

## Curriculum Vitae

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### **Name and position title**

Zhiyong Yang, Research Associate

### **Education**

1984 - 1988 BS (in Mechanics) Cheng Du Inst. of Tech, P. R. China  
1991 - 1994 MS (in Theoretical Physics) Beijing Normal Univ., P. R. China  
1994 - 1997 PhD (in Computer Vision) Chinese Academy of Sciences, P. R. China

### **Doctoral and postdoctoral research**

1994 - 1997 National Laboratory of Pattern Recognition  
Inst. of Automation, Chinese Acad. of Sciences, Beijing 100080, P. R. China  
Supervisor: Songde Ma, Ph.D.  
Research projects: Perceptual organization  
Model solutions for the binding problem  
Shape representation and similarity  
Neural dynamics of illusory brightness perception  
PhD Thesis Title: Visual Binding: Theories and Models

1997 - 1998 Pattern Theory Group, Division of Applied Mathematics, Brown University  
Providence, RI 02912.  
Supervisor: David Mumford, Ph.D.  
Research projects: High order statistics of natural images

1998 - 1999 Dept. of Psychology, University of Arizona, Tucson, AZ 85721.  
Supervisor: Richard S. Zemel, Ph.D.  
Research projects: Probabilistic framework for combining of multiple modes of  
information about shape

1999 - 2003 Dept. of Neurobiology, Duke Univ. Medical Center, Durham, NC 27710.  
Supervisor: Dale Purves, M.D.

2003 - present Center for Cognitive Neuroscience, Duke Univ., Durham, NC 27708  
Supervisor: Dale Purves, M.D.

Research projects: Visual perception of brightness, color, motion, stereopsis and space  
Statistics and probabilistic models of range, hyper-spectral and stereoscopic images based on natural scenes  
Visual system structure and function  
Theoretical framework of vision

### **Teaching experience**

1992-1993 Taught physics labs

1994-1997 Supervised four master degree students

### **Professional associations**

Society for Neuroscience  
Cognitive Neuroscience Society  
Vision ScienceS Society  
Association for the Scientific Study of Consciousness

### **Honors**

1996 Fellowship of the President of Chinese Academy of Sciences, P. R. China  
1996 Best paper award, Inst. of Automation, Chinese Acad. of Sciences, Beijing, P. R. China.

### **Referees**

Dr. Dale Purves  
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Fax: (919) 681-7033

## Publications

- [1] Z. Yang. A twisted matching procedure for unbinding transitions of interacting membranes. *Physics Letters A* **192**, 247-249 (1994).
- [2] Z. Yang. Morphological transitions for the fixed-point potentials of the renormalization group. *Journal of Physics A Math & Gen* **28**, 1799-1806 (1995).
- [3] Z. Yang. Mobile random pinning in fluctuating strings. *Physics Letters A* **220**, 209-212 (1995).
- [4] Z. Yang. Conformal invariance and  $1/f$  noise. *Physics Letters A* **197**, 235-237 (1995).
- [5] Z. Yang. Nonlinear superposition of receptive fields and phase transitions. *Physics Letters A* **219**, 277-281 (1996).
- [6] Z. Yang and S. D. Ma. A phenomenological approach to salient maps and illusory contours. *Network: Computation in Neural Systems* **7**, 555-571 (1996).
- [7] Z. Yang and L. L. Yuan. Directed paths in random media, function approximation and nonlinear regression. *Physics Letters A* **230**, 369-420 (1997).
- [8] Z. Yang and S. D. Ma. Some generalizations and applications of standard regularization theory. *China J. of Graphics and Images* **2**, 87-90 (1998).
- [9] Z. Yang, J. Xiao and S. D. Ma. Visual orders, visual binding and representation. *China J. of Graphics and Images* **3**, 353-357 (1998).
- [10] Z. Yang and S. D. Ma. Local interaction fields and adaptive regularizers for surface smoothing and image restoration. *Network: Computation in Neural Systems* **9**, 19-37 (1998).
- [11] Z. Yang and R. S. Zemel. Managing uncertainty in cue combination. *Advances in Neural Information Processing Systems* **12**, 869-875 (2000).
- [12] D. Purves, R. B. Lotto, S. M. Williams, S. Nundy and Z. Yang. Why we see things the way we do: evidence for a radically empirical strategy of vision. *Phil. Tran. Roy. Soc. Lond. B* **356**, 285-297 (2001).
- [13] Z. Yang, A. Shimpi and D. Purves. A wholly empirical explanation of perceived motion. *Proc. Natl. Acad. Sci. USA* **98**, 5252-5257 (2001).
- [14] Z. Yang, A. Shimpi and D. Purves. Perception of objects that are translating and rotating. *Perception* **31**, 925-942 (2002).
- [15] Z. Yang and D. Purves. A statistical explanation of visual space. *Nature Neuroscience* **6**, 632-640 (2003).
- [16] Z. Yang and D. Purves. Image/source statistics of surfaces in natural scenes. *Network: Computation in Neural Systems* **14**, 371-390 (2003).
- [17] Z. Yang and D. Purves. The Poggendorff illusion explained by the statistics of natural scene geometry. *Vision Research (revised version under review)*.
- [18] Zhiyong Yang and D. Purves. The statistical structure of natural light patterns determines perceived light intensity. *Submitted*.

## Papers/abstracts in referred conference proceedings

- [1] Z. Yang and S. D. Ma. Representation-induced similarity measures in vision. *Proc. Int'l Conf. on Neural Information Processing* **2**, 790-793 (1995).
- [2] Z. Yang, S. D. Ma and M. L. Qiu. Marginal effects, exchange interactions and phase transitions--A phenomenological approach to salient maps and illusory contours. *Proc. 2nd Asian Conf. on Computer Vision* **1**, 259-263 (1995).
- [3] Q. F. Ke, Z. Yang and S. D. Ma. Energy-based method for road extracting from satellite images. *Proc. IAPR Workshop on Machine Vision and Application*, 337-340 (1996).
- [4] Z. Yang, S. D. Ma and Q. F. Ke. A new way to visual representation and learning. *Proc. IAPR Workshop on Machine Vision and Application*, 115-118 (1996).
- [5] Z. Yang, S. D. Ma and Q. F. Ke. Minimum description length mediated by geometrical redundancy reduction and complement space. *Proc. IAPR Workshop on Machine Vision and Application*, 482-485 (1996).
- [6] Z. Yang and S. D. Ma. From local interaction to global perceptual correlation--Judgment of apparent brightness and perception of subjective figures as a case study. *Proc. World Congress on Neural Networks*, 31-34 (1996).
- [7] Z. Yang and S. D. Ma. A similarity measure of deformable shapes. *Proc. Int'l Conf. on Intelligent Proc. Systems*, 1455-1459 (1997).
- [8] Z. Yang and S. D. Ma. How line perception emerges from points. *Proc. Int'l Conf. on Intelligent Proc. Systems*, 1460-1464 (1997).
- [9] Z. Yang and S. D. Ma. Phase transitions and bifurcation in visual perception. *Proc. Int'l Conf. on Neural Networks*, 602-606 (1997).
- [10] Z. Yang and S. D. Ma. Beyond the standard regularization theory. Lecture Note in Computer Science 1296 (Ed G. Sommers, K. Daniilidis and J. Pauli, Springer-Verlag Berlin Hedelberg) 289-296 (1997).
- [11] Z. Yang, J. Xiao and S. D. Ma. Some general grouping principles: line perception from points as an example. *Proc. 14th Int'l Conf. Pattern Recognition*, 1825-1828 (1998).
- [12] Z. Yang. Invariance and scaling laws in natural images. *Proc. 14th Int'l Conf. Pattern Recognition*, 728-731 (1998).
- [13] Z. Yang and J. Xiao. Scaling laws in image gradient fields and texture retrieval. *Proc. 14th Int'l Conf. Pattern Recognition*, 1062-1064 (1998).
- [14] J. Xiao and Z. Yang, Q. F. Ke and S. D. Ma. Line structure extraction using multiple local and global grouping factors. *Proc. 1st Int'l Workshop on Computer Vision, Pattern Recognition and Image Processing*, NC, USA (1998).
- [15] Z. Yang. Scaling of local interaction energy and image similarity measure. *Proc. 1st Int'l Workshop on Computer Vision, Pattern Recognition and Image Processing*, NC, USA (1998).
- [16] Z. Yang. Image invariance, scaling features and image similarity. *Proc. Int'l Conf. Image Processing* **1**, 843-846 (1998).
- [17] Z. Yang and D. Purves. Perception of objects that are both rotating and translating. *Journal of Vision*, 1(3), 325a, <http://journalofvision.org/1/3/325>, DOI 10.1167/1.3.325.
- [18] D. Purves and Z. Yang. The Pogendorff illusion explained by the statistics of natural scene geometry. *Journal of Vision*, 2(7), 201a, <http://journalofvision.org/2/7/201/>, DOI 10.1167/2.7.201.

- [19] Z. Yang and D. Purves. The probabilistic foundation of visual space. *Journal of Vision*, 2(7), 715a, <http://journalofvision.org/2/7/715/>, DOI 10.1167/2.7.715.
- [20] Z. Yang and D. Purves. A probabilistic framework for contrast perception. *Society for Neuroscience Abstr.* 557.20 (2002).
- [21] Z. Yang and D. Purves. Statistical concatenations of luminance can explain lightness/brightness percepts. *Journal of Vision*, 3(9), 423a, <http://journalofvision.org/3/9/423/>, DOI,10.1167/3.9.423.
- [22] Z. Yang. Context-mediated probability vs. high-level processing in the perception of light intensity. *11th Annual Cognitive Neuroscience Society (CNS) Meeting, San Francisco, California, 2004.*
- [23] Z. Yang and D. Purves. Context-adaptive maximum entropy coding of light intensity and brightness perception. *Submitted to Computational & Systems Neuroscience, Cold Spring Harbor Laboratory, 2004.*
- [24] Z. Yang. The statistical structure of luminance and spectral contrast in natural scenes. *Submitted to Vision Sciences Society Meeting, Florida, 2004.*

### **Talks and presentations**

- [1] Representation-induced similarity measures in vision. Presented at *Intl' Conf. on Neural Information Processing* Beijing PR China 1995.
- [2] From local interaction to global perceptual correlation--Judgment of apparent brightness and perception of subjective figures as a case study. Presented at *World Congress on Neural Networks*. San Diego USA 1996.
- [3] A similarity measure of deformable shapes. Presented at *Int'l Conf. on Intelligent Proc. Systems*, Beijing, PR China 1997.
- [4] How line perception emerges from points. Presented at *Int'l Conf. on Intelligent Proc. Systems* Beijing, PR China 1997.
- [5] Scaling content of images and scaling content-based image classification and retrieval. Given at Department of Psychology State University of New Jersey Newark, Newark NJ. June 1998.
- [6] Visual combination of shading and texture. Given at Department of Neurobiology, Duke University NC. April 30, 1999.
- [7] Managing uncertainty in cue combination. Presented at *13<sup>th</sup> annual Neural Information processing Systems conference*. Colorado USA December 1999.
- [8] Perception of objects that are translating and rotating. Presented at *Vision ScienceS Society Conference*, May 2001, Florida USA.
- [9] The Poggendorff illusion explained by the statistics of natural scene geometry. Presented at *Vision ScienceS Society Conference*, Florida, 2002. USA.
- [10] The probabilistic foundation of visual space. Presented at *Vision ScienceS Society Conference*, May 2002, Florida USA.
- [11] Stereo vision and statistics of natural scenes. Presented at Gordon Research Conference on *Sensory coding and natural environment: Probabilistic models of perception*. June 30-July 5, 2002. MA, USA.
- [12] The Poggendorff illusion explained by the statistics of natural scene geometry. Presented at Gordon Research Conference on *Sensory coding and natural environment: Probabilistic models of perception*. June 30-July 5, 2002. MA, USA.

- [13] Visual space as a statistical construct. Presented at Gordon Research Conference on *Sensory coding and natural environment: Probabilistic models of perception*. June 30-July 5, 2002. MA, USA.
- [14] The visual brain as a fundamentally probabilistic machine. Given at Department of Cell Biology and Neuroscience, Center for Computational Biology, Montana State University, Bozeman, MT, March 2003.
- [15] The statistical structure of natural light patterns determines perceived light intensity. Center for Cognitive Neuroscience, Duke University, October 2003.