

Ali Borji

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RESEARCH INTERESTS

Scope: My research interests fall at the intersection of machine learning, computer vision, biological vision, cognitive psychology, neurosciences and statistics, and include:

1. Discovering behavioral factors driving human gaze and attention and subsequently translating them into computational models useful in a variety of applications. The main questions I have been addressing are: where/what do we look in natural scenes, and why do we look at them? While mechanisms of bottom-up visual attention (e.g., in free-viewing tasks) are well known, top-down and task-driven component of attention is less explored. Using a repertoire of theoretical (Bayesian statistics, classification tools, information theory) and experimental techniques (eye tracking, psychophysics, EEG), I am trying to understand and model task-driven attention in interactive environments.
2. Scene understanding and object recognition. I am also interested in probing object and scene recognition mechanisms in primates and leveraging the outcomes for developing new algorithms in computer vision. While object recognition plays a more significant role when humans scrutinize a scene in detail, humans are also able to immediately report the category of a scene after a very short presentation (as little as 100 ms) before they have time to recognize all objects. The mechanisms by which primates perceive complex visual scenes as a whole and efficiently process them are still open. The questions are: what type of information humans capture from a scene at a glance? how well current computational models of global scene context (a.k.a Gist) match with the human behavior? and how scenes are represented in the brain? I am also interested in pure computational visual recognition algorithms e.g., fine-grained categorization, language and vision, and segmentation.
3. I have recently started to explore active learning, especially how it relates to active vision and visual search. How do humans actively sample (e.g., look at) environments to obtain training samples that helps them generalize faster? What are the best strategies from a theoretical point of view? What are the strategies that humans might be employing?

Computer Science: Computer Vision, Pattern Recognition, Machine Learning, Active Learning, Bayesian Modeling, Cognitive Robotics, Bio-Inspired computing

Neurosciences: Visual Attention, Eye Movement Prediction, Human Object recognition, Scene Understanding, Early Vision, Decision Making

Google Scholar: <http://scholar.google.com/citations?user=7jTNT1IAAAA&hl=en&oi=ao>
Citations (as of July 24, 2014): 635, h-index: 11, i10-index: 15

EDUCATION

Postdoctoral Scholar, University of Southern California	03/2010-present
Research Assistant , Institute of Computer Science III, University of Bonn, Bonn, Germany	2009-2010
Ph.D. in Computational Neurosciences	2004-2009
School of Cognitive Sciences, Inst. for Research in Fundamental Sciences (IPM), Tehran, Iran Thesis title: "Interactive Learning of Task-driven Visual Attention Control"	
MSc. in Computer Engineering (Artificial Intelligence)	2001-2004
Shiraz University, Shiraz, Iran Thesis title: "Improving the Performance of Text Information Retrieval Systems Using Evolutionary Computation Techniques"	
BSc. in Computer Engineering (Software)	1997-2001
Petroleum University of Technology, Tehran, Iran Thesis title: "Design and Implementation of a Website Hit Counter"	

SKILLS

Proficient in C++, Java, Python, Pascal, Delphi, Matlab, Octave, Prolog, Linux Bash script, VB, ASP, SQL Server, SPSS, OOP, RUP, UML, Windows, Linux, LaTeX, Webot, PshycoToolbox, etc. Fluent in Persian and English; Familiar with Deutsch and Arabic.

**SELECTED
PUBLICATIONS
Journals**

[**Note:** Please refer to my academic homepage to access pdfs of my publications.]

1. A. Borji. *What is a Salient Object?*, **IEEE Trans. on Image Processing**, Submitted.
2. A. Borji and M.M. Cheng. *Salient Object Detection: A Large Scale Evaluation*, **IEEE Trans. on Pattern Analysis and Machine Intelligence (PAMI)**, In Preparation.
3. J. Wang, A. Borji, C.C. Jay Kuo, and L. Itti, *Para-Boosting Learning for Salient Object Location Prediction*, **IEEE Trans. on Image Processing**, Submitted.
4. D. Parks, A. Borji, and L. Itti. *Augmented saliency model using automatic 3D head pose detection and learned gaze following in natural scenes*, **Journal of Vision Research**, Under review.
5. A. Borji, D. Parks, and L. Itti. *Complementary Effects of Gaze Direction and Early Saliency in Guiding Fixations During Free-Viewing*, **Journal of Vision**, Under review.
6. A. Borji, Andreas Lennartz and M. Pomplun, *What Do Eyes Reveal About the Mind? Algorithmic Inference of Search Targets from Fixations*, **Neurocomputing**, 2014. [IF = 1.63]
7. A. Borji and L. Itti, *Optimal Attentional Modulation of a Neural Population*, **Frontiers in Computational Neuroscience**, 2014. [IF = 2.5]
8. A. Borji and L. Itti, *Defending Yarbus: Eye Movements Predict Observers' Task*, **Journal of Vision**, In 2014. [IF = 2.47]
9. A. Borji, D.N. Sihite, and L. Itti, *What Stands out in a Scene? A Study of Human Explicit Saliency Judgment*, **Vision Research**, vol. 31, pp. 62-77, 2013. [IF = 2.35]
10. A. Borji, D.N. Sihite, and L. Itti, *Objects Do not Predict Fixations Better than Early Saliency: A Re-analysis of Einhäuser et al.'s Data*, **Journal of Vision**, 2013. [IF = 2.47]
11. A. Borji, D.N. Sihite, and L. Itti, *What/Where to Look Next? Modeling Top-down Visual Attention in Complex Interactive Environments*, **IEEE T. Systems, Man, Cybernetics**, 2013. [IF = 2.18]
12. A. Borji, D.N. Sihite, and L. Itti, *Quantitative Analysis of Human-Model Agreement in Visual Saliency Modeling: A Comparative Study*, **IEEE Trans. on Image Processing**, 2012. [IF = 3.19]
13. A. Borji and L. Itti, *State-of-the-art in Visual Attention Modeling*, **IEEE Trans. on Pattern Analysis and Machine Intelligence (PAMI)**, 2012. [IF = 4.79]
14. A. Borji, M.N. Ahmadabadi, B.N. Araabi, *Interactive Learning of Task-driven Object-based Visual Attention Control*, **Image and Vision Computing**, vol. 28, pp. 1130-1145, 2010. [IF = 1.95]
15. A. Borji, M.N. Ahmadabadi, B.N. Araabi, *Cost-sensitive Learning of Top-down Modulation for Attentional Control*, **Machine Vision and Applications**, 2011. [IF = 1.1]
16. M. Hamidi, A. Borji, *Invariance Analysis of Modified C2 Features, Case Study- Hand Written Digit Recognition*, **Machine Vision and Applications**, vol. 21, no. 6, 2010. [IF = 1.1]
17. A. Borji, M. Hamidi, *A New Approach to Global Optimization Motivated by Parliamentary Political Competitions*, **International Journal of Innovative Computing, Information & Control**, vol. 5, no. 6, 2009. [IF = 2.79]
18. A. Borji, M. Hamidi, *Robust Handwritten Character Recognition with Features Inspired by Visual Ventral Stream*, **Neural Processing Letters**, vol. 8, no. 2, pp. 97-111, 2008. [IF = 1.24]
19. A. Borji, *Heuristic Function Optimization Inspired by Social Competitive Behaviors*, **Journal of Applied Sciences**, vol. 8, no. 11, pp. 2105-2111, 2008. [IF = 0.35]
20. A. Borji, M. Hamidi, *Optical Character Recognition Motivated by Primate Visual System*, **Neural Network World**, vol. 16, no. 5, pp. 433-445, 2007. [IF = 0.36]

Conferences

[**Note:** CVPR, ICCV, and ECCV are three best computer vision conferences with acceptance rate about 25%. NIPS and AAAI are prestigious conferences in machine learning and cognitive sciences. ICRA and IROS are two best conferences in robotics.]

1. A. Borji and L. Itti, *Human vs. computer in scene and object recognition*, IEEE Computer Vision and Pattern Recognition (**CVPR**), 2014.
2. A. Borji and L. Itti, *Bayesian Optimization Explains Human Active Search*, Advances in Neural Information Processing Systems (**NIPS**), 2013.
3. A. Borji, Hamed R. Tavakoli, D.N. Sihite, and L. Itti, *Analysis of Scores, Datasets and Models in Visual Saliency Modeling*, Inter. Conf. on Computer Vision (**ICCV**), 2013. [**ORAL**]
4. A. Borji, D.N. Sihite, and L. Itti, *Salient Object Detection: A Benchmark*, European Conference on Computer Vision (**ECCV**), 2012.
5. A. Borji, D.N. Sihite, and L. Itti, *An Object-based Bayesian Framework for Top-down Visual Attention*, Twenty-Sixth Conf. on Artificial Intelligence (**AAAI**), 2012.
6. A. Borji, D.N. Sihite, and L. Itti, *Probabilistic Learning of Task-Specific Visual Attention*, IEEE Computer Vision and Pattern Recognition (**CVPR**), 2012.
7. A. Borji and L. Itti, *Exploiting Local and Global Patch Rarities for Saliency Detection*, IEEE Computer Vision and Pattern Recognition (**CVPR**), 2012.
8. A. Borji, *Boosting Bottom-up and Top-down Visual Features for Saliency Estimation*, IEEE Computer Vision and Pattern Recognition (**CVPR**), 2012.
9. A. Borji, S. Frintrop, D.N. Sihite, and L. Itti, *Adaptive Object Tracking by Learning Background Context*, (**CVPR**), 2012, “Egocentric Vision workshop”.
10. A. Borji, D.N. Sihite, and L. Itti, *Modeling the Influence of Action on Spatial Attention in Visual Interactive Environments*, IEEE International Conference on Robotics and Automation (**ICRA**), 2012.
11. A. Borji, D.N. Sihite, and L. Itti, *Computational Modeling of Top-down Visual Attention in Interactive Environments*, British Machine Vision Conf. (**BMVC**), 2011.
12. A. Borji and L. Itti, *Scene Classification with a Sparse Set of Salient Regions*, IEEE International Conference on Robotics and Automation (**ICRA**), 2011.
13. A. Borji, M.N. Ahmadabadi, and B.N. Araabi, *Simultaneous Learning of Spatial Visual Attention and Physical Actions*, IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**), 2010.
14. A. Habibian, A. Borji, M.N. Ahmadabadi, and B.N. Araabi. *A Visual Attention Model for Omnidirectional Images*, Proceedings of 17th International Conference of Neural Information Processing, Sydney, 2010.
15. A. Borji and S. Frintrop, *Learning Context-based Feature Descriptors for Object Tracking*, IEEE Conference on Human Robot Interaction (**HRI**), 2010.
16. M. Ajalooian, A. Borji, M.N. Ahmadabadi, B.N. Araabi, and H. Moradi, *Fast Hand Gesture Recognition based on Saliency Maps: An Application to Interactive Robotic Marionette Playing*, IEEE Inter. Symp. on Robot and Human Interactive Communication (**ROMAN**), 2009.
17. A. Borji, M.N. Ahmadabadi, and B.N. Araabi, *Learning Sequential Visual Attention Control through State Space Descritization*, IEEE International Conference on Robotics and Automation (**ICRA**), 2009.
18. A. Borji and M.Z. Jahromi, *Evolving Weighting Functions for Query Expansion Based on Relevance Feedback*, Lecture Notes in Computer Science, LNCS, 4976, 233-238, 2008, (**AP-WEB**), 2008.
19. A. Borji, M.N. Ahamadabadi, and B.N. Araabi, *Interactive Learning of Top-down Attention Control and Motor Actions*, **IEEE IROS 2008** workshop on “From Motor to Interaction Learning in Robots”.
20. A. Borji, M.N. Ahamadabadi, and B.N. Araabi, *Learning Top-down Feature-based Attention Control*, **ECCV 2008** workshop on “Vision in Action: Efficient Strategies for Cognitive Agents in Complex Environments”.
21. A. Borji, *A New Global Optimization Algorithm Inspired from Parliamentary Political Competitions*, LNCS, vol.4827, pp.61-71, **MICAI**, 2007.

22. A. Borji and M. Hamidi, *Support Vector Machines for Persian Font recognition*, International Conference on Computer, Electrical, Systems Science, and Engineering (**CESSE**), Prague, 2007.
23. M. Hamidi, A. Borji, and F. Mahmoudi, *Human Vision Inspired Optical Character Recognition*, The 2nd Workshop on Computational Approaches to Arabic Script-based Languages (**ASL**), Linguistic Institute Stanford University, 2007.
24. A. Borji, M. Hamidi, and M.E. Moghadam, *CLPSO-based Fuzzy Color image Segmentation*, 26th IEEE Annual Meeting of the North American Fuzzy Information Processing Society (**NAFIPS'07**). San Diego, 2007.
25. M. Hamidi, A. Borji, and S.S. Ghidary, *Persian Word Sense Disambiguation*, Proceeding of 15-th Iranian Conference of Electrical and Electronics Engineers (**ICEE 2007**), Tehran.
26. A. Borji and C. Lucas, *Evolutionary Design of Gabor Filters with Application to Writer Identification*, 12th International CSI Computer Conference (**CSICC'07**), Tehran.
27. A. Borji, *Combining Heterogeneous Classifiers for Network Intrusion Detection*, Lecture Notes in Computer Science, LNCS, vol.4846, pp.254-260, **ASIAN**, 2007.
28. A. Borji and M.Z. Jahromi, *A New Method for Query Refinement Using Genetic Programming*, In 9-th international CSI computer conference (**CSICC 2004**), Tehran, 2004. [In Persian].

Book chapters

1. L. Itti and A. Borji, *Computational Models of Attention*, In: **Cognitive Neuroscience: The Biology of the Mind (Fifth Edition)**, Ed: Gazzaniga, 2013.
2. L. Itti and A. Borji, *Computational Models: Bottom-up and Top-down Aspects*, **Visual Attention**, Ed: Sabine Kastner, 2013.
3. A. Borji, *A Synthetic Face Generation Toolbox for Face Perception Psychophysics Studies*, **ICVW 2008**, LNCS 5329, pp. 14-23, 2008.

Abstracts

1. A. Borji, L. Itti, *Human vs. computer in scene and object recognition*, invited abstract in CVPR 2014 workshop: "Vision Meets Cognition: Functionality, Physics, Intentionality and Causality"; **FPIC**, 2014.
2. A. Borji, L. Itti, *Predicting observers' task from their scanpaths on natural scenes*, (**VSS**), 2014.
3. A. Borji, D.N. Sihite, L. Itti, *Quantifying the Relative Influence of Photographer Bias and Viewing Strategy on Scene Viewing*, (**VSS**), 2011.
4. A. Borji, M.N. Ahmadabadi, B.N. Araabi, *Learning Object-based Attention Control*, in **NIPS** workshop on Machine Learning Meets Human Learning, 2008.
5. A. Borji, *Eye Movement Prediction in Visual Interactive Environments Considering Physical Actions*, **AVA annual meeting**, Manchester University, UK, 2008.
6. A. Borji, *A Synthetic Face Generation Toolbox for Face Perception Psychophysics Studies*, **CNS**, BMC Neuroscience, 2008.
7. Z. Basseda, A. Borji, B. Esmaeili, A. Zadbood, *Evaluating Temporal Dynamics of Different Facial Information in Face Perception*, (**ECVP**), PERCEPTION, 2007.
8. A. Borji, B. Esmaeili, Z. Basseda, A. Zadbood, *Using Sp-line Curves for Generating Synthetic Faces*, (**ECVP**), PERCEPTION, vol 36, pp. 145, 2007.
9. A. Lak and A. Borji, *Red is Retained Efficiently in Human Visual Working Memory*, (**ECVP**), PERCEPTION 35: 105-105, 2006.

PROFESSIONAL ORGANIZATIONS	Member of the Institute of Electrical and Electronics Engineers (IEEE) Member of Association for the Advancement of Artificial Intelligence (AAAI) Member of the Society for Neuroscience (SfN) Member of the Vision Sciences Society (VSS) Tutorial Organizer on Attention at CVPR 2013 Demo Organizer on Attention at CVPR 2012 Helping organize Robotics Open House at USC, iLab, 2012, 2013 Program Committee Member for FG2013 Conference PC Member for ISACS'13 workshop at IJCAI-13 Conference Editor: Journal of Pattern Recognition and Intelligent Systems. Editorial Board Member: http://www.igi-global.com/publish/call-for-papers/call-details/615 Editorial Board Member: Journal of Ophthalmic Science http://openaccesspub.org/journals/index.php?jid=57 Special Issue Editor: Signal Processing; Image Communication; Special Issue on Recent Advances in Saliency Models, Applications and Evaluations
TEACHING EXPERIENCE	University of Industry & Mine, Tehran, Iran 2006 <i>Courses: Operating Systems, C++ Programming</i> Azad University, Branch of Karaj, Karaj, Iran 2005 <i>Courses: Databases, Data Structures, Numerical Methods, Pascal Programming</i>
TEACHING INTERESTS	Cognitive Neuroscience, Computational Neuroscience, Computer Vision, Machine Learning, Pattern Recognition, Human Vision, Visual Attention
PROFESSIONAL EXPERIENCE	Douran Data Processing Company, www.Douran.com , Tehran, Iran 2001 <i>Delphi, CGI and ASP Programmer</i> Shegerd Electronic Company, Shiraz, Iran 2002 <i>Delphi Programmer and System Designer</i> National Petroleum Co., Human Res. Dept, http://en.nioc.ir/ , Tehran 2003 <i>Visual Basic programmer</i> Hamkaran System (System Group), http://www.systemgroup.net/ , Tehran 2004 <i>Delphi Programmer and Database Designer</i>
HONORS	Ranked 150, Iranian nationwide graduate university entrance competition, 2002 Honorable Mention in Regional ACM/ICPC, Asian region, Tehran Site, Petroleum University of Technology, 2000 Ranked 900, Iranian nationwide undergraduate university entrance competition, 1996
SERVICE	Review service: <i>IROS 2011, NIPS 2011, ICCV 2013, ISACS 2013, ECCV 2014, ICRA 2014, ICME 2014, NIPS 2015, Int. J. of Social Robotics, J. of Electronic Imaging, IJCV, IEEE Trans. PAMI, IEEE Trans. Image Processing, IEEE Trans. Signal Processing, Signal Image and Video Processing, Pattern Recognition Letters, Image and Video Computing, Multidimensional Systems & Signal Process, J. Optical Society of America, Vision Research</i>
INVITED TALKS	Early Human Visual Processing , IPM. SCS, Tehran, IRAN Nov. 2007 Top-down Visual Attention Control , IPM. SCS, Tehran, IRAN Jan. 2008 Interactive Learning of Task-Based Attention Control , Institute of Informatik III, University of Bonn, Germany Jun 2009 Online Learning of Simultaneous Visual Attention Control and Physical Actions , Department of Psychology, University of Münster, Germany Aug. 2009 Interactive Learning of Object-Based Attention Control , Frankfurt Institute of Advanced Studies (FIAS), Frankfurt, Germany Sep. 2009 Interactive Learning of Task-Driven Visual Attention Control ,

Italian Institute of Technology (IIT), Genova, Italy Oct. 2010
Modeling Task-oriented Visual Attention in Complex Interactive Environments,
 University of Texas at Austin, Center for Perceptual Systems, USA, Oct. 2011
**Understanding Human Visual Attention: From Behavioral Studies to Computational
 Modeling**, Smith-Kettlewell Eye Research Inst., San Francisco, Jun. 2012
Visual Attention: From Behavioral Findings to Computational Models,
 Perona's lab., Caltech, Pasadena, Sep. 2013
Computational Modeling of Human Active Information Selection,
 Angela Yu's lab., UCSD, San Diego, Sep. 2013
Computational Modeling of Bottom-up and Top-down Visual Attention,
 Southern Polytechnic State University, Atlanta, Georgia, April. 2014
Computational Modeling of Bottom-up and Top-down Visual Attention,
 Prof. Marc Pomplun's lab, Boston, UMass Boston, April. 2014
Computational Modeling of Visual Attention and Search,
 Profs. Desimone and Poggio's labs at MIT, Boston, MA April. 2014 **Computational
 Modeling of Bottom-up and Top-down Visual Attention**,
 University of Wisconsin, Milwaukee, WI, May. 2014
Computational Modeling of Visual Attention,
 DigiPen Institute of Technology, Redmond, WA, June. 2014
Computational Modeling of Bottom-up and Top-down Visual Attention,
 Information Sciences Institute, USC, LA, CA, July. 2014

**ATTENDED
SCHOOLS**

Mini Math Neuroscience Summer School. IPM, Tehran, Iran, 12-17 Aug., 2008
Ottawa computational Neuroscience Summer School, Canada, 7-20 June, 2009
Barcelona Brain, Cognition and Technology (BCBT 2009) Summer School,
 Barcelona, Spain, 7-18 September, 2009
IPAM 2013 (GSS 2013), Computer Vision Summer School, UCLA, 22 July to 9 Aug., 2013
2014 Summer School in Computational Sensory-Motor Neuroscience (CoSMo 2014),
 University of Minnesota, Minneapolis, MN, USA, 3-17 August, 2014

**COLLAB-
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Laurent Itti, Ph.D. e-mail: itti@usc.edu
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REFERENCES

Laurent Itti, Ph.D. phone: +1(213)740-3527 e-mail: itti@usc.edu
 Associate Professor, Department of Computer Science, Neuroscience and Psychology, University
 of Southern California, USA.
Relation: Postdoc. Research Advisor

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 Professor of Computer Science, Biological Sciences, Biomedical Engineering, Electrical Engineer-
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Senior Scientific Assistant, Institute of Computer Science III, University of Bonn, Germany

Relation: Research Advisor

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Associate Professor, School of Electrical and Computer Engineering, University of Tehran, &
School of Cognitive Sciences, Institute for Research in Fundamental Sciences, Tehran, Iran.

Relation: Ph.D. Research Advisor