Fellowship. Ministry for National Education and Research, France.
- 1995           ERASMUS Fellowship. Universitat Politecnica de Catalonia, Barcelona, Spain.
- 1994           ERASMUS Fellowship. Universitat Politecnica de Catalonia, Barcelona, Spain.
- 1993           UPC Fellowship. Universitat Politecnica de Catalonia, Barcelona, Spain.

## PROFESSIONAL ACTIVITIES

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- 2008-09       Co-organizer of the International Workshop on Object Recognition.
- 2008           Area chair ECCV.
- 2007           Co-organizer of SUnS07: Scene Understanding Symposium, Cambridge, February 1 and 2<sup>nd</sup>.
- 2006           Co-organizer of SUnS06: Scene Understanding Symposium, Cambridge, February 2006.
- 2003           Consulting for MERL, Cambridge, USA.

Reviewer for Siggraph, ECCV, ICCV, CVPR, NIPS. Journal of Optical Society of America, NETWORK, IEEE Image processing, Transactions on Pattern Analysis and Machine Intelligence, Journal of Electronic Imaging, journal of Computer Vision and Image Understanding, International Journal of Computer Vision, Journal of Machine Learning, Journal of Vision, Journal of Experimental Psychology: Human perception and performance, Visual Cognition.

Grant reviewer for the Agència de Gestió d'Ajuts' Universitaris i de Recerca, Catalonia, Spain.

## INVITED TALKS AND SEMINARS

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- 2006 Nov.     Robotics Institute Seminar. School of Computer Science, Carnegie Mellon University.  
*Object recognition in context*
- 2006 Oct.     Image and Video Computing Group. Boston University.  
*Object recognition in context*
- 2006 Oct.     International Workshop on Object Recognition, Catania, Sicily, Italy.  
*Object recognition on tiny images.*
- 2006 Sept.    GAME Workshop, DARPA.  
*Multiclass object recognition in context.*
- 2006 Aug.     Gordon conference on Sensory coding and the natural environment, Big Sky, MT, USA.  
*Hierarchical models of scenes, objects, parts and features.*
- 2006 Jul.     Seminar Microsoft Research Cambridge, UK  
*Multiclass object recognition in context*
- 2006 Jul.     Open house on multiple-task and complex outputs learning. College of London, UK  
*Learning shared representations for object recognition*
- 2006 May     IMA Annual Program Year Workshop. Visual Learning and Recognition  
*Learning Shared Features*

- 2006 Feb. Harvard University, Dept. of Psychology, Vision Lab Seminar Series.  
*Global features for scene and object recognition.*
- 2006 Feb. Scene Understanding Symposium  
*Using the Forest to see the Trees: A computational model relating features, objects and scenes*
- 2006 Feb. NMR-MGH center, Harvard Medical School.  
*Learning Hierarchical Models of Scenes, Objects, and Parts*
- 2006 Feb. Boston University, CN730 -- Models of Visual Perception.  
*Multiclass object detection and recognition in context*
- 2005 Dec. NIPS workshop on Interclass Transfer.  
*Learning Shared Parts using Dirichlet Processes.*
- 2005 Aug. Lotus Hill International Workshop, Hubei, China.  
*Learning Hierarchical Models of Scenes, Objects, and Parts.*
- 2005 Apr. Visual Learning and Brain Plasticity workshop. University of Minnesota.  
*Learning Hierarchical Models of Scenes, Objects, and Parts.*
- 2005 Feb. MSRI Emphasis Week on Neurobiological Vision, Mathematical, Computational and Statistical Aspects of Image Analysis.  
*How scene context guides attention.*
- 2004 Dec. NIPS workshop "Statistical, computational, and psychophysical techniques for inferring features from stimulus classification", Whistler, B.C., Canada.  
*Feature sharing for multiclass object detection leads to edge and line detection.*
- 2004 Oct. International Workshop on Object Recognition, Taormina, Sicily.  
*Contextual Models for Multiclass Object Detection.*
- 2004 Oct. Rutgers-New Brunswick Human and Computer Vision, Psychology Dept., Rutgers University.  
*Multiclass object recognition and context modeling.*
- 2004 Jan. Mitsubishi Electric Research Laboratories, Cambridge, USA.  
*Using the forest to see the trees: a graphical model relating features, objects and scenes.*
- 2004 Jan. MIT, Independent Activities Period course, "From vision to cognition (and back)".  
*Scene perception and search.*
- 2003 Dec. MIT, Dept. Brain and Cognitive Sciences, Cognitive Lunch Talk Series.  
*The role of global scene factors in attention and object detection.*
- 2003 Dec. MIT, Dept. Brain and Cognitive Sciences, Topics in Vision Science: Natural Scene Statistics.  
*The statistics of natural images.*
- 2003 Nov. Harvard University, Dept. of Psychology, Vision Lab Seminar Series.  
*The role of global scene factors in attention and object detection.*
- 2003 Oct. The University of Texas at Austin, Center for Perceptual Systems.  
*The role of global scene factors in attention and object detection.*
- 2003 Apr. MIT, Center for Biological and Computational Learning.  
*Context-based vision system for place and object recognition.*
- 2003 Apr. Michigan State University, Seminar "Human and Machine Vision".  
*Modeling attention and context in object detection.*
- 2003 Jan. MIT, Computer Science and Artificial Intelligence Laboratory, "Vision retreat".  
*The statistics of natural images.*
- 2002 Nov. Max-Planck Institute for Biological Cybernetics, Tübingen, Germany.  
*Scene recognition.*
- 2002 Jan. Honda R&D Americas, Fundamental Research Laboratories. Mountain View, CA.  
*Scene modeling: applications for object recognition and robot localization.*
- 2000 Nov. MIT, Dept. Brain and Cognitive Sciences, Cognitive Architectures and Natural Kinds  
*Language and vision.*
- 2000 Jul. Nissan, Cambridge Basic Research Laboratory (CBR). Cambridge, MA.  
*Global representation of the structure of real-world scenes.*

## JOURNAL PUBLICATIONS

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- A. Torralba, K. P. Murphy and W. T. Freeman (in press). Sharing visual features for multiclass and multiview object detection. *IEEE Transactions on Pattern Analysis and Machine Intelligence.*

- A. Torralba, A. Oliva, M. Castelhana and J. M. Henderson (2006). Contextual guidance of attention in natural scenes: the role of global features on object search. *Psychological Review*, Vol. 113(4). pp.766-786.
- A. Oliva, A. Torralba and P. Schyns (2006). Hybrid images. *ACM Trans. on Graphics (Proc. Siggraph 2006)*, vol. 25, number 3, pp. 527-532.
- C. Liu, A. Torralba, W.T. Freeman, F. Durand and E.H. Adelson. (2005), Motion magnification. *ACM Trans. on Graphics (Proc. Siggraph 2005)*, pp. 519-526.
- R. W. Fleming, A. Torralba and E. H. Adelson (2004). Specular reflections and the perception of shape. *Journal of Vision*, 4(9), 798-820.
- A. Torralba (2003). Contextual priming for object detection. *International Journal of Computer Vision*. Vol. 53(2), 169-191.
- A. Torralba (2003). Modeling global scene factors in attention. *Journal of Optical Society of America A. Special Issue on Bayesian and Statistical Approaches to Vision*. Vol. 20(7): 1407-1418.
- A. Torralba, A. Oliva. (2003). Statistics of natural image categories. *Network: computation in neural systems*. Vol. 14, 391-412.
- A. Torralba, A. Oliva. (2002). Depth estimation from image structure. *IEEE Transactions on Pattern Analysis and Machine Intelligence*. Vol. 24(9): 1226-1238.
- A. Oliva, A. Torralba (2001). Modeling the shape of the scene: a holistic representation of the spatial envelope. *International Journal of Computer Vision*, Vol. 42(3): 145-175.
- A. Torralba, J. Héroult. (1999). An efficient neuromorphic analog network for motion estimation. *IEEE Transactions on Circuits and Systems-I. Special Issue on Bio-Inspired Processors and CNNs for Vision*. Vol. 46(2): 269-280.
- J. L. Pelegrina, M. Sade, C. Auguet, V. Torra, A. Torralba. (1999). Calorimetry under stress - A preliminary study in single crystalline Cu-Zn-Al shape memory alloys. *Journal of Thermal Analysis and Calorimetry*. Vol. 56 (1): 247-259.
- A. Torralba, J. Héroult. (1998). Minimal complexity velocity-tuned filters with analogue neuromorphic networks: A theoretical approach for efficient design. *Neural Processing Letters*. Vol. 8(3): 229-239.
- J. Lerchner, G. Wolf, A. Torralba, V. Torra. (1997). Ambient perturbation reduction in microsized calorimetric systems. *Thermochimica Acta*. Vol. 302: 201-210.
- A. Isalgue, H. Tachoire, A. Torralba, V. R. Torra, V. Torra. (1996). Predictable behavior of smart materials (Cu-Zn-Al SMA). *Journal of Thermal Analysis*. Vol. 47: 151-163.
- A. Isalgue, A. Torralba, V. Torra. (1994). From adapted and computerized thermomechanical equipments to modeling and the time-evolution behavior in Cu-Zn-Al shape memory alloys. *Journal of Thermal Analysis*. Vol. 41: 1425-1432.

## **BOOK CHAPTERS**

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- J. Ponce, T.L. Berg, M. Everingham, D.A. Forsyth, M. Hebert, S. Lazebnik, M. Marszalek, C. Schmid, B.C. Russell, A. Torralba, C.K.I. Williams, J. Zhang, and A. Zisserman (in press). Dataset Issues in Object Recognition. Sicily workshop on object recognition, Lecture Notes in Computer Science.
- K. Murphy, A. Torralba, D. Eaton, W. T. Freeman (in press). Object detection and localization using local and global features. Sicily workshop on object recognition, Lecture Notes in Computer Science.

- A. Torralba, K. P. Murphy and W. T. Freeman (in press). Sharing visual features for multiclass and multiview object detection. Sicily workshop on object recognition, Lecture Notes in Computer Science.
- Fleming, R. W., Torralba, A. and E. H. Adelson. Shape from sheen. *Three dimensional shape perception*. (Eds.) Zaidi, Q., Springer (in revision)
- A. Oliva, and A. Torralba (2006). Building the Gist of a Scene: The Role of Global Image Features in Recognition. *Visual Perception, Progress in Brain Research*, vol. 155.
- A. Torralba (2005). Contextual Influences on Saliency. *Neurobiology of Attention*. Eds. L. Itti, G. Rees and J. Tsotsos. Pages 586-593. Academic Press / Elsevier.

## PEER-REVIEWED CONFERENCE PAPERS

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- E. Sudderth, A. Torralba, A. Wilsky and W. T. Freeman. (2006). Depth from Familiar Objects: A Hierarchical Model for 3D Scenes. *Proceedings of the 2006 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)*.
- E. Sudderth, A. Torralba, A. Wilsky and W. T. Freeman. (2006). Describing Visual Scenes using Transformed Dirichlet Processes. *Adv. in Neural Information Processing Systems (NIPS)*.
- E. Sudderth, A. Torralba, A. Wilsky and W. T. Freeman. (2005). Learning Hierarchical Models of Scenes, Objects, and Parts. *IEEE Intl. Conference on Computer Vision (ICCV)*.
- A. Torralba, K. P. Murphy and W. T. Freeman. (2005). Contextual Models for Object Detection using Boosted Random Fields. *Adv. in Neural Information Processing Systems 17 (NIPS)*, pp. 1401-1408, Vancouver, BC, MIT Press.
- S. Ravela, A. Torralba, W. T. Freeman. (2005). An Ensemble Prior of Image Structure for Cross-modal Inference, *IEEE Intl. Conference on Computer Vision (ICCV)*.
- B. Hidalgo-Sotelo, A. Oliva, and A. Torralba. (2005). Human Learning of Contextual Priors for Object Search: Where does the time go? *Proceedings of the 3rd Workshop on Attention and Performance in Computer Vision at the Int. CVPR*.
- A. Torralba, K. P. Murphy and W. T. Freeman. (2004). Sharing features: efficient boosting procedures for multiclass object detection. *Proceedings of the 2004 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)*. pp 762- 769.
- A. Torralba, K. P. Murphy, W. T. Freeman, and M. A. Rubin. (2003), Context-based vision system for place and object recognition, *IEEE Intl. Conference on Computer Vision (ICCV)*, Nice, France, October.
- A. Torralba, W. T. Freeman. (2003). Properties and applications of shape recipes. *IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)*, Madison, WI, June, 2003.
- K. P. Murphy, A. Torralba and W. T. Freeman (2003). Using the forest to see the trees: a graphical model relating features, objects and scenes. *Adv. in Neural Information Processing Systems 16 (NIPS)*, Vancouver, BC, MIT Press.
- A. Oliva, A. Torralba, M. S. Castelhana, J. M. Henderson. (2003). Top-down control of visual attention in object detection. *Proceedings of the IEEE International Conference on Image Processing (ICIP'03)*. Barcelona, Spain.
- W. T. Freeman, A. Torralba. (2002). Shape Recipes: Scene Representations that Refer to the Image. *Adv. in Neural Information Processing Systems 15 (NIPS)*, MIT Press.

- A. Oliva, A. Torralba. (2002). Scene-Centered Description from Spatial Envelope Properties. In *Proc. 2nd Workshop on Biologically Motivated Computer Vision (BMCV'02)*, Tübingen, Germany.
- A. Torralba (2001). Contextual modulation of target saliency. *Adv. in Neural Information Processing Systems 14 (NIPS)*, Vol. 2, pp 1303-1311, MIT Press.
- A. Torralba, P. Sinha. (2001). Statistical context priming for object detection. *Proceedings of the International Conference on Computer Vision (ICCV)*, pp. 763-770, Vancouver, Canada.
- A. Torralba, A. Oliva. (1999). Semantic organization of scenes using discriminant structural templates. *Proceedings of the International Conference on Computer Vision (ICCV)*, pp. 1253-1258, Korfu, Greece.
- A. Torralba, J. Héroult. (1999). Asymmetrical filters for vision chips: a basis for the design of large sets of spatial and spatio-temporal filters. *IEEE Proceedings of the Seventh International Conference on Microelectronics for Neural, Fuzzy and Bio-Inspired Systems*. pp. 224-231, Granada, Spain, April 1999.
- A. Oliva, A. Torralba, A. Guerin-Dugue and J. Héroult (1999). Global Semantic Classification of Scenes using Power Spectrum Templates. *Proceedings of the Challenge of Image Retrieval (CIR)*, Newcastle. Electronic Workshop Computer Series, Springer-Verlag.
- A. Torralba, J. Héroult. (1997). From retinal circuits to motion processing: a neuromorphic approach to velocity estimation. *European Symposium on Artificial Neural Networks*, pp. 47-54, Bruges, April 1997.
- A. Torralba, J. Héroult. (1997). Circuits neuromorphiques pour l'estimation du mouvement. *16th symposium GRETSI on signal and image processing*, Grenoble, Septembre 1997.
- A. Torralba, V. R. Torra, V. Torra, H. Tachoire. (1995). Enhanced tools in SMA studies: conduction calorimeter and thermomechanical devices with high resolution thermal analysis. *Proceedings of Journées Med. CAT'95 (XVII Conference AICAT-GICAT, VI Meeting GECAT)*, 327-330, Cagliari, Italy.
- A. Isalgue, J. L. Pelegrina, A. Torralba, V. Torra. (1995). Time behavior analysis of smart materials (Cu-Zn-Al SMA). *Proceedings of Journées Med. CAT'95*, Cagliari, Italy.
- A. Isalgue, J. L. Pelegrina, A. Torralba, V. R. Torra, V. Torra. (1994). Meso-scale model of a Cu-Zn-Al single crystal SMA. *Mechanics of phase transformations and shape memory alloys*, Eds. L. C. Brinson and B. Moran, ISBN No. 0-7918-1437-8, New York (USA), pp. 71-84.

## CONFERENCE ABSTRACTS

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- A. Oliva, T. Konkle, M. R. Greene, A. Torralba, (2006). Not all scene categories are created equal: the role of object and layout diagnosticity in scene gist understanding. Vision Science Society Meeting.
- A. Torralba, A. Oliva, M. Castelhana, J. Henderson, (2004). Saliency, objects and scenes: global scene factors in attention and object detection. *Journal of Vision*, Visual Science Society Meeting.
- A. Torralba, A. Oliva, W. T. Freeman, (2003). Object recognition by scene alignment. Visual Science Society Meeting. *Journal of Vision*, 3(9), 196a.
- A. Oliva, A. Torralba, M. Castelhana, J. Henderson, (2003). Top-down control of visual attention in real world scenes. Visual Science Society Meeting. *Journal of Vision*, 3(9), 3a.
- W. T. Freeman, A. Torralba. (2003). Shape recipes: scene representations that refer to the image. Visual Science Society Meeting. *Journal of Vision*, 3(9), 419a.

- R. Fleming, A. Torralba, R. Dror, E. Adelson, (2003). How image statistics drive shape-from-texture and shape-from-specularity. Visual Science Society Meeting. *Journal of Vision*, 3(9), 73a.
- A. Torralba, A. Oliva. (2002). The scene sketch. European Conference on Visual Perception, European Conference on Visual Perception. *Perception*, supp. 31, p133.
- A. Torralba, A. Oliva. (2002). Global depth perception from familiar structure. Visual Science Society Meeting. *Journal of Vision*, 2(7), 494a.
- P. Sinha, A. Torralba. (2002). Detecting faces in impoverished images. Visual Science Society Meeting. *Journal of Vision*, 2(7), 601a.
- Y. Ostrovsky, A. Torralba, P Sinha (2002). Recognition with purely 3D information. Visual Science Society Meeting. *Journal of Vision*, 2(7), 684a.
- J. M. Wolfe, A. Torralba, T. S. Horowitz. (2002) Remodeling Visual Search: How gamma distributions can bring those boring old RTs to life. Visual Science Society Meeting. *Journal of Vision*, 2(7), 735a.
- A. Torralba, P. Sinha. (2001). Contextual influences on object recognition. European Conference on Visual Perception. *Perception*, supp. 30.
- A. Torralba, P. Sinha, A. Oliva. (2001). Modeling Contextual influences on object recognition. Visual Science Society Meeting. *Journal of Vision*, 1(3), 299a.
- A. Oliva, A. Torralba. (2001). A holistic view-based representation of real-world scenes. European Conference on Visual Perception. *Perception*, supp. 30, 6.
- P. Sinha, A. Torralba. (2001). Detecting faces in impoverished images. European Conference on Visual Perception. *Perception*, supp. 30.
- P. Sinha, A. Torralba. (2001). The role of low-level mechanisms in brightness perception. Visual Science Society Meeting. *Journal of Vision*, 1(3), 42a.
- A. Torralba, A. Oliva. (2000). A low dimensional representation of the scene structure. *Investigative Ophthalmology & Visual Science*, 41.
- A. Oliva, A. Torralba. (2000). Recognition of Real World Scenes using Scene Discriminant Filters. *International Conference on Cognitive and Neural Systems*, Boston. ICCNS'2000.
- A. Torralba, A. Oliva. (1999). A new spectral space for representing natural images. *Investigative Ophthalmology & Visual Science*, 40, 4, S350.
- A. Oliva, A. Torralba. (1999). Scene classification from low-level features. *Investigative Ophthalmology & Visual Science*, 40, 4, S414.
- A. Oliva, A. Torralba. (1999). Recognition of real world environments. Neuromorphic workshop, Telluride, Colorado, US.
- A. Torralba, D. Alleysson, J. Héroult. (1998). Spatio-chromatic processing in the human retina: Towards an optimal trade-off between spatial resolution of luminance and range colour perception. European Conference on Visual Perception. *Perception*, supp. p. 179.
- A. Torralba, J. Héroult. (1998). A study of motion after-effects in a neuromorphic model of motion detection. European Conference on Visual Perception. *Perception*, supp. p. 191.