Hossein Mobahi
Curriculum Vitæ
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Machine Perception
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Research Interests

- **Machine Learning** : High-Dimensional Learning, Deep Learning, Manifold Learning.
- **Computer Vision** : Image Matching, Image Segmentation, Learning Representation, Optical Flow.
- **Mathematics** : Convex and Nonconvex Optimization, Functional Analysis, Differential Equations.

Affiliations

2013–2016   Postdoctoral Research Associate
Computer Science & Artificial Intelligence Lab. (CSAIL)
Dept. of Electrical Engineering & Computer Science
Massachusetts Institute of Technology
Collaborating with Profs. **William T. Freeman** and **John W. Fisher**

Education

2012   Ph.D. in Computer Science
University of Illinois at Urbana Champaign
Advised by Prof. **Yi Ma** since September 2007

2005   M.S. in Computer Science
University of Tehran
Advised by Prof. Majid Nili Ahmadabadi and Prof. Babak Nadjar Araabi

2003   B.S. in Computer Engineering
Azad University, Tehran-South Campus

Awards and Honors

2011-2012   **Computational Science and Engineering (CSE) Fellowship**

2011   **UIUC Cognitive Science & Artificial Intelligence Award**
$2,000 unrestricted fund for promising research directions in Artificial Intelligence.

2011-2012   **Finalist of Qualcomm Fellowship**

2010-2011   **Computational Science and Engineering (CSE) Fellowship**

2010-2011   **Feng Chen Memorial Best Paper Award**

2009   **Best Student Paper Award (Sang Uk Lee Award)**
for "Natural Image Segmentation with Adaptive Texture and Boundary Encoding", at *Asian Conference on Machine Vision (ACCV'09)*.

2009   **UIUC Cognitive Science & Artificial Intelligence Award**
$2,000 unrestricted fund for promising research directions in Artificial Intelligence.

2008–2009   **Mavis Memorial Fund Scholarship Award**
$5,000 unrestricted fund due to academic performance, research accomplishments, and demonstrated interest in engineering education.

2005   **Best Student Paper Award (1st Place) in 5th Symposium of Understanding Complex Systems**
University of Illinois at Urbana-Champaign
Article: *Swarm Contours: An ALife approach to image processing*.

2005   **Top Graduated Student: Highest GPA (19.29/20.00) in the entire Faculty of Engineering**
University of Tehran.

2004   **IEEE Student Branch Award for Outstanding Extracurricular Activities**
University of Tehran

2003   **Young Inventor Award in the National Khwarizmi Festival**
Receiving certificate from ministry of "science, research and technology"

1993   **First Rank in Computer Programming Contest held among All Tehran High Schools.**
Received Certificate from *Minister of Education*.

Media Coverage

- **MIT News**: *More-Flexible Machine Learning*, October 2015.
  http://news.mit.edu/2015/more-flexible-machine-learning-1001

- **MIT News**: *Optimizing optimization algorithms*, January 2015.
  http://news.mit.edu/2015/optimizing-optimization-algorithms-0121

- **CS@UIUC News**: *PhD Student Wins Best Paper Award at ACCV 09,* October 2009.
  https://cs.illinois.edu/news/phd-student-wins-best-paper-award-accv-09

Preprints & Working Papers

[3] **Training Recurrent Neural Networks by Diffusion.**
Hossein Mobahi
arXiv: 1601.04114, January 2016.

[2] **A Theory of Local Matching: SIFT and Beyond.**
Hossein Mobahi, Stefano Soatto
arXiv: 1601.05116, January 2016.

[1] **Closed Form for Some Gaussian Convolutions.**
Hossein Mobahi
arXiv, January 2016.

Refereed Publications (1000+ Citations, H-Index=12, I10-Index=13)

[29] **Learning with a Wasserstein Loss.**
Charlie Frogner, Chiyuan Zhang, Hossein Mobahi, Mauricio Araya-Polo, Tomaso Poggio
Neural Information Processing Systems (NIPS), Canada, Dec. 2015.

[28] **The Aperture Problem for Refractive Motion.**
Tianfan Xue, Hossein Mobahi, Fredo Durand, William T. Freeman
Int. Conf. on Computer Vision & Pattern Recognition (CVPR 2015).

[27] **A Theoretical Analysis of Optimization by Gaussian Continuation.**
Hossein Mobahi, John W. Fisher III
29th AAAI Conference on Artificial Intelligence (AAAI-15), Texas, Jan. 2015.

[26] **On the Link Between Gaussian Homotopy Continuation and Convex Envelopes.**
Hossein Mobahi, John W. Fisher III
Energy Minimization Methods in Computer Vision & Pattern Recognition (EMMCVPR), Hong Kong, Jan. 2015.

[25] **Coarse-to-Fine Minimization of Some Common Nonconvexities.**
Hossein Mobahi, John W. Fisher III
Energy Minimization Methods in Computer Vision & Pattern Recognition (EMMCVPR), Hong Kong, Jan. 2015.

[24] **A Bayesian State-space Approach for Damage Detection and Classification.**
Zoran Dzunic, Justin Chen, Hossein Mobahi, Oral Buyukozturk, John W. Fisher III
IMAC XXXIII: Conf. and Exp. on Structural Dynamics, Florida, Feb. 2015.

[23] **A Compositional Model for Low-Dimensional Image Set Representation.**
Hossein Mobahi, Ce Liu, William T. Freeman
Int. Conf. on Computer Vision and Pattern Recognition (CVPR), Ohio, June 2014.

[22] **Seeing through the Blur.**
Hossein Mobahi, Yi Ma, C. Lawrence Zitnick
Int. Conf. on Computer Vision and Pattern Recognition (CVPR), Rhode Island, June 2012.

[21] **Deep Learning via Semi-Supervised Embedding.**
Jason Weston, Frederic Ratle, <u>Hossein Mobahi</u>, Ronan Collobert
Neural Networks: Tricks of the Trade, pg. 639-655, Sep. 2012.

[20] **Towards a Practical Face Recognition System:**
Robust Alignment and Illumination by Sparse Representation.
Andrew Wagner, John Wright, Arvind Ganesh, Zihan Zhou, <u>Hossein Mobahi</u>, Yi Ma
IEEE Transactions on Pattern Analysis & Machine Intelligence (PAMI) 34(2): 372-386, 2012.

[19] **Holistic 3D Reconstruction of Urban Structures from Low-rank Textures.**
<u>Hossein Mobahi</u>, Zihan Zhou, Allen Yang, Yi Ma
Workshop on 3D Reconstruction and Recognition, Int. Conf. on Computer Vision (ICCV), pp. 593-600, 2011.

[18] **Segmentation of Natural Images by Texture and Boundary Compression.**
<u>Hossein Mobahi</u>, Shankar Rao, Allen Yang, S. Shankar Sastry, Yi Ma
International Journal of Computer Vision (IJCV), 95 (1), pg. 86-98, Oct. 2011.

[17] **Learning Topology of Curves with Application to Clustering.**
<u>Hossein Mobahi</u>, Shankar Rao, Yi Ma
AAAI Fall Symposium on Manifold Learning, pp. 34-41, Virginia, November 2009.

[16] **Natural Image Segmentation with Adaptive Texture and Boundary Encoding.**   **(Best Paper Award)**
Shankar Rao, <u>Hossein Mobahi</u>, Allen Yang, Yi Ma
H. Zha, R.-i. Taniguchi, and S. Maybank (Eds.): ACCV 2009, pp. 135–146. Springer, Heidelberg (2010).

[15] **Face Recognition With Contiguous Occlusion Using Markov Random Fields.**
Zihan Zhou, Andrew Wagner, <u>Hossein Mobahi</u>, John Wright, Yi Ma
ICCV'09, pp. 1050-1057, Kyoto, Japan, September 2009.

[14] **Data-Driven Image Completion by Image Patch Subspaces.**
<u>Hossein Mobahi</u>, Shankar Rao, Yi Ma
27th Picture Coding Symposium, Chicago, May 2009.

[13] **Deep Learning from Temporal Coherence in Video.**
<u>Hossein Mobahi</u>, Ronan Collobert, Jason Weston
ICML'09, pp. 737-744, Montreal, Canada, June 2009.

[12] **Deep Learning Via Semi-Supervised Embedding.**
Jason Weston, Ronan Collobert, Frederic Ratle, <u>Hossein Mobahi</u>, Pavel Kuksa, Koray Kavukcuoglu
ICML'09, Workshop on Learning Feature Hierarchies, Montreal, Canada, June 2009.

[11] **A Biologically Inspired Method for Conceptual Imitation using Reinforcement Learning.**
<u>Hossein Mobahi</u>, Majid Nili-Ahmadabadi, Babak Nadjar-Araabi
Journal of Applied Artificial Intelligence Vol. 21, No. 3, pp. 155-183, Taylor & Francis Group, Mar. 2007.

[10] **Swarm Contours: An ALife approach to image processing.**
<u>Hossein Mobahi</u>, Majid Nili-Ahmadabadi, Babak Nadjar-Araabi
5th Symposium of Understanding Complex Systems, University of Illinois at Urbana-Champaign, May (2005).

[9] **Concept Oriented Imitation.**
<u>Hossein Mobahi</u>, Majid Nili-Ahmadabadi, Babak Nadjar-Araabi
Proceedings of IEEE International Conference on Robotics and Automation (ICRA05), pp. 1495-1500, Spain,

April 2005.

[8] **Swarm Contours: A fast self-organization approach for snake initialization.**
<u>Hossein Mobahi</u>, Majid Nili-Ahmadabadi, Babak Nadjar-Araabi
Complexity, Vol 12, Issue 1, pp. 41-52, John Wiley & Sons Inc, Oct. 2006.

[7] **HCI Applications for Aiding Children with Mental Disorders.**
<u>Hossein Mobahi</u>, Karrie Karahalios
ACM Crossroads, Special Issue on Human-Computer Interaction, Issue 12.2, Winter 2005, pp. 8-12.

[6] **Fast initialization of active contours: towards practical visual interfaces for human-robot interaction.**
<u>Hossein Mobahi</u>, Majid Nili-Ahmadabadi, Babak Nadjar-Araabi
Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2004), pp. 546-551, Japan, October 2004.

[5] **Temporal Resolution in Coevolutionary Optimization.**
<u>Hossein Mobahi</u>, Caro Lucas
Workshop on Applied Optimization (WAO 2004), Germany, October 2004.

[4] **Peak Stick RBF Network for Online System Identification.**
<u>Hossein Mobahi</u>, Farrokh Sharifi-Janabi
Proceedings of the International Joint Conference on Neural Networks (IJCNN04), pp. 2105-2111, Budapest, Hungary, July 2004.

[3] **Fuzzy Perception, Emotion and Expression for Interactive Robots.**
<u>Hossein Mobahi</u>, Shahin Ansari
Proceedings of IEEE International Conference on Systems, Man and Cybernetic (SMCC03), Volume 4, pp. 3918-3923,Washington, D.C., USA, Oct. 2003.

[2] **Fuzzy Behaviors for an Emotional Interactive and Emotional Robot Face.**
<u>Hossein Mobahi</u>, Caro Lucas
WSEAS Transactions on Systems (M. Mladenov, Ed.), Issue 4, Volume 2, pp. 1111-1117, October 2003.

[1] **Shape Representation.**
<u>Hossein Mobahi</u>
1st International Seminar on Graphs, Combinatorics and Computational Algorithms, Amir Kabir University, Tehran, Iran, Feb. 2001.

Internships

Summer 2012 **Microsoft Research**, Redmond, Washington.
Project: Free Energy Models for Flexible Template Matching
Supervisor: Dr. Nebojsa Jojic

Summer 2008 **NEC Laboratories of America**, Princeton, NewJersey.
Project: Exploiting temporal coherence in video for learning.
Supervisor: Dr. Jason Weston

Teaching and Mentoring

Undergraduates Mentored

2015   Arshavi Shah, *MIT Visiting Undergraduate Student*, **Learning with Recurrent Neural Networks**, MIT.

2011   Andrew J. Beugelsdijk, *Supervising an Undergraduate Research Assistant (RA)*, **Image Coding using Gaussian Radial Basis Functions**, UIUC.

2010–2011   Walter R. Sorto, *Illinois Scholars Undergraduate Research Program (ISUR) (Funded by Intel)*, **Perspective Invariant Object Representation**, UIUC.

2009   Jason Cho, *CS498LA "Undergrad Research Lab,"*, **Learning Contour Shapes to Represent Objects**, UIUC.

2009   Sanchit Mathur, *CS498LA "Undergrad Research Lab,"*, **Image Inpainting using Contour Recognition and Completion**, UIUC.

Teaching Experience

2005   **Volunteer Teaching for Lecture Series on "Introduction to Pattern Recognition".**
                     ACM Student Chapter, University of Illinois at Urbana-Champaign.

2005   **Teaching Assistant for "Introduction to Artificial Intelligence" (CS440-ECE448).**
                     Taught by Prof. *Jean Ponce*, University of Illinois at Urbana-Champaign.

2003   **Workshop Lecturer, "Stereo Vision and Object Tracking".**
                     2nd National Robotic Workshop, ACM Student Chapter, University of Tehran.

2003   **Teaching Summer Course, "Applied Machine Vision".**
                     IEEE Student Branch, University of Tehran.

Invited Talks

Major Conferences

Dec 2015   **Invited Speaker, NIPS 2015 Workshop**, Workshop on Non-Convex Optimization for Machine Learning: Theory and Practice (NCO'2015), Montreal, Canada.
                     Deep Learning and Large Image Sets.

Jun 2014   **Invited Speaker, ICML 2014 Workshop**, Workshop on Deep Learning Models for Emerging Big Data Applications (DLBD'2014), Beijing, China.
                     Deep Learning and Large Image Sets.

Academic Institutes

Oct 2015   **Computational Vision Lab**, California Institute of Technology (Caltech). Host: *Prof. Pietro Perona*.
                     Learning, Complexity and Diffusion.

Mar 2014   **Center for Biological & Computational Learning (CBCL)**, Massachusetts Institute of Technology (MIT). Host: *Prof. Tomaso Poggio*.
A Compositional Model for Low-Dimensional Image Set Representation.

Apr 2014   **Computer Graphics Seminar**, Massachusetts Institute of Technology (MIT). Host: *Prof. Fredo Durand*.
A Compositional Model for Low-Dimensional Image Set Representation.

Aug 2012   **CS and AI Lab (CSAIL)**, Massachusetts Institute of Technology (MIT). Host: *Prof. William T. Freeman*.
Gaussian Relaxations in Optimization with Applications to Image Alignment, Segmentation and More.

Apr 2012   **UW Optimization Seminar**, University of Washington. Hosts: *Prof. Rekha Thomas & Prof. James Burke*.
Gaussian Smoothing and Asymptotic Convexity.

Apr 2012   **UIUC Digital Signal Processing (DSP) Seminar**, University of Illinois at Urbana Champaign. Host: *Prof. Minh Do*.
Seeing through the Blur.

Mar 2012   **GRaphics And Imaging Lab (GRAIL)**, CS Department, University of Washington. Host: *Dr. Bryan Russell*.
Seeing through the Blur.

Feb 2012   **Microsoft Research (MSR) Talk Series**, Redmond, Washington. Host: *Dr. Larry Zitnick*.
Nonconvex optimization by Gaussian smoothing and continuation with applications to image alignment.

Apr 2011   **Qualcomm Research, Innovation Fellowship Final Presentation**, Bridgewater, New Jersey.
A Holistic Approach to 3D Reconstruction & Recognition.

Apr 2011   **NEC Labs, Machine Learning Group**, Princeton, New Jersey. Host: *Dr. Hans Peter Graf.*
Segmentation of Natural Images & Urban Scenes via Compression.

Jul 2010   **Microsoft Corp., Bing Map Research Group**, Bellevue, Washington. Host: *Dr. Eyal Ofek*.
Segmentation of Natural Images by Texture and Boundary Compression.

Aug 2010   **Microsoft Research**, Redmond, Washington. Host: *Dr. Larry Zitnick*.
Segmentation of Natural Images by Texture and Boundary Compression.

Dec 2004   **Institute for studies in theoretical Physics and Mathematics (IPM)**, Tehran, Iran. Host: *Prof. Majid Nili-Ahmadabadi*.
Image Processing with self organized contours.

Feb 2004   **Institute for studies in theoretical Physics and Mathematics (IPM)**, Tehran, Iran. Host: *Prof. Majid Nili-Ahmadabadi*.
The Role of Imitation in Learning.

Service

- **Technical Committee Member**

ICML 2014	Workshop on Deep Learning Models for Emerging Big Data Applications	Beijing, China
CVPR 2014	Workshop on Vision Meets Cognition	Ohio, USA

- **Conference Reviewer**

CVPR	International Conference on Computer Vision & Pattern Recognition
ICCV	International Conference on Computer Vision
ECCV	European Conference on Computer Vision
ICML	International Conference on Machine Learning
NIPS	Annual Conference on Neural Information Processing Systems
AISTATS	International Conference on Artificial Intelligence and Statistics
ICLR	International Conference on Learning Representations

- **Journal Reviewer**

CVIU	Computer Vision & Image Understanding
TOMM	ACM Transactions on Multimedia Computing, Communications and Applications
TPAMI	IEEE Transactions on Pattern Analysis and Machine Intelligence
TNNLS	IEEE Transactions on Neural Networks and Learning Systems
TIFS	IEEE Transactions on Information Forensics and Security
SPM	IEEE Signal Processing Magazine
IJRAS	Elsevier Journal of Robotics and Autonomous Systems