

# CURRICULUM VITAE

David Jacobs

Notarization. I have read the following and certify that this curriculum vitae is a current and accurate statement of my professional record.

Signature 

Date: January 6, 2021

## 1 Personal Information

### 1.1 Current Position

Professor, University of Maryland (appointed August, 2002)  
Computer Science Department (50%)  
University of Maryland Institute for Advanced Computer Studies (UMIACS)  
(50%)

### 1.2 Education

- Ph.D. in Computer Science, MIT, member of the Artificial Intelligence Lab, graduated Summer 1992.  
Advisor Prof. Eric Grimson.  
Thesis Title: ``Recognizing 3-D Objects Using 2-D Images``.
- S.M. in Computer Science, MIT, January 1988.  
Advisor Prof. Eric Grimson.  
Thesis Title: ``The Use of Grouping in Visual Object Recognition``.
- Part-time Graduate Student, New York University, 1982-85.  
Conducted research with Prof. Robert Hummel.
- Bachelor of Arts, Yale College, May 1982. Magna Cum Laude, Distinction in the Mathematics major.

### 1.2 Employment

- 2019-Present      Interim Director,  
                                 University of Maryland Center for Machine Learning
- 2009-Present      Professor,  
                                 Computer Science Department, University of Maryland
- 2014-2016          Consultant, Dropbox
- 2014                  Consultant, Cellular South, Inc.

- 2007-2014            Consultant, Kriegman-Belhumeur Vision Technologies
- 2002-2009            Associate Professor,  
   Computer Science Department, University of Maryland.
- 2001-2002            Senior Research Scientist, NEC Research Institute,
- 1992-2001            Research Scientist, NEC Research Institute,
- Fall, 1997, 1998    Visiting Member,  
   Computer Science Department, New York University.
- 1998                    Sabbatical Visitor,  
   KTH (Royal Institute of Technology, Stockholm)
- 1986-1992            Research Assistant, Teaching Assistant,  
   MIT Artificial Intelligence Laboratory.
- 1989-1990            Consultant,  
   Chestnut Software.
- Summer, 1989       Software development,  
   MIT Department of Brain and Cognitive Sciences.
- Summer 1988        Member, Research Group  
   Thinking Machines Corporation
- 1982-1985            Software Developer  
   Control Data Corporation

## **2 Research, Scholarly, and Creative Activities**

\* Indicates a student or post-doc co-author.

### **2.1 Chapters in Books**

1. David Jacobs, "Generalizing Invariants for 3-D to 2-D Matching", *Applications of Invariance in Computer Vision*, edited by J. Mundy, A. Zisserman and D. Forsyth, Springer-Verlag, pp. 415-434, 1994.
2. Zili Liu\*, David Jacobs, and Ronen Basri, "Convexity in Perceptual Completion", In *Perceptual Organization for Artificial Vision Systems*, edited by K. Boyer and S. Sarkar, Kluwer Academic Publishers, 2002.

3. David Jacobs, "What Makes Viewpoint Invariant Properties Perceptually Salient?: A Computational Perspective", In *Perceptual Organization for Artificial Vision Systems*, edited by K. Boyer and S. Sarkar, Kluwer Academic Publishers, 2002.
4. David Jacobs, Jitendra Malik, and Ram Nevatia, "Breakout Session Report: Principles and Methods", In *Perceptual Organization for Artificial Vision Systems*, edited by K. Boyer and S. Sarkar, Kluwer Academic Publishers, 2002.
5. David Jacobs, "Perceptual Organization as Generic Object Recognition", In *From Fragments to Objects: Segmentation and Grouping in Vision*, edited by T. Shipley and P. Kellman, Elsevier, pages 295-329, 2001.
6. David Jacobs, "Perceptual Completion and Memory," In *Perceptual Organization in Vision: Behavioral and Neural Perspectives*, edited by R. Kimchi, M. Behrmann, and C. Olson, Lawrence Erlbaum Associates, 2003, pages 403-430.
7. Ronen Basri and David Jacobs, "Illumination Modeling for Face Recognition," In *Handbook of Face Recognition*, edited by S. Li and A. Jain, Springer-Verlag, 2005.
8. Carlos Castillo\* and David Jacobs, "Face Variation," in *Encyclopedia of Biometrics*, edited by S. Li, Springer-Verlag, 2009.
9. Haibin Ling and David Jacobs, "Shape Matching for Foliage Database Retrieval," In *Semantic Mining Technologies for Multimedia Databases*, edited by D. Tao, D. Xu, and X. Li, IGI Global, pp. 100-129, 2009.
10. David Jacobs, Anne Jorstad\*, and Alain Trouvé. "Deformation and Lighting," in *Shape Perception in Human and Computer Vision*, edited by S. Dickinson and Z. Pizlo, Springer-Verlag, pp. 133-144, 2013.

## 2.2 Articles in Refereed Journals

1. David Clemens\* and David Jacobs, "Space and Time Bounds on Indexing 3D Models from 2D Images", *IEEE Trans. on Pattern Analysis and Machine Intelligence*, **13**(10):1007-1017, 1991.
2. Eric Grimson, Dan Huttenlocher, and David Jacobs, "A Study of Affine Matching with Bounded Sensor Error", *International Journal of Computer Vision*, **13**(1):7-32, 1994.
3. David Jacobs, "The Space Requirements of Indexing Under Perspective Projection", *IEEE Trans. on Pattern Analysis and Machine Intelligence*, **18**(3):330-333, 1996.
4. David Jacobs, "Robust and Efficient Detection of Convex Groups", *IEEE Trans. on Pattern Analysis and Machine Intelligence*, **18**(1):23-37, 1996.

5. David Jacobs, "Matching 3-D Models to 2-D Images", *International Journal of Computer Vision*, **21**(1/2):123-153, 1997.
6. Ronen Basri and David Jacobs, "Constancy and Similarity", *Computer Vision, and Image Understanding*, **65**(3):447-449., (commentary, 1997).
7. Lance Williams\* and David Jacobs, "Stochastic Completion Fields: A Neural Model of Illusory Contour Shape and Saliency", *Neural Computation*, **9**:837-858, 1997.
8. Lance Williams\* and David Jacobs, "Local Parallel Computation of Stochastic Completion Fields," *Neural Computation*, **9**:859-881, 1997.
9. Ronen Basri and David Jacobs. "Recognition Using Region Correspondences", *International Journal of Computer Vision*, **25**(2):145-166, 1997.
10. Tao Alter\* and David Jacobs, "Uncertainty Propagation in Model-Based Recognition", *International Journal of Computer Vision* **27**(2):127-159, 1998.
11. Ronen Basri, Luiz Costa\*, Davi Geiger, and David Jacobs, "Determining the Similarity of Deformable Shapes", *Vision Research*, **38**(15/16):2365-2385, 1998.
12. Ronen Basri, Adam Grove, and David Jacobs, "Efficient Determination of Shape from Multiple Images Containing Partial Information," *Pattern Recognition*, **31**(11):1691-1703, 1998.
13. Zili Liu\*, David Jacobs, and Ronen Basri, "The Role of Convexity in Perceptual Completion: Beyond Good Continuation," *Vision Research*, **39**:4244-4257, 1999.
14. David Jacobs and Ronen Basri, "3-D to 2-D Pose Determination with Regions", *International Journal of Computer Vision*, **34**(2/3):123-145, 1999.
15. David Jacobs, Daphna Weinshall, and Yoram Gdalyahu\*, "Classification with Nonmetric Distances: Image Retrieval and Class Representation," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, **22**(6):583-600, 2000.
16. Ronen Basri and David Jacobs, "Projective Alignment with Regions," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, **23**(5):519-527, 2001.
17. David Jacobs, "Linear Fitting with Missing Data for Structure-From-Motion," *Computer Vision and Image Understanding*, **82**:57-81, 2001.
18. Ronen Basri and David Jacobs, "Lambertian Reflectance and Linear Subspaces," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, **25**(2):218-233, 2003.

19. Tom Funkhouser, Patrick Min\*, Michael Kazhdan\*, Joyce Chen\*, Alex Halderman\*, David Dobkin, and David Jacobs, "A Search Engine for 3D Models," *ACM Transactions on Graphics*, **22**(1):83-105, January, 2003.
20. David Jacobs, "What Makes Viewpoint Invariant Properties Perceptually Salient?" *Journal of the Optical Society of America A*, **20**(7): 1304-1320, 2003.
21. Gaurav Agarwal\*, Peter Belhumeur, Steven Feiner, David Jacobs, W. John Kress, Ravi Ramamoorthi, Norman A. Bourg, Nandan Dixit\*, Haibin Ling\*, Dhruv Mahajan\*, Rusty Russell, Sameer Shirdhonkar\*, Kalyan Sunkavalli\*, Sean White\*, "First Steps Toward an Electronic Field Guide for Plants," *Taxon*, **55**: 597-610, 2006.
22. Ronen Basri, David Jacobs, Ira Kemelmacher\*, "Photometric Stereo with General, Unknown Lighting," *Int'l J. of Computer Vision*. **72**(3): 239-257, 2007.
23. Margarita Osadchy\*, David Jacobs, Michael Lindenbaum, "Surface Dependent Representations for Illumination Insensitive Image Comparison," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, **29**(1):98-111, 2007.
24. S. Kevin Zhou\*, Gaurav Aggarwal\*, Rama Chellappa, David Jacobs, "Appearance Characterization of Linear Lambertian Objects, Generalized Photometric Stereo and Illumination-Invariant Face Recognition," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, **29**(2):230- 245, 2007.
25. Haibin Ling\*, David Jacobs, "Shape Classification Using the Inner-Distance," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, **29**(2):286-299, 2007.
26. Margarita Osadchy\*, David Jacobs, Ravi Ramamoorthi, David Tucker\*, "Using Specularities in Comparing 3D Models and 2D Image", *Computer Vision and Image Understanding*, **111**(3):275-294, 2008.
27. Carlos D. Castillo\*, David Jacobs, "Using Stereo Matching with General Epipolar Geometry for 2-D Face Recognition Across Pose", *IEEE Trans. on Pattern Analysis and Machine Intelligence*, **31**(12):2298-2304, 2009.
28. Youngmin Kim\*, Amitabh Varshney, David Jacobs, and Francois Guimbretiere, "Mesh Saliency and Human Eye Fixations", *ACM Transactions on Applied Perception*, **7**(2):12:1-12:13, 2009.
29. Raghuraman Gopalan\*, David Jacobs, "Comparing and Combining Lighting Insensitive Approaches for Face Recognition," *Computer Vision and Image Understanding*, **114**:(1)135-145, 2010.
30. Haibin Ling\*, Stefano Soatto, Narayanan Ramanathan\*, and David Jacobs, "Face Verification Across Age Progression Using Discriminative Methods," *IEEE Transactions on Information Forensics and Security*, **5**(1):82-91, 2010.

31. Xue Mei\*, Haibin Ling, and David Jacobs, "Illumination Recovery from Images with Cast Shadows via Sparse Representation," *IEEE Transactions on Image Processing*, **20**(8):2366-2377, 2011.
32. Daozheng Chen\*, Mustafa Bilgic\*, Lise Getoor, and David Jacobs, "Dynamic Processing Allocation in Video," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, vol.33, no.11, pp.2174-2187, Nov. 2011.
33. Abhishek Sharma, Murad Al Haj, Jonghyun Choi, Larry S. Davis, David W. Jacobs "Robust pose invariant face recognition using coupled latent space discriminant analysis," *Computer Vision and Image Understanding (CVIU)*, vol. 116, pp. 1095-1110, 2012.
34. Peter Belhumeur, David Jacobs, David Kriegman, and Neeraj Kumar\* "Localizing Parts of Faces Using a Consensus of Exemplars", *IEEE Trans. on Pattern Analysis and Machine Intelligence*, Volume 35, Number 12, pp. 2930-2940, 2013.
35. Joao Soares and David Jacobs "Efficient segmentation of leaves in semi-controlled conditions," *Machine Vision Applications*, Vol. 24, Number 8, pp. 1623-1643, 2013.
36. Yaron Lipman, Stav Yagev\*, Roi Poranne\*, David W. Jacobs and Ronen Basri, "Feature matching with bounded distortion," *ACM Transactions on Graphics*, Volume 33, Issue 3, 2014.
37. Arijit Biswas\* and David Jacobs, "Active image clustering with pairwise constraints from humans", *International Journal of Computer Vision*, Volume 108, pp. 133-147, 2014.
38. Arijit Biswas\* and David Jacobs, "Active subclustering," *Computer Vision and Image Understanding*, Volume 125, pp. 72-84, 2014.
39. Konrad Simon\*, Sameer Sheorey, David Jacobs, Ronen Basri, "A linear force optimization model for shape matching," *Journal of Mathematical Imaging and Vision*, published online, 2014.
40. Ying Xiong\*, Ayan Chakrabarti\*, Ronen Basri Steven Gortler, David Jacobs, Todd Zickler, "From shading to local shape," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, Volume 37, Number 1, pp. 67-79, 2015.
41. Konrad Simon\*, Sameer Sheorey, David Jacobs and Ronen Basri "A Hyperelastic Two-Scale Optimization Model for Shape Matching." *SIAM Journal on Scientific Computing*. 39(1), B165-189, 2017.
42. Soumyadip Sengupta\*, Hao Zhou\*, Walter Forkel\*, Ronen Basri, Tom Goldstein, and David Jacobs. "Solving Uncalibrated Photometric Stereo Using Fewer Images by

Jointly Optimizing Low-rank Matrix Completion and Integrability." *Journal of Mathematical Imaging and Vision* 60, no. 4 (2018): 563-575.

43. W. John Kress, Carlos Garcia-Robledo, João VB Soares\*, David Jacobs, Katharine Wilson, Ida C. Lopez, and Peter N. Belhumeur. "Citizen Science and Climate Change: Mapping the Range Expansions of Native and Exotic Plants with the Mobile App Leafsnap." *BioScience* (2018).
44. Soumyadip Sengupta\*, Daniel Lichy\*, Angjoo Kanazawa, Carlos Castillo, David Jacobs. "SfSNet: Learning Shape, Reflectance and Illuminance of Faces in the Wild." *IEEE Trans. on Pattern Analysis and Machine Intelligence*, Accepted for publication.

### 2.3 Articles in Refereed Conferences

1. David Clemens\* and David Jacobs, "Model Group Indexing for Recognition", IEEE Conf. on Computer Vision and Pattern Recognition (CVPR), pp. 4-9, 1991.
2. David Jacobs "Optimal Matching of Planar Models in 3D Scenes", IEEE Conf. on Computer Vision and Pattern Recognition (CVPR), pp. 269-274, 1991.
3. Eric Grimson, Dan Huttenlocher, and David Jacobs, "A Study of Affine Matching with Bounded Sensor Error", European Conference on Computer Vision (ECCV), pp. 291-306, 1992.
4. David Jacobs, "Space Efficient 3D Model Indexing", IEEE Conf. on Computer Vision and Pattern Recognition (CVPR), pp. 439-444, 1992.
5. David Jacobs, "Robust and Efficient Detection of Convex Groups", IEEE Conf. on Computer Vision and Pattern Recognition (CVPR), pp. 770-771, 1993.
6. David Jacobs, "2-D Images of 3-D Oriented Points", IEEE Conf. on Computer Vision and Pattern Recognition (CVPR), pp. 226-232, 1993.
7. Tao Alter\* and David Jacobs, "Error Propagation in Full 3D-from-2D Object Recognition", IEEE Conf. on Computer Vision and Pattern Recognition (CVPR), pp. 892-898, 1994.
8. David Jacobs and Chakra Chennubhotla, "Finding Structurally Consistent Motion Correspondences", 12th Int. Conf. on Pattern Recognition(ICPR), pp. 650-653, 1994.
9. Lance Williams\* and David Jacobs, "Stochastic Completion Fields: A Neural Model of Illusory Contour Shape and Saliency", Conference of the Association for Research in Vision and Ophthalmology (ARVO), p. S474, 1995, (abstract).

10. Zili Liu\*, David Jacobs, and Ronen Basri, "Perceptual Completion: Beyond Good Continuation", Conference of the Association for Research in Vision and Ophthalmology (ARVO), pp. S475, 1995, (abstract).
11. Lance Williams\* and David Jacobs, "Stochastic Completion Fields: A Neural Model of Illusory Contour Shape and Saliency", IEEE International Conference on Computer Vision (ICCV), pp. 408-415, 1995.
12. Ronen Basri and David Jacobs, "Recognition Using Region Correspondences", IEEE International Conference on Computer Vision (ICCV), pp. 8-15, 1995.
13. Adam Grove and David Jacobs, "Space/Time Tradeoffs for Associative Memory", International Conference on Pattern Recognition (ICPR), pp. D. 296-302, (August 1996).
14. Ronen Basri, Adam Grove, and David Jacobs, "Efficient Determination of Shape from Multiple Images Containing Partial Information", International Conference on Pattern Recognition (ICPR), pp. A. 268-274, (August 1996).
15. Lance Williams\* and David Jacobs, "Local Parallel Computation of Stochastic Completion Fields", IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp. 161-168, (June 1996).
16. David Jacobs and Ronen Basri, "3-D to 2-D Recognition with Regions", IEEE Conference on Computer Vision and Pattern Recognition (ICPR), pp. 547-553, (June 1997).
17. David Jacobs, "Linear Fitting with Missing Data", IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp. 206-212, (June 1997).
18. David Jacobs, Daphna Weinshall, and Yoram Gdalyahu\*, "Condensing Image Databases when Retrieval is based on Non-Metric Distances", 6th IEEE International Conference on Computer Vision (ICCV), pp. 596-601, (January 1998).
19. Ronen Basri, Dan Roth, and David Jacobs. "Clustering Appearances of 3D Objects", IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp. 414-420, (June 1998).
20. David Jacobs, Peter Belhumeur and Ronen Basri, "Comparing Images Under Variable Illumination", IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp. 610-617, (June 1998).
21. Daphna Weinshall, David Jacobs, and Yoram Gdalyahu\*, "Classification in Non-Metric Spaces", Neural Information Processing Systems (NIPS) 11, pp. 838-844, (1999).



22. Ronen Basri and David Jacobs, "Projective Alignment with Regions", International Conference on Computer Vision (ICCV), pp. 1158-1164, (September 1999).
23. Hansen Chen\*, Peter Belhumeur, and David Jacobs, "In Search of Illumination Invariants," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp. 254--261, (June 2000). (Honorable Mention, Best Paper Award).
24. Ronen Basri and David Jacobs, "Lambertian Reflectance and Linear Subspaces," International Conference on Computer Vision (ICCV), pp. II:383-390, (July 2001).
25. David Jacobs, Bas Rokers\*, Archi Rudra\* and Zili Liu, "Fragment Completion in Humans and Machines," in Advances in Neural Information Processing Systems 14 (NIPS), edited by T. G. Dietterich, S. Becker and Z. Ghahramani, MIT Press, Cambridge, MA, 2002.
26. Ronen Basri and David Jacobs, "Photometric Stereo with General, Unknown Lighting," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Vol. II: 374-381, 2001.
27. Margarita Osadchy\*, David Jacobs, Ravi Ravamoorthi, "Using Specularities for Recognition," IEEE International Conference on Computer Vision (ICCV), Vol. II:1512-1519, 2003.
28. Bongwon Suh\*, Haibin Ling\*, Ben Bederson, and David Jacobs, "Automatic Thumbnail Cropping and its Effectiveness," ACM Symposium on User Interface Software and Technology (UIST 2003), CHI Letters, 5(2), 95-104 (Best Student Paper Award).
29. Shaohua Zhou\*, Rama Chellappa and David Jacobs, "Characterization of human faces under illumination variations using rank, integrability, and symmetry constraints," European Conference on Computer Vision (ECCV), pp. 588-601, 2004.
30. Margarita Osadchy\*, Michael Lindenbaum, and David Jacobs, "Whitening for Photometric Comparison of Smooth Surfaces under Varying Illumination," European Conference on Computer Vision (ECCV), pp. 217-228, 2004.
31. Haibin Ling\* and David Jacobs, "Using the Inner Distance for Classification of Articulated Shapes," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Vol. II, pp. 719-726, 2005.
32. Haibin Ling\* and David Jacobs, "Deformation Invariant Image Matching," IEEE International Conference on Computer Vision (ICCV), Vol. II, pp. 1466-1473, 2005.

33. Sameer Shirdhonkar\* and David Jacobs, "Non-Negative Lighting and Specular Object Recognition," IEEE International Conference on Computer Vision (ICCV), Vol. II, pp. 1323-2330, 2005.
34. Chang Ha Lee\*, Amitabh Varshney, and David Jacobs, "Mesh Saliency," ACM Transactions on Graphics (Proceedings of SIGGRAPH 2005) Vol 24, No 3:659-666, 2005.
35. Margarita Osadchy\*, David Jacobs and Michael Lindenbaum, "On the Equivalence of Common Approaches to Lighting Insensitive Recognition," IEEE International Conference on Computer Vision (ICCV), Vol. II, pp. 1721-1726, 2005.
36. Carlos D. Castillo\* and David Jacobs, "Using Stereo Matching for 2-D Face Recognition Across Pose", IEEE International Conference on Computer Vision and Pattern Recognition (CVPR), 2007.
37. Li Yi\* and David Jacobs, "Efficiently Determining Silhouette Consistency," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2007.
38. Hazem El-Alfy\*, David Jacobs, and Larry Davis, "Multi-scale Video Cropping," ACM International Multimedia Conference, pp. 97-206, 2007.
39. Haibin Ling\*, Stefano Soatto, Narayanan Ramanathan\*, and David Jacobs, "A Study of Face Recognition as People Age," IEEE International Conference on Computer Vision (ICCV), pp. 1-8, 2007.
40. Sameer Shirdhonkar\* and David Jacobs, "Approximate earth mover's distance in linear time", IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2008.
41. Peter N. Belhumeur, Daozheng Chen\*, Steven Feiner, David Jacobs, W. John Kress, Haibin Ling\*, Ida Lopez, Ravi Ramamoorthi, Sameer Sheorey\*, Sean White\*, and Ling Zhang, "Searching the world's herbaria: a system for visual identification of plant species", European Conference on Computer Vision (ECCV), pp. 116-129 2008.
42. Hazem El-Alfy, David Jacobs, and Larry Davis, "Assigning Cameras to Subjects in Video Surveillance Systems," International Conference on Robotics and Automation (ICRA), 2009.
43. Ronen Basri, Pedro Felzenszwalb, Ross Girshick, David Jacobs, Caroline Klivans, "Visibility Constraints on Features of 3D Objects," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2009.

44. Xue Mei\*, Haibin Ling, David Jacobs, "Sparse Representations of Cast Shadows via  $l_1$ -Regularized Least Squares", IEEE International Conference on Computer Vision (ICCV), 2009.
45. Anne Jorstad\*, David Jacobs, Alain Trouve, "A Deformation and Lighting Insensitive Metric for Face Recognition Based on Dense Correspondence", IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2011.
46. Abhishek Sharma\*, David Jacobs, "Bypassing Synthesis: PLS for Face Recognition with Pose, Low-Resolution and Sketch," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2011.
47. Peter Belhumeur, David Jacobs, David Kriegman, Neeraj Kumar, "Finding Fiducial Points with Local Detectors and a Consensus of Global Models," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2011.
48. Derek Hansen, David Jacobs, Darcy Lewis\*, Arijit Biswas\*, Jennifer Preece, Dana Rotman\*, and Eric Stevens\*. 2011. "Odd Leaf Out: Improving visual recognition with games". In Proceedings of the IEEE International Conference on Social Computing. Boston, MA, 2011.
49. Abhishek Sharma\*, Abhishek Kumar\*, Hal Daume III, David W. Jacobs. "Generalized Multiview Analysis: A Discriminative latent space". IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2012.
50. Arijit Biswas\*, David Jacobs. "Active Image Clustering: Seeking Constraints from Humans to Complement Algorithms". IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2012.
51. Neeraj Kumar, Peter N. Belhumeur, Arijit Biswas\*, David Jacobs, W. John Kress, Ida Lopez, João V. B. Soares\*. "Leafsnap: A Computer Vision System for Automatic Plant Species Identification," Proceedings of the 12th European Conference on Computer Vision (ECCV), October 2012.
52. Anne Jorstad\*, David Jacobs, Alain Trouvé. "A Fast Illumination and Deformation Insensitive Image Comparison Algorithm Using Wavelet-Based Geodesics." European Conference on Computer Vision (ECCV), Oct. 2012.
53. Jiongxin Liu\*, Angjoo Kanazawa\*, Peter Belhumeur, David Jacobs, "Dog Breed Classification Using Part Localization", European Conference on Computer Vision (ECCV), Oct. 2012.
54. Dana Rotman\*, Jenny Preece, Jen Hammock, Kezee Procita, Derek Hansen, Cynthia Parr, Darcy Lewis\*, David Jacobs. "Dynamic Changes in Motivation in Collaborative Citizen-Science Projects," Proceedings of the ACM conference on Computer Supported Cooperative Work (CSCW), 2012.

55. Thomas Berg\*, Jiongxin Liu\*, Seung Woo Lee\*, Michelle Alexander\*, David Jacobs, Peter Belhumeur. "BirdSnap: Large-scale Fine-grained Visual Categorization of Birds," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2014.
56. Kotaro Hara\*, Jin Sun\*, Robert Moore\*, David Jacobs, Jon E. Froehlich, "Tohme: Detecting Curb Ramps in Google Street View Using Crowdsourcing, Computer Vision, and Machine Learning", Proceedings of UIST, 2014.
57. Abhishek Sharma\*, Oncel Tuzel, David Jacobs, "Deep Hierarchical Parsing for Semantic Segmentation", IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2015.
58. Arijit Biswas\*, David Jacobs, "An Efficient Algorithm for Learning Distances that Obey the Triangle Inequality", 26<sup>th</sup> British Machine Vision Conference, 2015.
59. Soumyadip Sengupta\*, Jun-Cheng Chen\*, Carlos D. Castillo, Vishal M. Patel, Rama Chellappa, David W. Jacobs, "Frontal to Profile Face Verification in the Wild", Winter Conference on Applications of Computer Vision, 2016.
60. Angjoo Kanazawa\*, Shahar Kovalsky\*, Ronen Basri and David Jacobs, "Learning 3D deformation of animals from 2D images," vol. 35, no. 2, pp. 365-374. Eurographics, 2016.
61. Angjoo Kanazawa\*, David Jacobs, Manmohan Chandraker "Unsupervised matching in fine-grained datasets for single view reconstruction," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2016.
62. Sohil Shah\*, Abhay Kumar Yadav\*, Carlos Castillo, David W. Jacobs, Christoph Studer, Tom Goldstein. "Biconvex Relaxation for Semidefinite Programming in Computer Vision," European Conference on Computer Vision (ECCV), 2016.
63. Soham De\*, Abhay Yadav\*, David Jacobs, and Tom Goldstein. "Big Batch SGD: Automated Inference using Adaptive Batch Sizes." *AISTATS*, 2017.
64. Soumyadip Sengupta\*, Tal Amir\*, Meirav Galun, Amit Singer, Tom Goldstein, David Jacobs, and Ronen Basri, "A New Rank Constraint on Multi-view Fundamental Matrices, and its Application to Camera Location Recovery," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2017.
65. Jin Sun\* and David Jacobs, "Seeing What Is Not There: Learning Context to Determine Where Objects Are Missing", IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2017.

66. Silvia Zuffi, Angjoo Kanazawa\*, David Jacobs, and Michael Black, "3D Menagerie: Modeling the 3D Shape and Pose of Animals," *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2017.
67. Ronen Basri and David Jacobs. "Efficient Representation of Low-Dimensional Manifolds using Deep Networks," *International Conference on Learning Representations (ICLR)*, 2017.
68. Benjamin Charlier, Jean Feydy, David W. Jacobs, and Alain Trouvé. "Distortion Minimizing Geodesic Subspaces in Shape Spaces and Computational Anatomy." In *European Congress on Computational Methods in Applied Sciences and Engineering*, pp. 1135-1144. Springer, Cham, 2017.
69. Angjoo Kanazawa\*, Michael J. Black, David W. Jacobs, and Jitendra Malik. "End-to-end Recovery of Human Shape and Pose." *CVPR*, 2018.
70. Hao Zhou\*, Jin Sun\*, Yaser Yacoob, and David W. Jacobs. "Label Denoising Adversarial Network (LDAN) for Inverse Lighting of Face Images." *CVPR*, 2018.
71. Soumyadip Sengupta\*, Angjoo Kanazawa, Carlos D. Castillo, and David Jacobs. "SfSNet: Learning Shape, Reflectance and Illuminance of Faces in the Wild." *CVPR*, 2018.
72. Abhay Yadav\*, Sohil Shah\*, Zheng Xu\*, David Jacobs, and Tom Goldstein. "Stabilizing adversarial nets with prediction methods." *International Conference for Learning Representations (ICLR)*, 2018.
73. Soumyadip Sengupta,, Jinwei Gu, Kihwan Kim, Guilin Liu, David W. Jacobs, and Jan Kautz. "Neural inverse rendering of an indoor scene from a single image." In *Proceedings of the IEEE International Conference on Computer Vision*, pp. 8598-8607. 2019.
74. Ronen Basri, David Jacobs, Yoni Kasten\*, and Shira Kritchman\*. "The convergence rate of neural networks for learned functions of different frequencies." In *Advances in Neural Information Processing Systems*, pp. 4763-4772. 2019.
75. Hao Zhou\*, Sunil Hadap, Kalyan Sunkavalli, and David W. Jacobs. "Deep Single-Image Portrait Relighting." In *Proceedings of the IEEE International Conference on Computer Vision*, pp. 7194-7202. 2019.
76. Hao Zhou\*, Xiang Yu, and David W. Jacobs. "GLoSH: Global-Local Spherical Harmonics for Intrinsic Image Decomposition." In *Proceedings of the IEEE International Conference on Computer Vision*, pp. 7820-7829. 2019.
77. Ali Shafahi\*, Parsa Saadatpanah\*, Chen Zhu\*, Amin Ghiasi\*, Christoph Studer, David Jacobs, and Tom Goldstein. "Adversarially robust transfer learning." *International Conference on Learning Representations (ICLR)*, 2020.

78. Ronen Basri, Meirav Galun, Amnon Geifman\*, David Jacobs, Yoni Kasten\*, and Shira Kritchman\*. "Frequency bias in neural networks for input of non-uniform density." *International Conference on Machine Learning (ICML)*, 2020.
79. Koutilya PNVR\*, Hao Zhou, and David Jacobs. "SharinGAN: Combining Synthetic and Real Data for Unsupervised Geometry Estimation." In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pp. 13974-13983. 2020.
80. Amnon Geifman\*, Abhay Yadav, Yoni Kasten\*, Meirav Galun, David Jacobs, and Ronen Basri. "On the similarity between the Laplace and neural tangent kernels." *Conference on Neural Information Processing Systems (Neurips)*, 2020.

#### **2.4 Articles in Refereed Workshops**

1. David Jacobs, "GROPER: A Grouping Based Object Recognition System for Two-Dimensional Objects", *IEEE Workshop on Computer Vision*. pp. 164-169, 1987.
2. David Jacobs, "Opportunistic Recognition", *AAAI Workshop on Qualitative Vision*, pp. 147-151, 1990 (extended abstract).
3. David Jacobs and Chakra Chennubhotla, "Segmenting Independently Moving, Noisy Points", *IEEE Workshop on Motion of Non-Rigid and Articulate Objects*, pp. 96-103, 1994.
4. David Jacobs, "Finding Salient Convex Groups", *Proc. of the DIMACS Workshop on Partitioning Data Sets*, pp. 237-269, 1995.
5. Ronen Basri, Luiz Costa\*, Davi Geiger, and David Jacobs, "Determining the Similarity of Deformable Objects", *IEEE Workshop on Physics-Based Modeling in Computer Vision*, pp. 135-143, 1995.
6. Ronen Basri and David Jacobs, "Matching Convex Polygons and Polyhedra, Allowing for Occlusion", *First ACM Workshop on Applied Computational Geometry*, pp. 57-66, May 1996.
7. David Jacobs, Peter Belhumeur, and Ian Jermyn\*, "Judging Whether Multiple Silhouettes Can Come from the Same Object," *International Workshop on Visual Form*, pp. 532-541, May 2001.

8. Aniruddha Kembhavi\*, Ryan Farrell\*, Yuan Cheng Luo\*, David Jacobs, Ramani Duraiswami, and Larry Davis. "Tracking Down Under: Following the Satin Bowerbird", Workshop on Applications of Computer Vision, 2008.
9. Daozheng Chen\*, Mustafa Bilgic\*, Lise Getoor, and David Jacobs. Efficient Resource-constrained Retrospective Analysis of Long Video Sequences. In NIPS Workshop on Adaptive Sensing, Active Learning and Experimental Design: Theory, Methods and Applications, 2009.
10. Daozheng Chen\*, Mustafa Bilgic\*, Lise Getoor, David Jacobs, Lilyana Mihalkova\*, and Tom Yeh\*, "Active Inference for Retrieval in Camera Networks," Workshop on Person-Oriented Vision, 2011.
11. Jonghyun Choi\*, Abhishek Sharma\*, David Jacobs, Larry S. Davis, "Data Insufficiency in Sketch Versus Photo Face Recognition," IEEE Conf. on Computer Vision and Pattern Recognition Workshop (CVPRW) on Biometrics, 2012.
12. Hao Zhou\*, Torsten Sattler, and David W. Jacobs. "Evaluating Local Features for Day-Night Matching." *Computer Vision–ECCV 2016 Workshops*. Springer International Publishing, 2016.

## **2.5 Tutorials, Talks, Abstracts, and Other Professional Papers Presented**

1. Invited speaker, 1998 Rosenon Workshop on Computational Vision.
2. Invited speaker, 31st Carnegie Symposium on Cognition, 2000.
3. "Recognizing and Reconstructing Objects When the Lighting Changes," February 6, 2004, University of Pennsylvania GRASP Lab.
4. "Recognizing and Reconstructing Objects When the Lighting Changes," February 4, 2005, University of Toronto Department of Computer Science.
5. "Recognizing and Reconstructing Objects When the Lighting Changes," April 20, 2005, Johns Hopkins University, Center for Imaging Science.
6. "Deformation Invariant Image Matching and Plant Species Discovery," February 27, 2006, New York University, Invited Talk, Post-CVPR AC Meeting Workshop.
7. "It's a 3D World," May 24, 2006, Invited Panelist, Workshop on Visual Learning and Recognition, IMA, University of Minnesota
8. "Deformation Invariant Image Matching and Plant Species Discovery," May 24, 2006, Invited Poster Presentation, Workshop on Visual Learning and Recognition, IMA, University of Minnesota.

9. "Comparing Images of 3D Objects," October 15, 2007, Invited Talk, International Workshop on Object Categorization, Rio de Janeiro, Brazil.
10. "Matching Images with Deformations," October 1, 2008, Ecole Normale Supérieure, Paris, Department of Computer Science.
11. "Matching Images with Deformations," November 6, 2008, Ecole Normale Supérieure, Cachan, Center for Mathematics and its Applications.
12. "Matching Images with Deformations," November 6, 2008, Ecole Centrale, Department of Applied Mathematics.
13. "Applications of the Earth Mover's Distance in Computer Vision, with a New Approximate Algorithm," June 30, 2009, Invited Talk, Workshop "Optimal transportation: Theory and applications" Institut Fourier, Grenoble, France.
14. "Matching Images with Deformations," April 16, 2010, York University, Centre for Vision Research, Toronto, Canada.
15. "Matching Images with Deformations," June 18, 2010, Third Workshop on Non-Rigid Shape Analysis and Deformable Image Alignment, San Francisco, CA, (Plenary Talk).
16. "Matching Images with Deformations for Recognition," November 4, 2010, Johns Hopkins University, Center for Imaging Sciences, Baltimore, Maryland.
17. "Segmentation and Shape Matching for Plant Species Identification," April 4, 2011, U.S. Patent and Trademark Office, Alexandria, Virginia.
18. "Understanding Shape by Comparing Images," May 5, 2011, 4<sup>th</sup> International Workshop on Shape Perception in Human and Computer Vision (Invited talk).
19. "Leafsnap: Interactive Plant Species Identification," June 14, 2012, Bioinspired Forum 2012, Simrishamn, Sweden (Invited talk, presented remotely).
20. "Leafsnap: Mobile applications for plant identification for ecologists and citizen scientists using image recognition technology," August 9, 2012, Meeting of the Ecological Society of America in Portland, W. John Kress, Peter Belhumeur, David Jacobs (presented by John Kress).
21. "Leafsnap: Interactive tree species identification," August 13, 2012. Symposium on Technology and Innovative Environments for Science Education and Public Outreach, Center of Computer Network Information Center, Chinese Academy of Sciences, Beijing, China (Invited Talk, presented remotely).



22. "Leafsnap: Interactive tree species identification," October 22, 2012. 2012 ASA-CSSA-SSSA annual conference in Cincinnati, OH. (Invited Talk, presented remotely).
23. "Using Computer Vision for Species Identification", January 22, 2013. University of Nebraska, Lincoln, Big Ideas Seminar, Invited Talk.
24. "Part Detection and Species Identification," August 29, 2013, ICCV Area Chairs Workshop.
25. "Using Computer Vision for Species Identification," December 9, 2013, Keynote talk, IEEE International Conference on Image Information Processing, Shimla, India.
26. "Part Detection and Species Identification," February 24, 2014, Workshop on Recent Trends in Computer Vision.
27. "Part Detection and Species Identification," March 18, 2014, Microsoft Research Center, Cambridge, England.
28. "Understanding Plants and Animals," July 3, 2015, ETH Zurich, Zurich Switzerland.
29. "Understanding Plants and Animals," August 31, 2015, ETH Hornegger, Zurich Switzerland.
30. "Seeing What Isn't There," February 27, 2017, Area Chair Workshop, University of Maryland.
31. "Seeing What Isn't There," May 19, 2017, Army Research Lab.
32. Other invited seminars prior to 2002 at: Brown University, Carnegie-Mellon University, Cornell University, David Sarnoff Labs, the Hebrew University, KTH (Royal Institute of Technology, Sweden), MIT, McGill University, New York University, Princeton University, Rutgers University, Stanford University, SUNY Stonybrook, University of California at Berkeley, University of California at Santa Cruz, University of Illinois, University of Maryland, University of Massachusetts, University of Pennsylvania, University of Minnesota, University of Texas, the Weizmann Institute of Science, Yale University.

## **2.6 Patents**

1. David Jacobs. "Linear Fitting with Missing Data: Applications to Structure-from-Motion and to Characterizing Intensity Images", US Patent No. 6,009,437.
2. David Jacobs and Ronen Basri. "Lambertian Reflectance and Linear Subspaces", US Patent No. 6,853,745.

3. Karvel Thornber and David Jacobs. "Broadened-Specular Reflection and Linear Subspaces for Object Recognition", US Patent No. 7,058,217.
4. Karvel Thornber and David Jacobs. "Cast Shadows and Linear Subspaces for Object Recognition", US Patent No. 7,006,684.
5. Peter Belhumeur, David Jacobs, David Kriegman, Neeraj Kumar. "Method and System for Localizing Parts of an Object in an Image for Computer Vision Applications", US Patent No. 9,275,273.

## 2.7 Contracts and Grants

Before I joined the University of Maryland, my research at NECI was fully funded internally, by NEC. However, I am coauthor and unpaid collaborator in the following grants.

1. Ronen Basri and David Jacobs. "Object Recognition, Pose Estimation, and Indexing Using Region Correspondences", United States-Israel Binational Science Foundation Grant #94-00100, \$66,000, 1995-1998.
2. Bernard Chazelle, David Dobkin, Adam Finkelstein, Tom Funkhauser, and David Jacobs. "ITR/IM:3D Shape-Based Retrieval and Its Applications." National Science Foundation Award #IIS-0121446. \$500,000, 2001-2004.

Since joining the University of Maryland, I have participated in the following grants:

3. Ronen Basri, David Jacobs (co-PI), Eitan Sharon. "Extraction of Semantic Information from Images using Adaptive Multiscale Techniques," United States-Israel Binational Science Foundation Grant #2002-254, \$120,000. Jacobs received \$30,000, 2003-2007.
4. Peter Belhumeur, Steve Feiner, David Jacobs (co-PI), John Kress, Ravi Ramamoorthi. "An Electronic Field Guide: Plant Exploration and Discovery in the 21st Century," NSF Medium ITR #0325867. \$2,224,000. Jacobs received \$420,000. 2003-2008.
5. Rama Chellappa, David Jacobs (co-PI), "Face Recognition", Horvitz Foundation. \$250,000. Jacobs to receive \$125,000. 2004-2009.
6. James Reggia, Jose Contreras-Vidal, David Jacobs (co-PI), Wassem Naqvi, Malle Tagamets, Scott Weems, Chia-Hung Yang, "The Maryland Large-Scale Neurocognitive Architecture, DARPA, Jacobs received \$25,000. 2005-2006.
7. Amitabh Varshney, David Jacobs (co-PI), NSF #0541120 "Saliency-guided Graphics and Visualization," \$325,000. Jacobs to receive \$162,500. 2006-2009.

8. Larry Davis (PI), et al., (Jacobs, co-PI) “Integrated research on visual surveillance”, ARDA, \$1,200,000. Jacobs to receive funds for one graduate student and ½ month of summer support. 2006-2009.
9. Lise Getoor and David Jacobs (co-PI), “Statistical Relational Learning as an Enabling Technology for Data Acquisition and Data Fusion in Heterogeneous Sensor Network,” ARO \$50,000, 2007-2008.
10. David Jacobs (PI), “Face Recognition: When Lighting and Pose Vary,” Honda Research Initiation Grant, \$50,000, 2007-2008.
11. Rama Chellappa, et al. (Jacobs, co-PI), “Remote Multi-Modal Biometrics for the Maritime Domain”, MURI. \$4,500,000, 2008-2011.
12. David Jacobs (PI), “RI: Small: Robust Image Matching with Deformation and Lighting Variation”, NSF. \$324,884, 2009-2012.
13. Rama Chellappa, et al. (Jacobs, co-PI) “Robust Methods for Face Recognition in Unconstrained Environments, IARPA. \$1,335,667, 2010.
14. Jennifer Preece, et al. (Jacobs, co-PI) “SoCS: Biotracker – Melding Human and Machine Intelligence to Create Large-Scale Collaborative Systems”, NSF. \$749,873, 2010-2013.
15. David Jacobs (PI) and Peter Belhumeur (co-PI) “III:Small:Collaborative Research: A Hierarchy of Describable and Localizable Attributes for Identification, Search, and Image Exploration,” NSF. \$500,000. 2011-2014.
16. Ronen Basri and David Jacobs (co-PI) “Matching and Reconstruction Under Variable Lighting and Pose,” US-Israel Binational Science Foundation. \$79,868. 2011-2015.
17. Yael Wyner, Jennifer Doherty, David Jacobs (co-PI), Peter Belhumeur, W. John Kress “Unifying Life: Placing Urban Tree Diversity in an Evolutionary Context,” National Science Foundation, \$450,000, 2012-2015.
18. Larry Davis (PI) and David Jacobs. “Finder”, SAIC/IARPA. \$1,591,323, 2012-2013.
19. David Jacobs (PI) “Food Identification – Computer Vision Collaboration”, Vignet Corp., \$25,000, 2013.
20. Jon Froehlich (PI) and David Jacobs (co-PI), “HCC: Medium: Combining Crowdsourcing and Computer Vision for Street-level Accessibility”, NSF \$1,199,034, 2013-2017.

21. Rama Chellappa (PI), Larry Davis, David Jacobs, et al, "Sparse Heterogeneous Representations and Domain Adaptive Matching for Unconstrained Face Recognition", IARPA, \$3,813,858 (Phase I), 2014-2016.
22. David Jacobs (PI), "RI: Small: Bounded distortion models for articulated and deformable object recognition", NSF, \$435,618, 2016-2019.
23. David Jacobs (PI), Tom Goldstein, Ronen Basri, "Lifelong Episodic Memory," DARPA, \$750,000, 2018-2020.
24. David Jacobs (PI), Tom Goldstein, Soheil Feizi, "Robust Ensembles: Securing Classifiers through Diversity," DARPA, \$863,788, 2019 – 2021.
25. David Jacobs (PI), "RI: Small: Reconstructing Shape, Lighting, and Reflectance Properties of Indoor Scenes from Video," NSF, \$493,297, 2019-2022.
26. Yaser Yacoob (PI), David Jacobs (co-PI), et al. "Multi-media Analytics Leading to Intent and Semantic Evidence (MALISE)," DARPA, \$1,189,444, 2020-2024.
27. Tom Goldstein (PI), David Jacobs (co-PI), et al., "Repelling Evasion and Poisoning Attacks: A Principled Way Forward – Base Period," DARPA \$810,931, 2019-2020.

## **2.8 Fellowships, Prizes and Awards**

1. Graduated Magna Cum Laude, with Distinction in the Mathematics Major, from Yale College.
2. Awarded graduate fellowship from General Motors, 1986-87.
3. Received the Bergmann Memorial Research Grant award, receiving an additional award of \$5,000, for: "Object Recognition, Pose Estimation, and Indexing Using Region Correspondences", United States-Israel Binational Science Foundation Grant #94-00100, 1994.
4. Honorable mention, best paper award, IEEE Conf. on Computer Vision and Pattern Recognition, 2000. For paper: "In Search of Illumination Invariants," by Hansen Chen\*, Peter Belhumeur, and David Jacobs.
5. Co-author of paper awarded best student paper, UIST 2003. For paper: "Automatic Thumbnail Cropping and its Effectiveness," by Bongwon Suh\*, Haibin Ling\*, Ben Bederson, and David Jacobs.
6. Co-recipient of the Edward O. Wilson Biodiversity Technology Pioneer Award for development of Leafsnap, 2011.

7. Digiteo Chair, awarded from the government of France, to support sabbatical visit to Ecole Centrale and ENS-Cachan, 2016.
8. Best paper award, Eurographics, 2016.
9. Teaching Award, best professor, 2018.

## 2.9 Editorial Boards and Reviewing Activities for Learned Publications

1. Associate Editor, IEEE Transactions on Pattern Analysis and Machine Intelligence, 1999-2003.
2. Area Editor, Computer Vision and Image Understanding, 2013-.
3. Guest Co-Editor, IEEE Transactions on Pattern Analysis and Machine Intelligence, Special Issue on Perceptual Organization in Computer Vision, 2003.
4. Served as referee for journals in computer vision, human vision and artificial intelligence, including *IEEE Trans. on Pattern Analysis and Machine Intelligence (PAMI)*, *Int. Journal of Computer Vision (IJCV)*, *Vision Research*, *Perception*, *Comp. Vis.*, *Graphics and Image Processing (CVGIP)*, *Artificial Intelligence*, *IE Proc. on Vision, Image and Signal Processing*, *IE Electronics Letters*, *Image and Vision Computing*, the *Journal of Vision*, *ACM Transactions on Perception*, the *Journal of the Optical Society of America*, the *Journal of Math. Imaging and Vision*, and the *SIAM Journal on Scientific Computing*
5. and the conferences *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*, *IEEE Conf. on Robotics and Automation*, *IAPR Int. Conf. on Pattern Recognition (ICPR)*, *IEEE Workshop on Non-Rigid and Articulate Motion*, and *IEEE Workshop on Interpretation of 3D scenes*.

## 2.10 Research Software and Data Sets

1. Convex Grouping. This code finds convex groups of line segments in images. (<http://www.cs.umd.edu/~djacobs/>).
2. Linear Fitting with Missing Data. This code fills in missing entries of a low rank matrix, and includes methods for applying this to problems of structure from motion. (<http://www.cs.umd.edu/~djacobs/>).
3. Our team has produced the largest publicly available data set of images of leaves with their species identified, containing over 7,000 leaf images. (<http://herbarium.cs.columbia.edu/data.php>).

4. We have released the free iphone app, Leafsnap, which has more than 1,500,000 downloads. We have also released the free apps, Dogsnap (over 50,000 downloads) and Birdsnap (over 50,000 downloads).

### **3. Teaching and Advising**

#### **3.1 Courses Taught in the Last Five Years**

1. Fall, 2019, CMSC 4223, Machine Learning.
2. Fall, 2018, CMSC 828, Deep Learning.
3. Fall, 2017, CMSC 422, Machine Learning.
4. Spring, 2017, CMSC 426, Computer Vision.
5. Fall, 2016, CMSC 828, Deep Learning.
6. Spring, 2015, CMSC 427, Computer Graphics.
7. Fall, 2014, CMSC 733, Computer Processing of Pictorial Information.
8. Spring, 2014, CMSC 426, Image Processing.
9. Fall, 2013, CMSC 733, Computer Processing of Pictorial Information.
10. Spring, 2013, CMSC 828j, Subspaces and Manifolds for Computer Vision and Machine Learning.
11. Fall, 2012. CMSC 426, Image Processing.
12. Spring, 2012. CMSC 828b, Image Segmentation.
13. Fall, 2011. CMSC 131, Introduction to Object Oriented Programming.
14. Spring, 2011. CMSC 131, Introduction to Object Oriented Programming.
15. Fall, 2010. CMSC 828b, Recent Advances in Biometrics.
16. Spring, 2010. CMSC 426, Image Understanding.
17. Fall, 2009. CMSC 828, Image Segmentation.
18. Spring, 2009. CMSC 828, Approaches to Representing and Recognizing Objects (18 students).
19. Spring, 2008. CMSC 828, Visual and Auditory Scene Analysis. Co-taught with Prof. Moss' NACS 728X. (12 students).
20. Fall, 2007. CMSC 427, Computer Graphics. (15 students).
21. Spring, 2007. CMSC 427, Computer Graphics. (8 students)
22. Fall, 2006. CMSC 828, Image Segmentation. (7 students)
23. Spring, 2006. CMSC 828, Approaches to Representing and Recognizing Objects. (16 students)
24. Fall, 2005. CMSC 426, Image Processing. (9 students).
25. Spring, 2004. CMSC 427, Computer Graphics. (25 students)
26. Fall, 2004. CMSC 828, Image Segmentation. (19 students).
27. Spring, 2004. CMSC 426, Image Processing. (35 students).
28. Fall 2003. CMSC 828, Approaches to Representing and Recognizing Objects. (16 students)
29. Spring, 2003. CMSC 426, Image Processing. (43 students).

#### **3.2 Course and Curriculum Development**

1. Designed new curriculum, extensive new notes, projects and problem sets for CMSC 426 (Image Processing). Supporting class material has been used by other University of Maryland instructors, and faculty at other universities (eg., UC San Diego, Columbia University, Cal Tech). Latest material is at:  
[http://www.cs.umd.edu/~djacobs/CMSC426/CMSC426\\_05.htm](http://www.cs.umd.edu/~djacobs/CMSC426/CMSC426_05.htm).
2. Designed new, two-course sequence of graduate vision courses on Image Segmentation, and Visual Classification. Links to these courses at:  
<http://www.cs.umd.edu/~djacobs/>.
3. Designed new interdisciplinary graduate course with Prof. Cindy Moss on biological and computational approaches to visual and auditory scene analysis (Links at:  
<http://www.cs.umd.edu/~djacobs/>).
4. Volunteered to co-organize *How to do Research* course, 2005.
5. Designed new course, Recent Advances in Biometrics, 2010.
6. Designed new course, Subspaces and Manifolds for Computer Vision and Machine Learning, 2013.
7. Designed new course, Deep Learning, in 2016.

### **3.3 Advising: Other than Research Directions**

Approximately 3 graduate students per year.

### **3.4 Advising: Research Directions**

#### **3.4.1 Undergraduate**

- Brett Hutchinson, Spring 2003.
- In Joon Chu, 2003.
- David Tucker, Spring 2004-Fall 2004 (co-author in accepted journal publication).
- Matthew Roberts, Spring 2004.
- Daozheng Chen, Fall 2006, Spring 2007 (became graduate student, U. of MD College Park).
- Allie Hoch, 2009.
- Aditya Malik, 2011, 2013-2014.
- Jefferson Teng, 2011.
- Wasif Sikder, 2014.
- Andrea Bajcsy, 2014-2015.
- Aaron Chan, 2014-2015.
- Bowen Li, 2016.
- Daniel Lichy, 2017 (became graduate student, UMD).
- Inyeob Kim, 2020.
- Xiyi Chen, 2019-2020.

- Joshua Rung-Chuan Lo, 2019-2020.
- Samantha Levin, 2019-2020.

### **3.4.2 Master's**

- Gaurav Agarwal, graduated 2005.
- Sri Kankanhalli, graduated 2017.

### **3.4.3 Doctoral co-supervised (completed)**

- Tao Alter, MIT, 1998, (now at Intelligent Markets).
- Archi Rudra, New York University, 2001, (now at Lehman Brothers).

### **3.4.4 Doctoral**

- Haibin Ling (graduated, 2006), Postdoc, UCLA, first placement. Currently Prof. at SUNY Stonybrook.
- Sameer Sheorey (graduated, 2008), Research Assistant Professor, Toyota Technological Institute – Chicago, first placement.
- Carlos Castillo (graduated, 2012). Postdoc, SUNY Buffalo, first placement.
- Daozheng Chen (graduated, 2013). Yahoo!, first placement.
- Anne Jorstad (AMSC) (graduated 2012). Postdoc, EPFL, first placement.
- Joao Soares (graduated 2015). Yahoo!, First placement.
- Arijit Biswas (graduated 2013). Xerox research lab, Bangalore, India, first placement.
- Abhishek Sharma (graduated 2015). Apple, first placement.
- Angjoo Kanazawa (graduated 2017), Postdoc, UC Berkeley, first placement.
- Jin Sun (graduated 2018), Postdoc, Cornell Tech, first placement.
- Soumyadip Sengupta (graduated 2019), Postdoc, University of Washington, first placement.
- Hao Zhou (graduated 2019), Amazon, first placement.
- Abhay Kumar Yadav
- Ryen Krusinga
- Koutilya PNVR
- Daniel Lichy.
- Jiaye Wu
- Shlok Mishra

### **3.4.5 Postdoctoral co-supervised**

- Lance Williams, (1993-1996) now Professor, University of New Mexico.
- Zili Liu, (1993-1995) now Professor, UCLA.
- Sebastien Roy, (2001), now Professor, University of Montreal.
- Mike Langer, (1994-1996) now Professor, McGill University.



- Bosco Tjan, (1998-2000) now Professor, University of Southern California (USC).
- Olga Veksler, (2000-2002) now Professor, University of Waterloo.
- Rita Osadchy, (2001-2002) now Professor, Haifa University, Israel.
- Daniele Zavagno, (2001-2002) now faculty, Milano University, Italy.

### 3.4.6 High School

- Andrew Gibiansky, (Summer, 2010), student at Montgomery Blair High School.
- Judge for 2012 Siemens Science Competition for high school students.
- Calvin Dong, (Summer 2014), student at Montgomery Blair High School.

### 3.5 Advising: Ph.D. Committees

- Seokbin Kang, 2020.
- Ilya Kavelarov (ECE), 2020.
- Pallabi Ghosh, 2020.
- Moustafa Meshry (proposal), 2020.
- Rambhatla Saketh (ECE, proposal), 2020.
- Anirudh Nanduri (ECE, proposal), 2020.
- Chen Zhao (proposal), 2020.
- Ankan Bansal (ECE), 2020.
- Junbang Liang (proposal), 2020.
- Bor-Chun Chen, 2019.
- Mahyar Najibi, 2019.
- Mingfei Gao, 2019.
- Yogarshi Vyas, 2019.
- Zheng Xu, 2019.
- Hao Zhou, 2019.
- Soumyadip Sengupta (ECE), 2019.
- Steve Schwarcz, 2019.
- Rajeev Ranjan, 2019.
- Seokbin Kang, (proposal) 2018.
- Varun Manjanatha, 2018.
- Sudha Rao, 2018.
- Venkat Santhanam, 2018.
- Bharat Singh, 2018.
- Matthew Maurillo, 2018.
- Wei Chen, 2018.
- Hao Li, 2018.
- Soham De, 2018.
- Xintong Han, 2018.
- Jin Sun, 2018.

- Yogarshi Vyas, 2018.
- Emily Hand, 2018.
- Yaming Wang (ECE), 2018.
- Abhay Yadav (proposal), 2018.
- Sohil Shah, 2018.
- Joe Ng, 2018.
- Maya Kabkab, 2018.
- Mohammed Fathy, 2018.
- Hao Zhou (proposal), 2017.
- Xianzhi Du, 2017.
- Zheng Xu (proposal), 2017.
- Kookjin Lee, 2017.
- Angjoo Kanazawa, 2017.
- Soham De (proposal), 2017.
- Varun Manjanuth (proposal), 2017.
- Hao Li (proposal), 2017.
- Sudha Rao (proposal), 2017.
- Mahyar Najibi (proposal), 2017.
- Bharat Singh (proposal), 2017.
- Chau-Wai Wong (ECE), 2017.
- Soumyadip Sengupta (proposal, ECE), 2017.
- Mohammad Fathy (proposal), 2017.
- Jin Sun (proposal), 2017.
- Thomas Berg (Columbia University), 2017.
- Jiongxin Liu (Columbia University), 2017.
- Matthew Mauriello, (Proposal), 2016.
- Austin Myers, 2016.
- Uran Oh, 2016.
- Jun-Cheng Chen, 2016.
- Ching-Hui Chen (ECE), 2016.
- Oliver Rourke (AMSC), 2016.
- Kotaro Hara, 2016.
- Angjoo Kanazawa (proposal), 2015.
- Anne Bowser (Ischool), 2015.
- Jun-Cheng Chen, (proposal) 2015.
- Ching Lik Teo, 2015.
- Aleksandrs Ecin (proposal), 2015.
- Varun Nagaraja (proposal), 2015.
- Yurong He (proposal, Ischool), 2015.
- Victoria Taroudaki (AMSC), 2015.
- Rajiv Jain, 2015.
- Ejaz Ahmed, 2015.
- Jonghyun Choi, 2015.
- Kaustav Nandy, 2015.

- Yu Wei (NACS) 2015.
- Abhishek Sharma, 2015.
- Joao Soares, 2015.
- Fan Yang (preliminary exam), 2015.
- Austin Myers (preliminary exam), 2014.
- Sravanthi Bondugula (preliminary exam), 2014.
- Jie Ni (ECE), 2014.
- Uran Oh, (preliminary exam), 2014.
- Hyungtae Lee, (ECE), 2014.
- Sumit Shekhar, (ECE), 2014.
- Arijit Biswas, 2014.
- Ejaz Ahmed, (preliminary exam), 2014.
- Arpit Jain, (ECE), 2014.
- Yuwei Cui, (NACS, preliminary exam), 2013.
- Oliver Rourke, (AMSC, proposal), 2013.
- Jiarong Jiang, 2013.
- Ching Lik Teo (proposal), 2013.
- Fatemeh Mirrashid, 2013.
- Sima Taheri, 2013.
- Xiaodong Yu, 2013.
- Kaustav Nandy (proposal), 2013.
- Daozheng Chen, 2013.
- Dana Rotman, (Information School) 2013.
- Jiriang Jiang, (proposal) 2013
- Arijit Biswas, (proposal) 2013.
- Jayant Kumar (proposal), 2013.
- Abhishek Sharma (proposal), 2012.
- Wei-Hong Chuang, (ECE) 2012.
- Morimichi Nishigaki, 2012.
- Huimin Guo, 2012.
- Nitesh Shroff, 2012.
- Brianna Cash, (AMSC, proposal), 2012.
- Anne Jorstad, (AMSC) 2012.
- David Schug, (AMSC) 2012.
- John Tritschler, (Aerospace Engineering) 2012.
- Fatemeh Mirrashid, (proposal) 2012.
- Douglas Summers-Stay, (proposal) 2012.
- Thuan Huynh, 2012.
- Cheuk Liu Ip (proposal), 2012.
- Rajiv Jain, (MS), 2012.
- Ming-Yu Liu, (ECE), 2012.
- Carlos Castillo, 2012.
- Behjat Siddiquie, 2011.
- Wenjun Lu, 2011 (ECE).

- Elena Zheleva, 2011.
- Neeraj Kumar, 2011 (Columbia U.)
- Raghuraman Gopalan, 2011 (ECE).
- John Tritschler, 2011 (pre-proposal, Aerospace Engineering).
- Radu Dondera, 2011 (proposal).
- Bhargav Kanagal, 2011.
- Mudit Agrawal, 2011.
- Eunhui Park, 2011 (proposal).
- Nagilla Reddy, 2011 (ECE).
- Kaushik Mitra, 2011 (ECE).
- Daozheng Chen, 2011 (proposal).
- John Karvounis, 2011 (ECE).
- Samah Ramadan, 2011 (proposal).
- Ruonan Li, 2011 (ECE).
- Ryan Farrell, 2011.
- Vlad Morariu, 2010.
- Yi Li, 2010 (ECE).
- Kate McBryan, 2010, (proposal, Aerospace Engineering).
- Mohamed Abdelkader, 2010 (ECE)
- Mustafa Bilgic, 2010
- John Tritschler, 2010 (Proposal, Aerospace Engineering).
- Mahesh Ramachandran, 2010 (ECE).
- Elena Zheleva, 2010 (Proposal)
- David Schug, 2010 (Proposal, Applied Math)
- Aniruddha Kembhavi, 2010
- Konstantinos Bitsakos, 2010.
- Bhargav Kanagal, 2010, proposal.
- Jie Shao, 2009 (ECE).
- Soma Biswas, 2009 (ECE).
- Guangyu Zhu, 2009 (ECE).
- Xue Mei, 2009 (ECE).
- Ryan Farrell, 2009, proposal.
- Thuan Huynh, 2009, proposal.
- William Schwartz, 2009, proposal.
- Mudit Agarwal, 2009, proposal.
- Hao Wu, 2009 (ECE).
- Justin Domke, 2009.
- Prithviraj Sen, 2009.
- Mudit Agrawal, 2009.
- Prashant Athavale, 2009 (Applied Math).
- Hazem El-Alfy, 2009.
- Abhinav Gupta, 2009.
- Zhe Lin, 2009 (ECE).
- Morimichi Nishigaki, 2009, proposal.

- Hyoungjune Yi, 2008, proposal.
- Gaurav Aggarwal, 2008.
- Xing Tian, 2008.
- Minkyong Cho, proposal, 2008.
- Xu Liu, proposal, 2008.
- Guilherme Foseca, 2007.
- Justin Domke, 2007, proposal.
- Gutemberg Bezerra Guerra-Filho, 2007.
- Youngmin Kim, proposal, 2007.
- Feng Guo, 2007.
- Hui Ji, 2006.
- Yefeng Zheng, 2005.
- Yang Ran, 2006.
- Sernam Lim, 2006.
- Philip David, 2006.
- Ransom Winder, 2007.
- Kyungnam Kim, 2005.
- Bohyung Han, 2005.
- Chang Ha Lee, 2005.
- Changjiang Yang, 2005.
- Gustavo Rohde, 2005.
- Francisco Estrada (University of Toronto), 2005.
- Bongwon Suh, 2005.
- Abhijit Ogale, 2004.
- Reiner Schulz, 2004.
- Kevin Zhou (ECE), 2004.
- Vasudev Parameswaran, 2004.
- Motilal Agrawal, 2003.
- Eugene Borovikov, 2003
- Patrick Min (Princeton University), 2003.
- Prior to joining the University of Maryland,
  - Bernard Baldwin, New York University.
  - Ian Jermyn, New York University.
  - Hsing-Kuo Pao, New York University.
  - Par Fornland, KTH (Royal Institute of Technology, Sweden).
  - Danny Roobaert (Opponent), KTH (Royal Institute of Technology, Sweden).

### **3.6 Advising: Master's Committees**

- Vinay Shet, 2003.
- Ladan Najafizadeh, (MS), 2016.
- Srihar Kankanhalli (MS), 2017.
- Seyed Esmaeili (MS), 2017.

## **4 Service**

### **4.1 Professional**

#### **4.1.1 Unpaid reviewing activities for agencies**

1. Member, NSF Computer Vision Proposal Review Panel.
2. Member, NSF ITR Proposal Review Panel.
3. Member, DOE Project Review Committee, 2008.
4. Member, NSF Review Panel, 2010.
5. Member, NSF Computer Vision Proposal Review Panel, 2014.
6. Member, NSF Computer Vision Proposal Review Panel, 2017.
7. Member, NSF Computer Vision Proposal Review Panel, 2018.

#### **4.1.2 Other Non-University Panels and Positions**

1. Program co-Chair, IEEE Conference on Computer Vision and Pattern Recognition, 2010.
2. Area Chair, IEEE Conference on Computer Vision and Pattern Recognition, 2003, 2004, 2006, 2008, 2014, 2015, 2017, 2020.
3. Area Chair, European Conference on Computer Vision, 2012, 2018.
4. Area Chair, International Conference on Computer Vision, 2013.
5. Publications Chair, IEEE Conference on Computer Vision and Pattern Recognition, 2004.
8. Member, Program Review Committee, for the University of Illinois' Beckman Institute Human-Computer Intelligent Interaction Program, 2001 and 2005.
9. Co-chair, 3rd IEEE Workshop on Perceptual Organization, 2001.
10. Co-organized four NEC vision workshops.
11. Program Committee IEEE International Conference on Computer Vision, 1999, 2003, 2007, 2009.
12. Program Committee IEEE Conference on Computer Vision and Pattern Recognition, 1997, 98, 99, 2004, 05, 07, 09, 11, 12.
13. Program Committee, European Conference on Computer Vision, 2002, 04, 08, 10.

14. Program Committee IEEE Workshop on Perceptual Organization, 1998, 99, 2004, 2006, 2008, 2014.
15. Program Committee, Second International Symposium on 3D Data Processing, Visualization, and Transmission, 2004.
16. Program Committee IEEE Workshop on Applications of Computer Vision, 1998.
17. Program Committee International Conference on Pattern Recognition, 2004.
18. Reviewer, NIPS 2000, '01.
19. Reviewer, SIGGRAPH 2008.
20. Program Committee, IEEE Workshop on Component Analysis, 2007.
21. Program Committee, IEEE International Workshop on Analysis and Modeling of Faces and Gestures (AMFG), 2005, 2007, 2013.
22. Program Committee, IEEE Workshop on Photometric Analysis for Computer Vision, 2007.
23. Program Committee, 3<sup>rd</sup> International Symposium on Visual Computing, 2007.
24. Program Committee, International Conference on Energy Minimization Methods in Computer Vision and Pattern Recognition, 2009, 2011, 2013, 2015.
25. Program Committee, Workshop on Non-Rigid Shape Analysis and Deformable Image Alignment, 2009, 2014.
26. Program Committee, IEEE Color and Photometry in Computer Vision Workshop, 2011, 2014.
27. Program Committee, Deep Learning Workshop, NIPS, 2014.
28. Program Committee, Workshop on Intelligent Vehicle with Vision Technology, ACCV 2014.

#### **4.2 Departmental Service**

(For appointments that span a full academic year, I have list the year in which the appointment begins).

- Committee to examine department service courses, 2003.
- Committee on women and minority participation, 2003.
- Teaching evaluation committee, 2003, 2004, 2005, 2009, 2010, 2011.

- Committee to examine graduate student requirements, 2006.
- CS graduate school admissions committee, 2006, 2007, 2008, 2010, 2011, 2012, 2016.
- Bioinformatics faculty search committee, 2007.
- Co-organizer, weekly vision seminar series, 2002-2009.
- Graduate Student Review Committee, 2007, 2008, 2013, 2017, 2018.
- Faculty Lunch Committee, 2009.
- Department Council, 2012, 2014, 2016.
- Academic Integrity Committee, 2011-2012, 2014, 2016.
- Undergraduate Awards and Scholarship Committee, 2012.
- Visual and Geometric Computing Field Committee Chair, 2013 (spring), 2017-18.
- Chair, APT committee, Ben Bederson, Hal Daume (2012), Evan Golub (2013).
- Learning outcomes assessment committee, 2012, 2013.
- Chair, subcommittee on Research Directions, for Committee on Strategic Planning (2014-15).
- Faculty Search Committee (2016-17).
- Associate Chair for Graduate Admissions, 2017-2019.

#### **4.3 Other University Service**

- UMIACS newsletter committee, 2005.
- UMIACS Steering Committee, 2005.
- UMIACS APT committee, 2003, 2006, 2011, 2017.
- Presentations at Maryland Day, 2005, 2007.
- Associate Director, Program in Neuroscience and Cognitive Science (NACS), 2007-2010.
- Executive Committee, Program in Neuroscience and Cognitive Science (NACS), 2007-2012, 2013-2015.
- NACS graduate program admissions committee, 2005, 2006, 2007, 2008, 2009.
- NACS faculty search committee, 2007.
- NACS self-study committee for external review, 2013.
- CMPS committee to judge the Dorfman prize for undergraduate research, 2008.
- University APT committee, 2013, 2014.
- UMIACS committee for external review, 2015.
- Interim Director, University of Maryland Center for Machine Learning, 2019-present.
- CS lead in development of Professional Masters program in Machine Learning.
- Member of committee formed by Provost on CS, 2019.