

## **PEDRO F. FELZENSZWALB**

Professor  
School of Engineering and Department of Computer Science  
Brown University  
Email: pff@brown.edu

### **Education**

Massachusetts Institute of Technology, Ph.D. in Computer Science, 2003  
(Thesis: Representation and Detection of Shapes in Images, Advisor: W. Eric. L. Grimson)

Massachusetts Institute of Technology, M.S. in Computer Science, 2001  
(Thesis: Object Recognition with Pictorial Structures, Advisor: W. Eric. L. Grimson)

Cornell University, B.S. in Computer Science, 1999

### **Appointments**

Brown University, Professor, Engineering and Computer Science, 2016-present

Brown University, Associate Professor, Engineering and Computer Science, 2011-2016

Cornell University, Visiting Professor, Computer Science, 2009-2010

University of Chicago, Associate Professor, Computer Science, 2008-2011

University of Chicago, Assistant Professor, Computer Science, 2004-2008

Cornell University, Postdoctoral Fellow, Computer Science, 2003-2004

### **Honors and Awards**

Longuet-Higgins Prize, IEEE CVPR 2018

2013 ACM Grace Murray Hopper Award

IEEE Technical Achievement Award, 2014

PASCAL Visual Object Challenge “Lifetime Achievement” Prize, 2010

Longuet-Higgins Prize, IEEE CVPR 2010

1st Place, PASCAL Visual Object Detection Challenge, 2008, 2009

NSF Faculty Early Career Development (CAREER) Award, 2008

Best paper Award, Mini Symposium on Machine Understanding of People and Their Responses, Rank Prize Funds, 2005

Best poster Award, IEEE CVPR 2004

Runner up, CRA Outstanding Undergraduate Award, 1998

## **Service to the Profession**

Organizer (chair), ICERM semester program on Computer Vision, 2019

Organizer, ICERM workshop on Computational Imaging, 2019

Organizer, ICERM workshop on Optimization Methods in Computer Vision and Image Processing, 2019

Program Chair, IEEE Conference on Computer Vision and Pattern Recognition, 2011

Associate Editor, IEEE Transactions on Pattern Analysis and Machine Intelligence, 2009-2013

Editorial Board, International Journal of Computer Vision, 2009-present

Senior Program Committee Member, AAAI Conference on Artificial Intelligence 2017

Area Chair, IEEE Conference on Computer Vision and Pattern Recognition, 2009, 2010, 2015

Area Chair, European Conference on Computer Vision, 2008, 2012

Area Chair, IEEE International Conference on Computer Vision, 2007

Program Committee

- IEEE CVPR, 2004, 2005, 2006, 2007, 2012, 2014

- IEEE ICCV 2013

- ECCV 2014

- Int. Workshop on Structured Prediction, Tractability, Learning and Inference, 2013

- Int. Workshop on Stochastic Image Grammars, 2011

- Int. Workshop on Parts and Attributes, 2010

- Int. Workshop on Computer Vision Applications for Developing Regions, 2007

Tutorial on Object Recognition at the SIAM Conference on Imaging Science, 2010

Tutorial on Discrete Optimization Methods in Computer Vision at CVPR 2005

## **Service to the University**

Computer Engineering ABET review lead, 2013, 2014, 2019

Concentration Advisor and Undergraduate Program Committee, 2013-2017

Freshman and Sophomore Advisor, 2013, 2014, 2015, 2016, 2018, 2019

## **Grants Awarded**

NSF Award 1447413, Structured Nearest Neighbor Search in High Dimensions, 2015-2018

Brown University Seed Award, 2014

Google Research Award, Scalable Visual Object Detection, 2013

DARPA, Hierarchical Representation for the Evaluation of Sensed Data (co-PI), 2013-2015

NSF Award 1161282, Graph Cut Algorithms for Domain-specific Higher Order Priors, 2012-2015

NSF CAREER Award 0746569, Object Recognition with Hierarchical Models, 2008-2013

NSF Award 0534820, The Generalized A\* Architecture for Perceptual Systems, 2006-2009

## Teaching

### *Courses at Brown University*

Pattern Recognition and Machine Learning (ENGN 2520), Fall 2019  
Topics in Image Analysis (ENGN 2912S), Spring 2019  
Image Understanding (ENGN 1610), Fall 2018  
Pattern Recognition and Machine Learning (ENGN 2520 / CSCI 1420), Spring 2017  
Image Understanding (ENGN 1610), Fall 2016  
Topics in Optimization (ENGN 2912P), Spring 2016  
Linear System Analysis (ENGN 1570), Fall 2015  
Pattern Recognition and Machine Learning (ENGN 2520 / CSCI 1420), Spring 2015  
Linear System Analysis (ENGN 1570), Fall 2014  
Topics in Optimization (ENGN 2912P), Spring 2014  
Introduction to Engineering (ENGN 0030), Fall 2013  
Pattern Recognition and Machine Learning (ENGN 2520 / CSCI 1950F), Spring 2013  
Introduction to Engineering (ENGN 0030), Fall 2012  
Pattern Recognition and Machine Learning (ENGN 2520), Spring 2012

### *Courses at the University of Chicago*

Computer Vision (CMSC 25040/35040), Spring 2011  
Theory of Algorithms (CMSC 27200), Winter 2011  
Introduction to Artificial Intelligence (CMSC 25000), Winter 2009  
Theory of Algorithms (CMSC 27200), Winter 2009  
Topics in AI: Statistical Models for Image Analysis (CMSC 35900), Fall 2008  
Computer Vision (CMSC 25040/35040), Spring 2008  
Theory of Algorithms (CMSC 27200), Winter 2008  
Theory of Algorithms (CMSC 27200), Winter 2007  
Introduction to CS 2 (CMSC 15200), Winter 2007  
Computer Vision (CMSC 25040/35040), Fall 2006  
Theory of Algorithms (CMSC 27200), Winter 2006  
Introduction to CS 2 (CMSC 15200), Winter 2006

Computer Vision (CMSC 25040/35040), Fall 2005

Introduction to Programming for the WWW II (CMSC 10200), Spring 2005

Introduction to CS 2 (CMSC 15200), Winter 2005

Topics in AI: Computer Vision (CMSC 35900), Fall 2004

## Invited Talks

Scene Grammars, Factor Graphs, and Belief Propagation

- UC Berkeley, October 2017
- Google, November 2017

The Grammar of Vision

- Indiana University, Computer Science Colloquium, December 2016

Graphical Models for Computer Vision

- Pure and Applied Math Institute (IMPA), Rio de Janeiro, Brazil, August 2014

Contour Completion with Fields-of-Patterns

- Workshop on Structured Prediction, Tractability, Learning and Inference, July 2013

Graphical Models for Computer Vision

- Conference on Uncertainty in Artificial Intelligence, August 2012

Tiered Scene Labeling

- IEEE Workshop on Perceptual Organization in Computer Vision, June 2012

Object Detection with Grammar Models

- New England Machine Learning Day, MSR New England, May 2012

Object Detection Grammars

- Boston University, Computer Vision seminar, February 2012
- Int. Workshop on Stochastic Image Grammars, November 2011

Compositional Models

- Frontiers in Computer Vision, NSF workshop, August 2011

Object Detection with Discriminatively Trained Part Based Models

- University of Pennsylvania, GRASP Seminar, February 2011
- Theory and Practice of Computational Learning (Summer School/Workshop), June 2009

Metric Labeling With Tree Metrics

- Cornell Theory seminar, April 2010

Hierarchical Models for Shape Recognition

- Int. Workshop on Shape Perception in Human and Computer Vision, October 2008
- CMU VASC Seminar, November 2007
- Workshop on Geometry and Statistics of Shape Spaces, SAMSI, July 2007

Efficient Belief Propagation for Early Vision

- IPAM, February 2008

Object Recognition with Deformable Models

- University of Vermont, January 2008
- Penn State University, February 2008
- University of Iowa, February 2008
- University of Washington, March 2008
- UC Berkeley, March 2008

Models and Algorithms for Image Parsing

- NIPS workshop, The Grammar of Vision, December 2007

Hierarchical Matching of Deformable Shapes

- Harvard University, April 2007
- MIT, April 2007
- Brown University, April 2007

A Hierarchical Representation for Matching Deformable Shapes

- Workshop on Category-Level Object Recognition, Siracusa, Italy, September 2006

Representation and Detection of Deformable Shapes

- Workshop on Mathematics and Image Analysis, Paris, France, September 2006

Deformable Templates

- IMA, Visual learning and recognition workshop, 2006

A Global Model and Algorithm for Finding the Curves in an Image

- University of Illinois at Urbana-Champaign, November 2005

Representation and Detection of Shapes in Images

- Johns Hopkins University, October 2005
- Cornell University, April 2004
- University of Illinois at Urbana-Champaign, March 2004
- University of Chicago, March 2004

Pictorial Structures for Object Recognition

- Machine Understanding of People and Their Responses, Grasmere, UK, February 2005

Learning Models for Object Recognition with the Hausdorff Distance

- Cornell University, AI Seminar, February 2004

Representation and Detection of Non-rigid Objects

- UC Berkeley, Computer Vision Seminar, 2003

Efficient Graph-based Image Segmentation

- ALADDIN Workshop on Graph Partitioning in Vision and Machine Learning, CMU, 2003

Learning Models for Object Recognition

- MIT AI Lab Student Seminar, 2001

Computer Vision

- MIT Applied Mathematics Student Seminar, May 2001

Efficient Matching of Pictorial Structures

- Siemens Research, 2000

Efficiently Computing a Good Segmentation  
- DIMACS Workshop on Graph Theoretic Methods in Computer Vision, May 1999

## **Advising**

### *Current Ph.D. Students*

Jeova Farias

Anna Grim

### *Former Ph.D. Students*

Ross B. Girshick. Rigid Templates to Grammars: Object Detection with Structured Models. University of Chicago, 2012.

Eric Purdy. Grammatical Methods in Computer Vision. University of Chicago, 2013.

Sobhan Naderi Parizi. Modeling and Optimization of Classifiers with Latent Variables. Brown University, 2016.

Jeroen Chua. Probabilistic Scene Grammars: A General-Purpose Framework For Scene Understanding. Brown University 2017.

### *Postdocs*

Alice Paul (Brown data science), 2017-2019

Marilyn Vazquez (ICERM), 2018-2019

### *Masters Thesis Advised*

Sobhan Naderi Parizi. Image Classification with Reconfigurable Spatial Structures. University of Chicago, 2011.

Ross B. Girshick. Object Detection with Heuristic Coarse-to-Fine Search. University of Chicago, 2009.

Paolo Codenotti. Two-Dimensional Min-Filters with Polygons. University of Chicago, 2006.

### *Undergraduate Student Research Supervised*

Sarah Sachs, 2015-2016

Michael Lazos, 2014-2015

Gabriel Bender, 2006-2008

Joshua Schwartz, 2005-2007

Trevor Smith, 2005-2006

Alexandra Shapiro, 2006

## **Patent**

Method and apparatus for image processing employing image segmentation using tokenization.  
W. Rucklidge, D. Huttenlocher, P. Felzenszwalb. US Patent No. 6,295,371. September, 2001.

## Journal Publications

- P. Felzenszwalb, B. Svaiter. Diffusion Methods for Classification with Pairwise Relationships. Quarterly of Applied Math, Vol. 77, No. 4, Pages 793-810, December 2019.
- H.O. Song, R. Girshick, S. Zickler, C. Geyer, P. Felzenszwalb, T. Darrell. Generalized Sparselet Models for Real-Time Multiclass Object Recognition. IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 37, No. 5, Pages 1001-1012, May 2015.
- P. Felzenszwalb, D. Huttenlocher. Distance Transforms of Sampled Functions. Theory of Computing, Vol. 8, No. 19, Pages 415-428, September 2012.
- P. Felzenszwalb, J. McAuley. Fast Inference with Min-Sum Matrix Product. IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 33, No. 12, Pages 2549-2554, December 2011.
- P. Felzenszwalb, R. Zabih. Dynamic Programming and Graph Algorithms in Computer Vision. IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 33, No. 4, Pages 721-740, April 2011.
- P. Felzenszwalb, R. Girshick, D. McAllester, D. Ramanan. Object Detection with Discriminatively Trained Part Based Models. IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 32, No. 9, Pages 1627-1645, September 2010.
- L. Babai, P. Felzenszwalb. Computing Rank Convolutions with a Mask. ACM Transactions on Algorithms, Vol. 6, Issue 1, Article 20, December 2009.
- P. Felzenszwalb, D. McAllester. The Generalized A\* Architecture. Journal of Artificial Intelligence Research, Vol. 29, Pages 153-190, May 2007.
- P. Felzenszwalb, D. Huttenlocher. Efficient Belief Propagation for Early Vision. International Journal of Computer Vision, Vol. 70, No. 1, Pages 41-54, October 2006.
- P. Felzenszwalb. Representation and Detection of Deformable Shapes. IEEE Transactions of Pattern Analysis and Machine Intelligence, Vol. 27, No. 2, Pages 208-220, February 2005.
- P. Felzenszwalb, D. Huttenlocher. Pictorial Structures for Object Recognition. International Journal of Computer Vision, Vol. 61, No. 1, Pages 55-79, January 2005.
- P. Felzenszwalb, D. Huttenlocher. Efficient Graph-based Image Segmentation. International Journal of Computer Vision, Vol. 59, No. 2, Pages 167-181, September 2004.

## Conference Publications

- S. Naderi Parizi, K. He, S. Sclaroff, P. Felzenszwalb. Generalized Majorization-Minimization. International Conference on Machine Learning, Proceedings of Machine Learning Research, Vol 97, Pages 5022-5031, 2019.
- S. Naderi Parizi, A. Vedaldi, A. Zisserman, P. Felzenszwalb. Automatic Discovery and Optimization of Parts for Image Classification. International Conference on Learning Representations, 2015.
- P. Felzenszwalb, J. Oberlin. Multiscale Fields of Patterns. Neural Information Processing Systems, Pages 82-90, 2014.
- H.O. Song, S. Zickler, T. Althoff, R. Girshick, M. Fritz, C. Geyer, P. Felzenszwalb, T. Darrell. Sparselet Models for Efficient Multiclass Object Detection. European Conference on Computer Vision, Pages 802-815, 2012.

- S. Naderi Parizi, J. Oberlin, P. Felzenszwalb. Reconfigurable Models for Scene Recognition. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 2775-2782, 2012.
- R. Girshick, P. Felzenszwalb, D. McAllester. Object Detection with Grammar Models. *Neural Information and Processing Systems*, Pages 442-450, 2011.
- P. Felzenszwalb, R. Girshick, D. McAllester. Cascade Object Detection with Deformable Part Models. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 2241-2248, 2010.
- P. Felzenszwalb, O. Veksler. Tiered Scene Labeling with Dynamic Programming. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 3097-3104, 2010.
- P. Felzenszwalb, G. Pap, E. Tardos, R. Zabih. Globally Optimal Pixel Labeling Algorithms for Tree Metrics. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 3153-3160, 2010.
- R. Basri, P. Felzenszwalb, R. Girshick, D. Jacobs, C. Klivans. Visibility Constraints on Features of 3D Objects. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 1231-1238, 2009.
- P. Felzenszwalb, D. McAllester, D. Ramanan. A Discriminatively Trained, Multiscale, Deformable Part Model. *IEEE Conference on Computer Vision and Pattern Recognition*, 2008.
- P. Felzenszwalb, J. Schwartz. Hierarchical Matching of Deformable Shapes. *IEEE Conference on Computer Vision and Pattern Recognition*, 2007.
- D. Crandall, P. Felzenszwalb, D. Huttenlocher. Spatial Priors for Part-Based Recognition using Statistical Models. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 10-17, 2005.
- P. Felzenszwalb, D. Huttenlocher. Efficient Belief Propagation for Early Vision. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 261-268, 2004.
- P. Felzenszwalb, D. Huttenlocher, J. Kleinberg. Fast Algorithms for Large-State-Space HMMs with Applications to Web Usage Analysis. *Neural Information Processing Systems*, Pages 409-416, 2003.
- P. Felzenszwalb. Representation and Detection of Deformable Shapes. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 102-108, 2003.
- P. Felzenszwalb. Learning Models for Object Recognition. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 1056-1062, 2001.
- T. Darrel, D. Demirdjian, N. Checka, P. Felzenszwalb. Plan-View Trajectory Estimation with Dense Stereo Background Models. *International Conference on Computer Vision*, Pages 628-635, 2001.
- P. Felzenszwalb, D. Huttenlocher. Efficient Matching of Pictorial Structures. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 2066-2073, 2000.
- D. Huttenlocher, P. Felzenszwalb, W. Rucklidge. Digipaper: A Versatile Color Document Image Representation. *International Conference on Image Processing*, Pages, 219-223, 1999.
- P. Felzenszwalb, D. Huttenlocher. Image Segmentation Using Local Variation. *IEEE Conference on Computer Vision and Pattern Recognition*, Pages 98-104, 1998.

## Other Publications

- P. Felzenszwalb. Similar Elements and Metric Labeling on Complete Graphs. Technical report, arXiv:1803.08037, March 2018.

- J. Chua, P. Felzenszwalb. Scene Grammars, Factor Graphs, and Belief Propagation. Technical report, arXiv:1606.01307, June 2016.
- P. Felzenszwalb. A Stochastic Grammar for Natural Shapes. In Shape Perception in Human and Computer Vision. Advances in Computer Vision and Pattern Recognition. Editors: Sven Dickinson, Zygmunt Pizlo. Pages 229-310, Springer, 2013.
- Y. Amit, P. Felzenszwalb. Object Detection. In Computer Vision, A Reference Guide. Pages 537-542, Springer, 2014.
- P. Felzenszwalb, R. Girshick, D. McAllester, D. Ramanan. Visual Object Detection with Deformable Part Models. Communications of the ACM (CACM), Vol. 56, No. 9, Pages 97-105, September 2013.
- P. Felzenszwalb, R. Girshick, D. McAllester, D. Ramanan. Discriminative Latent Variable Models for Object Detection. Invited Applications Paper, International Conference on Machine Learning (ICML), Pages 11-12, 2010.
- P. Felzenszwalb, D. McAllester. Object Detection Grammars. University of Chicago, Department of Computer Science, Technical Report 2010-02, February 2010.
- P. Codenotti, P. Felzenszwalb. 2D Min-Filters with Polygons. Fall Workshop on Computational and Combinatorial Geometry, 2007.
- D. Crandall, P. Felzenszwalb, D. Huttenlocher. Object Recognition by Combining Appearance and Geometry. In Towards Category-Level Object Recognition. LNCS Vol. 4170. Pages 462-482, Springer, 2006.
- P. Felzenszwalb, D. McAllester. A Min-Cover Approach for Finding Salient Curves. IEEE Workshop on Perceptual Organization in Computer Vision (in conjunction with CVPR), 2006.
- P. Felzenszwalb, D. Huttenlocher. Distance Transforms of Sampled Functions. Cornell Computing and Information Science, Technical Report 2004-1963.
- P. Felzenszwalb. Representation and Detection of Shapes in Images. Ph.D. thesis. MIT Artificial Intelligence Laboratory, Technical Report 2003-016.
- P. Felzenszwalb. Object Recognition with Pictorial Structures. Master's thesis. MIT Artificial Intelligence Laboratory, Technical Report 2001-002.
- P. Felzenszwalb, D. Huttenlocher. Recognizing Flexible Objects. IEEE Workshop on Graph Algorithms and Computer Vision (in conjunction with ICCV), 1999.
- P. Felzenszwalb, D. Huttenlocher. Efficiently Computing a Good Segmentation. DARPA Image Understanding workshop, 1998.