

Robert Pless

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Education

December 2000	Ph.D. Computer Science	University of Maryland
May 1994	B.S. Computer Science	Cornell University

Appointments

01/17 – present	Patrick and Donna Martin Endowed Professor & Department Chair, Department of Computer Science, George Washington University
01/12 – 12/16	Professor, Department of Computer Science, Washington University
04/06 – 12/11	Associate Professor, Department of Computer Science, Washington University
9/00 – 04/06	Assistant Professor, Department of Computer Science, Washington University

Department and University Positions

12/17 – present	Department Chair, Computer Science
7/11 – 12/16	Director of Doctoral Program, Computer Science and Engineering
9/02 – 9/12	Director, Graduate Admissions, Computer Science and Engineering
2/02 – 2/08	Assistant Director, Center for Security Technology, Washington University

Research Activities, Patents and Publications

My research focus is Visual Computing with applications to perception, robotics, environmental measurement and social justice. I am particularly interested in data-driven and geometric techniques to more robustly understand images taken in real application environments. My current research seeks answers to questions in three areas:

- Next generation imaging systems: How can we design new cameras and new materials to make it easier to see, manipulate and understand the objects around us?
- Understand visual change at scales from the sidewalk to the planet: What can we learn from the trillions of images of the planet taken by drones, webcams, satellites and smartphones?
- Democratizing Visual Analytics and Applications to Societal Computing: How can we make visual reasoning more available to help more people solve more problems?

Patents

“Method for detecting optical defects in transparencies”, US 8,358,830 January 22, 2013, Issued to: Ronald L Bookout, Michael P Gleason, Matthew M Thomas, Michael S Dixon, Robert Pless, William Smart

“Evaluation of optical distortion in a transparency”, US 7,899,235, March 1, 2011, Issued to: Philip L Freeman, Michael P Gleason, Matthew M Thomas, Michael S Dixon, Robert Pless, William Smart

Journal Publications

- [1] J Aaron Hipp, Alicia Manteiga, Amanda Burgess, Abby Stylianou, and Robert Pless. Webcams, crowdsourcing, and enhanced crosswalks: developing a novel method to analyze active transportation. *Frontiers in public health*, 4, 2016.
- [2] Kelsey L Tinkum, Kristina M Stemler, Lynn S White, Andrew J Loza, Sabrina Jeter-Jones, Basia M Michalski, Catherine Kuzmicki, Robert Pless, Thaddeus S Stappenbeck, David Piwnica-Worms, et al. Fasting protects mice from lethal dna damage by promoting small intestinal epithelial stem cell survival. *Proceedings of the National Academy of Sciences*, 112(51):E7148–E7154, 2015.
- [3] Zachary V Freudenburg, Charles M Gaona, Mohit Sharma, David T Bundy, Jonathan D Breshears, Robert B Pless, and Eric C Leuthardt. Fast-scale network dynamics in human cortex have specific spectral covariance patterns. *Proceedings of the National Academy of Sciences*, 111(12):4602–4607, 2014.

- [4] John J Boyle, Maiko Kume, Matthew A Wyczalkowski, Larry A Taber, Robert B Pless, Younan Xia, Guy M Genin, and Stavros Thomopoulos. Simple and accurate methods for quantifying deformation, disruption, and development in biological tissues. *Journal of The Royal Society Interface*, 11(100):20140685, 2014.
- [5] Austin Abrams and Robert Pless. Web-accessible geographic integration and calibration of webcams. *ACM Trans. Multimedia Comput. Commun. Appl.*, 9(1):8:1–8:20, February 2013.
- [6] Nathan Jacobs, Austin Abrams, and Robert Pless. Two cloud-based cues for estimating scene structure and camera calibration. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, pages 2526–2538, 2013.
- [7] K Stark, A Eckart, S Haidari, A Tirniceriu, M Lorenz, M-L von Bruehl, F Gaertner, AG Khandoga, KR Legate, R Pless, et al. Ng2 (+) pericytes support interstitial migration and effector function of myeloid leukocytes during sterile inflammation. In *European Journal Of Clinical Investigation*, volume 43, pages 3–3, 2013.
- [8] J Aaron Hipp, Deepti Adlakha, Amy A Eyler, Bill Chang, and Robert Pless. Emerging technologies: webcams and crowd-sourcing to identify active transportation. *American Journal of Preventive Medicine*, 44(1):96–97, Jan 2013.
- [9] K. Stark, A. Eckart, S. Haidari, A. Tirniceriu, M. Lorenz, M.L. von Brühl, F. Gärtner, A.G. Khandoga, K.R. Legate, R. Pless, Ingrid Hepper, Kirsten Lauber, Barbara Walzog, and Steffen Massberg. Capillary and arteriolar pericytes attract innate leukocytes exiting through venules and ‘instruct’ them with pattern-recognition and motility programs. *Nature Immunology*, 14(1):41–51, 2013.
- [10] J. Hipp, R. Pless, D. Adlakha, B. Chang, and A. Eyler. Can publicly available webcams and mechanical turks be used to evaluate physical activity policy and built environment change? *Journal of Science and Medicine in Sport*, 15:S33, 2012.
- [11] Teresa M. Abney, Yuan Feng, Robert Pless, Ruth J. Okamoto, Guy M. Genin, and Philip V. Bayly. Principal component analysis of dynamic relative displacement fields estimated from MR images. *PLoS ONE*, 6(7):e22063, July 2011.
- [12] P.V. Bayly, B.L. Lewis, E.C. Ranz, R.J. Okamoto, R.B. Pless, and S.K. Dutcher. Propulsive forces on the flagellum during locomotion of *chlamydomonas reinhardtii*. *Biophysical Journal*, 100(11):2716 – 2725, 2011.
- [13] Michael Dixon, Robert Glaubius, Philip Freeman, Robert Pless, Michael P. Gleason, Matthew M. Thomas, and William D. Smart. Measuring optical distortion in aircraft transparencies: a fully automated system for quantitative evaluation. *Machine Vision and Applications*, 22(5):1–14, 2011.
- [14] Y. Feng, T. M. Abney, R. J. Okamoto, R. B. Pless, G. M. Genin, and P. V. Bayly. Relative brain displacement and deformation during constrained mild frontal head impact. *Journal of The Royal Society Interface*, 7(6):1677–1688, 2010.
- [15] Daniel Kreisel, Ruben G. Nava, Wenjun Li, Bernd H. Zinselmeyer, Baomei Wang, Jiaming Lai, Robert Pless, Andrew E. Gelman, Alexander S. Krupnick, and Mark J. Miller. In vivo two-photon imaging reveals monocyte-dependent neutrophil extravasation during pulmonary inflammation. *Proceedings of the National Academy of Sciences*, 107(42):18073–18078, 2010.
- [16] Guoliang Xing, Xiangmao Chang, Chenyang Lu, Jianping Wang, Robert Pless, and Joseph A O’Sullivan. Efficient coverage maintenance based on probabilistic distributed detection. *IEEE Transactions on Mobile Computing*, 9(9):1346–1360, 2010.
- [17] Philip V Bayly, B. L. Lewis, P. S. Kemp, Robert Pless, and S. K. Dutcher. Efficient spatiotemporal analysis of the flagellar waveform of *chlamydomonas reinhardtii*. *Cytoskeleton*, 67(1):56–69, 2010.
- [18] Robert Pless and Richard Souvenir. A survey of manifold learning for images. *IPSN Transactions on Computer Vision and Applications*, 1:83–94, 2009.
- [19] Nathan Jacobs and Robert Pless. Time scales in video surveillance. *IEEE Transactions on Circuits and Systems for Video Technology*, 18(8):1106–1113, August 2008.
- [20] Richard Souvenir and Robert Pless. Image distance functions for manifold learning. *Image and Vision Computing*, 25(3):365–373, 2007.
- [21] Guoliang Xing, Chenyang Lu, Ying Zhang, Qingfeng Huang, and Robert Pless. Minimum power configuration for wireless communication in sensor networks. *ACM Transactions on Sensor Networks*, 3(2):11, 2007.
- [22] Guoliang Xing, Chenyang Lu, Robert Pless, and Qingfeng Huang. Impact of sensing coverage on greedy geographic routing algorithms. *IEEE Transactions on Parallel and Distributed Systems, Special Issue on Localized Communication and Topology Protocols for Ad Hoc Networks*, 17(4):348–360, 2006.
- [23] Robert Pless. Detecting roads in stabilized video with the spatio-temporal structure tensor. *Geoinformatica*, 10(1):39–56, 2006.

- [24] Guoliang Xing, Xiaorui Wang, Yuanfang Zhang, Chenyang Lu, Robert Pless, and Christopher Gill. Integrated coverage and connectivity configuration for energy conservation in sensor networks. *ACM Transactions on Sensor Networks*, 1(1):36–72, 2005.
- [25] Robert Pless. Spatio-temporal background models for outdoor surveillance. *Journal on Applied Signal Processing*, 14:2281–2291, 2005.
- [26] Robert Pless. Camera cluster in motion: Motion estimation for generalized camera designs. *IEEE Robotics and Automation Magazine*, 11(4):39–44, 2004.
- [27] Samir Khuller, Randeep Bhatia, and Robert Pless. On local search and placement of meters in networks. *SIAM Journal on Computing*, 32(2):470–487, 2003.
- [28] Robert Pless, Tomas Brodsky, and Yiannis Aloimonos. Detecting independent motion: The statistics of temporal continuity. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 22(8):68–73, 2000.
- [29] Randeep Bhatia, Samir Khuller, Yoram Sussman, and Robert Pless. The full degree spanning tree problem. *Networks*, 36(4):203–209, 2000.
- [30] Samir Khuller, Robert Pless, and Yoram Sussman. Fault tolerant k-center problems. *Theoretical Computer Science*, 242:237–245, 2000.
- [31] Cornelia Fermuller and Robert Pless. The ouchi illusion as an artifact of biased flow estimation. *Vision Research*, 40(1):77–95, 2000.
- [32] Cornelia Fermuller, Robert Pless, and Yiannis Aloimonos. Families of stationary patterns producing illusory movement: Insights into the visual system. *Proc. Royal Society, London B*, 264:795–806, 1997.
- [33] Ward L Johnson, Stephen J Norton, Felix Bendec, and Robert Pless. Ultrasonic spectroscopy of metallic spheres using electromagnetic-acoustic transduction. *Journal of the Acoustical Society of America*, 91(5):2637–2642, 1992.

Volumes as Editor

- [1] Robert Pless, James Davis, and Stefano Soatto, editors. *Proc. IEEE Workshop on Motion and Video Computing*, Snowbird, Utah, 2009. IEEE Computer Society.
- [2] Robert Pless, Jose Santos-Victor, and Yasushi Yagi, editors. *Proc. IEEE Workshop on Omnidirectional Vision and Camera Networks*, Madison Wisconsin, 2003. IEEE Computer Society.

Book Chapters

- [1] Bernd H Zinselmeyer, John Dempster, David L Wokosin, Jonathan Cannon, Robert Pless, Ian Parker, and Mark J Miller. Two-photon microscopy and multidimensional analysis of cell dynamics. *Methods in Enzymology*, 461:349–378, 2009.
- [2] Robert Pless. Imaging through time: The advantages of sitting still. In Kostas Daniilidis, Reinhard Klette, and Alex Leonardis, editors, *Imaging Beyond the Pinhole Camera*, pages 345–363. Kluwer, 2006.

Premier Conference Publications

- [1] Ian Schillebeeckx and Robert Pless. Pose hashing with microlens arrays. In *European Conference on Computer Vision*, pages 600–614. Springer International Publishing, 2016.
- [2] Ian Schillebeeckx and Robert Pless. Single image camera calibration with lenticular arrays for augmented reality. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2016.
- [3] Calvin Murdock, Nathan Jacobs, and Robert Pless. Building dynamic cloud maps from the ground up. In *Proc. International Conference on Computer Vision (ICCV)*, 2015.
- [4] Ian Schillebeeckx and Robert Pless. Structured light field design for correspondence free rotation estimation. In *Proc. International Conference on Computational Photography (ICCP)*, 2015.
- [5] Abby Stylianou, Austin Abrams, and Robert Pless. Characterizing feature matching performance over long time periods. In *IEEE Winter Conference on Computer Vision*, pages 892–898, 2015.
- [6] J. Aaron Hipp, Alicia Manteiga, Amanda Burgess, Abby Stylianou, and Robert Pless. Cameras and crowds in transportation tracking. In *International Conference on Wireless, Connected and Mobile Health Research*, 2015.

- [7] Ian Schillebeeckx, Joshua Little, and Robert Pless. The geometry of colorful, lenticular fiducial markers. In *Proc. IEEE International Conference on 3D Vision (3DV)*, 2015.
- [8] Austin Abrams, Ian Schillebeeckx, and Robert Pless. Structure from shadow motion. In *International Conference on Computational Photography (ICCP)*, May 2014.
- [9] Austin Abrams, Kyliia Miskell, and Robert Pless. The episolar constraint: Monocular shape from shadow correspondence. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2013.
- [10] Abby Stylianou, Austin Abrams, and Robert Pless. Finding jane doe: A forensic application of 2d image calibration. In *International Conference on Imagery in Crime Detection and Prevention*, 2013.
- [11] Austin Abrams, Christopher Hawley, and Robert Pless. Heliometric stereo: Shape from sun position. In *Proc. European Conference on Computer Vision (ECCV)*, 2012.
- [12] Michael Dixon, Austin Abrams, Nathan Jacobs, and Robert Pless. On analyzing video with very small motions. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2011.
- [13] Austin Abrams and Robert Pless. Webcams in context: Web interfaces to create live 3d environments. In *Proc. ACM SIGMM International Conference on Multimedia (ACMMM)*, pages 331–340, Jun 2010.
- [14] Nathan Jacobs, Brian Bies, and Robert Pless. Using cloud shadows to infer scene structure and camera calibration. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 1102–1109, Jun 2010.
- [15] Nathan Jacobs, Stephen Schuh, and Robert Pless. Compressive sensing and differential image motion estimation. In *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, pages 718–721, March 2010.
- [16] Michael Dixon, Nathan Jacobs, and Robert Pless. An efficient system for vehicle tracking in multi-camera networks. In *ACM/IEEE International Conference on Distributed Smart Cameras (ICDSC)*, pages 1–8, September 2009.
- [17] Nathan Jacobs, Walker Burgin, Nick Fridrich, Austin Abrams, Kyliia Miskell, Bobby H. Braswell, Andrew D. Richardson, and Robert Pless. The global network of outdoor webcams: Properties and applications. In *ACM International Conference on Advances in Geographic Information Systems (SIGSPATIAL GIS)*, pages 111–120, November 2009.
- [18] Manfred Georg, Richard Souvenir, Andrew Hope, and Robert Pless. Simultaneous data volume reconstruction and pose estimation from slice samples. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 1–6, 2008.
- [19] Nathan Jacobs, Nathaniel Roman, and Robert Pless. Consistent temporal variations in many outdoor scenes. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 1–6, June 2007.
- [20] Nathan Jacobs, Scott Satkin, Nathaniel Roman, Richard Speyer, and Robert Pless. Geolocating static cameras. In *Proc. International Conference on Computer Vision (ICCV)*, pages 1–6, Rio De Janiero, Brazil, October 2007.
- [21] Andrew Hope, Manfred Georg, Jonathan Cannon, J Hubenschmidt, Wei Lu, Dan Low, and Robert Pless. Applications of manifold learning techniques in 4d-ct reconstruction. In *International Conference on the Use of Computers in Radiation Therapy (ICCR)*, pages 1–5, June 2007.
- [22] Qilong Zhang, Richard Souvenir, and Robert Pless. On manifold structure of cardiac MRI data: Application to segmentation. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 1092–1098, 2006.
- [23] Richard Souvenir, Qilong Zhang, and Robert Pless. Image manifold interpolation using free-form deformations. In *Proc. International Conference on Image Processing (ICIP)*, pages 1437–1440, 2006.
- [24] Richard Souvenir and Robert Pless. Manifold clustering. In *Proc. International Conference on Computer Vision (ICCV)*, pages 648–653, 2005.
- [25] Guoliang Xing, Chenyang Lu, Ying Zhang, Qingfeng Huang, and Robert Pless. Minimum power configuration in wireless sensor networks. In *ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc)*, pages 390–401, Urbana-Champaign, IL, 2005.
- [26] Robert Pless and David Jurgens. Road extraction from motion cues in aerial video. In *Proceedings of the ACM Conference on Geographic Information Systems*, pages 31–38, 2004.
- [27] Guoliang Xing, Chenyang Lu, Robert Pless, and Qingfeng Huang. On greedy geographic routing algorithms in sensing-covered networks. In *ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc)*, pages 31–42. ACM Press, 2004.
- [28] Qilong Zhang and Robert Pless. Extrinsic calibration of a camera and laser range finder. In *Proc. IEEE International Conference on Intelligent Robots and Systems (IROS)*, pages 2301–2306, 2004.

- [29] Qilong Zhang and Robert Pless. Fusing video and sparse depth data in structure from motion. In *Proceedings of the IEEE International Conference on Image Processing (ICIP)*, pages 3403–3406, 2004.
- [30] Guoliang Xing, Chenyang Lu, Robert Pless, and Joseph A. O’Sullivan. Co-grid: An efficient coverage maintenance protocol for distributed sensor networks. In *Proceedings of the International Symposium on Information Processing in Sensor Networks (IPSN)*, pages 414–423. ACM Press, 2004.
- [31] Xiaorui Wang, Guoliang Xing, Yuanfang Zhang, Chenyang Lu, Robert Pless, and Christopher Gill. Integrated coverage and connectivity configuration in wireless sensor networks. In *Proceedings of the International Conference on Embedded Networked Sensor Systems (Sensys)*, pages 28–39. ACM Press, 2003.
- [32] Robert Pless. Using many cameras as one. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages II: 587–593, 2003.
- [33] Robert Pless. Using isomap to explore video sequences. In *Proc. International Conference on Computer Vision (ICCV)*, pages 1433–1440, 2003.
- [34] Robert Pless, John Larson, Scott Siebers, and Ben Westover. Evaluation of local models of dynamic backgrounds. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 73–78, 2003.
- [35] Patrick Baker, Cornelia Fermuller, Yiannis Aloimonos, and Robert Pless. A spherical eye from multiple camera (makes better models of the world). In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 576–583, 2001.
- [36] Cornelia Fermuller and Robert Pless. Statistical biases in optic flow. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 1561–1566, 1999.
- [37] Robert Pless, Tomas Brodsky, and Yiannis Aloimonos. Independent motion: The importance of history. In *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 2092–2097, 1999.

Other Refereed Conference and Workshop Publications

- [1] Abigail Stylianou and Robert Pless. Sparklegeometry: Glitter imaging for 3d point tracking. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops*, pages 10–17, 2016.
- [2] Ian Schillebeeckx and Robert Pless. Using chromo-coded light fields for virtual reality. In *IEEE Virtual Reality (poster)*, 2016.
- [3] Abby Stylianou, Abigail Norling-Ruggles, Richard Souvenir, and Robert Pless. Indexing open imagery to create tools to fight sex trafficking. In *Applied Imagery Pattern Recognition Workshop (AIPR)*, 2015.
- [4] Abby Stylianou, Joseph O’Sullivan, and Robert Pless. Images don’t forget: Online photogrammetry to find lost graves. In *Applied Imagery Pattern Recognition Workshop (AIPR)*, 2014.
- [5] Joseph O’Sullivan, Abby Stylianou, and Robert Pless. Democratizing the visualization of 500 million webcam images. In *Applied Imagery Pattern Recognition Workshop (AIPR)*, 2014.
- [6] Ruth West, Abby Halley, Daniel Gordon, Jarlath O’Neil-Dunne, and Robert Pless. Collaborative rephotography. In *ACM SIGGRAPH 2013 Studio Talks*, page 20. ACM, 2013.
- [7] Ruth West, Abby Halley, Jarlath O Neil-Dunne, Daniel Gordon, and Robert Pless. Collaborative imaging of urban forest dynamics: augmenting re-photography to visualize changes over time. In *IS&T/SPIE Electronic Imaging*, pages 86490L–86490L. International Society for Optics and Photonics, 2013.
- [8] Austin Abrams, Chris Hawley, Kyla Miskell, Adina Stoica, Nathan Jacobs, and Robert Pless. Shadow estimation method for” the episolar constraint: Monocular shape from shadow correspondence”. *arXiv preprint arXiv:1304.4112*, 2013.
- [9] Austin Abrams, Jim Tucek, Nathan Jacobs, and Robert Pless. Lost: Longterm observation of scenes (with tracks). In *Workshop on Applications of Computer Vision (WACV)*, 2012.
- [10] Joshua Little, Austin Abrams, and Robert Pless. Tools for richer crowd source image annotations. In *Workshop on Applications of Computer Vision (WACV)*, 2012.
- [11] Nathan Jacobs, Kyla Miskell, and Robert Pless. Webcam geo-localization using aggregate light levels. In *Proc. IEEE Workshop on Applications of Computer Vision*, pages 132–138, 2011.
- [12] Austin Abrams, Emily Feder, and Robert Pless. Exploratory analysis of time-lapse imagery with fast subset pca. In *Proc. IEEE Workshop on Applications of Computer Vision*, pages 336–343, 2011.

- [13] Nathan Jacobs, Walker Burgin, Richard Speyer, David Ross, and Robert Pless. Adventures in archiving and using three years of webcam images. In *IEEE CVPR Workshop on Internet Vision*, pages 39–46, June 2009.
- [14] Nathan Jacobs, Michael Dixon, Scott Satkin, and Robert Pless. Efficient tracking of many objects in structured environments. In *IEEE ICCV Workshop on Visual Surveillance*, pages 1–8, October 2009.
- [15] Nathan Jacobs and Robert Pless. Calibrating and using the global network of outdoor webcams (Winner Phd Forum Prize). In *ACM/IEEE International Conference on Distributed Smart Cameras (ICDSC)*, September 2009.
- [16] Robert Pless, Nathan Jacobs, Michael Dixon, Ralph Hartley, Patrick Baker, Derek Brock, Nick Cassimatis, and Dennis Perzanowski. Persistence and tracking: Putting vehicles and trajectories in context. In *Applied Imagery Pattern Recognition Workshop (AIPR)*, pages 1–8, 2009.
- [17] Nathan Jacobs, Richard Souvenir, and Robert Pless. The global webcam imaging network. In *Applied Imagery Pattern Recognition Workshop (AIPR)*, pages 1–8, 2009.
- [18] Manfred Georg, Richard Souvenir, Andrew Hope, and Robert Pless. Manifold learning for 4d ct reconstruction of the lung. In *Mathematical Methods in Biomedical Image Analysis*, pages 1–8, 2008.
- [19] Nathan Jacobs, Michael Dixon, and Robert Pless. Location-specific transition distributions for tracking. In *Proc. IEEE Workshop on Applications of Computer Vision*, pages 1–8, 2008.
- [20] Nathan Jacobs, Nathaniel Roman, and Robert Pless. Toward fully automatic geo-location and geo-orientation of static outdoor cameras. In *Proc. IEEE Workshop on Video/Image Sensor Networks*, pages 1–6, 2008.
- [21] Nathaniel Roman and Robert Pless. A system for rapid interactive training of object detectors. In *Proc. International Symposium on Visual Computing*, volume 5359 of *Lecture Notes in Computer Science*, pages 123–132, 2008.
- [22] Nathan Jacobs and Robert Pless. Shape background modeling: The shape of things that came. In *Proceedings of the IEEE Workshop on Motion and Video Computing*, pages 27–32, 2007.
- [23] Qilong Zhang and Robert Pless. Segmenting multiple familiar objects under mutual occlusion. In *Proc. International Conference on Image Processing (ICIP)*, pages 197–200, 2006.
- [24] Michael Dixon, Nathan Jacobs, and Robert Pless. Finding minimal parameterizations of cylindrical image manifolds. In *CVPRW '06: Proceedings of the 2006 Conference on Computer Vision and Pattern Recognition Workshop on Perceptual Organization in Computer Vision (POCV)*, pages 192–197, Washington, DC, USA, 2006. IEEE Computer Society.
- [25] Nathan Jacobs and Robert Pless. Real-time constant memory visual summaries for surveillance. In *VSSN '06: Proceedings of the 4th ACM international workshop on Video surveillance and sensor networks*, pages 155–160, New York, NY, USA, 2006. ACM Press.
- [26] Qilong Zhang and Robert Pless. Segmenting cardiopulmonary images using manifold learning with level sets. In *IEEE Workshop on Computer Vision for Biomedical Image Applications (LNCS 3765)*, pages 479–488, 2005.
- [27] Qilong Zhang, Richard Souvenir, and Robert Pless. Segmentation informed by manifold learning. In *International Workshop on Energy Minimization Methods in Computer Vision and Pattern Recognition EMMCVPR (LNCS 3757)*, pages 398–413, 2005.
- [28] Richard Souvenir, John Wright, and Robert Pless. Spatio-temporal detection and isolation: Results on the pets2005 datasets. In *Proceedings of the IEEE Workshop on Performance Evaluation in Tracking and Surveillance*, pages 62–69, 2005.
- [29] Richard Souvenir and Robert Pless. Isomap and non-parametric models of image deformation. In *Proceedings of the IEEE Workshop on Motion and Video Computing*, pages 195–200, 2005.
- [30] John Wright and Robert Pless. Analysis of persistent motion patterns using the 3d structure tensor. In *Proceedings of the IEEE Workshop on Motion and Video Computing*, pages 14–19, 2005.
- [31] Robert Pless. Differential structure in non-linear image embedding functions. In *Proceedings of the IEEE Workshop on Articulated and non-rigid Motion*, pages 10–17, 2004.
- [32] Qilong Zhang and Robert Pless. Constraints for heterogeneous sensor auto-calibration. In *IEEE Workshop on Realtime 3D Sensors and Their Use*, pages 38–43, 2004.
- [33] John Larson and Robert Pless. Bayesian stereo: 3d vision designed for sensor fusion. In *SPIE: Intelligent Robots and Computer Vision XXII: Algorithms, Techniques, and Active Vision*, volume 5608, pages 198–206, 2004.
- [34] Lei Wang, Cindy Grimm, and Robert Pless. A 3d pattern for pose estimation for object capture. In *Vision Interface*, pages 395–401, 2003.

- [35] Mark Schroering, Cindy Grimm, and Robert Pless. A new input device for 3d sketching. In *Vision Interface*, pages 311–318, 2003.
- [36] Robert Pless and Ian Simon. Embedding images in non-flat spaces. In *Conference on Imaging Science Systems and Technology*, pages 182–188, 2002.
- [37] Robert Pless. Two view discrete and differential constraints for generalized imaging systems. In *Proc. of the IEEE Workshop on Omnidirectional Vision*, pages 53–59, 2002.
- [38] Robert Pless and Ian Simon. Using thousands of images of an object. In *Proceedings of the 6th Joint Conference on Information Science, (CVPRIP)*, pages 684–687, 2002.
- [39] Robert Pless, Scott Siebers, and Ben Westover. Better background models for visual surveillance. In *Optical Society of America: Optical Sensing for Homeland Security*, 2003.
- [40] Robert Pless and Cornelia Fermuller. Explaining the ouchi illusion. In *Optical Society of America*, 1999.
- [41] Patrick Baker, Robert Pless, Cornelia Fermuller, and Yiannis Aloimonos. Camera networks for building shape models from video. In *Workshop on 3D Structure from Multiple Images of Large-scale Environments (SMILE)*, 2000.
- [42] Patrick Baker, Robert Pless, Cornelia Fermuller, and Yiannis Aloimonos. New eyes for shape and motion estimation. In *BMVC '00: Proceedings of the First IEEE International Workshop on Biologically Motivated Computer Vision*, pages 118–128. Springer-Verlag, 2000.

Research Funding

Active Funding

Agency	Funding	Title and Details
NSF	\$135,563	“A Field-Based High Throughput Phenotyping Platform for Plant Genetics”, Wash U. PI, collaborative project led by Jesse Poland (Kansas State University) with overall budget \$890,000. 02/16 - 01/18
DOE	\$902,010	“High Throughput Phenotyping System for Energy Sorghum”, Wash U. PI, project led by Danforth Plant Science Center with overall budget \$8,000,000. 9/2015 – 8/2019
Exchange Initiative	\$67,000	“CrowdSourcing Tools to Fight Sex Trafficking”, PI, \$67,000. 11/2015 – 10/2016
Wash. U	\$48,010	“Quantifying Diverse Ecosystem to Assess Agricultural Responses to Climate Change”, PI, collaborative project with Scott Mangan, Wash. U biology and Steven Blake, Max-Planck Institute. 8/2015 – 8/2016
NSF	\$396,274	“The Missouri Transect: Climate, plants and community”, Collaborative project with Univ. Missouri, Missouri University of Science and Technology, SLU, UMSL. Overall project budget \$25,000,000. 8/2014 – 7/2019
Object Video	\$307,236	“Algorithms for geo-locating with found imagery”, Wash U PI. Collaborative project with many university and several corporate partners. 3/2012 – 9/2016.
NSF	\$247,358	“Collaborative research: Continental-scale monitoring modeling and forecasting of phenological responses to climate change through the PhenoCam network”, Wash U. PI. Collaborative with Harvard, BU, University of New Hampshire. Overall project budget \$1,250,000. 3/2011 - 3/2016.

Funding for Completed Projects

NSF	\$423,714	“RI: Large: Collaborative Research: Analyzing Images Through Time”, Wash U. PI. Collaborative project with MIT, Harvard, Cornell. Overall project budget \$2,300,000. 8/2011 - 7/2015.
NIH	\$75,000	“R21-CA186481 Emerging Technologies: Capture and measurement of outdoor physical activity patterns and environments”, co-PI (PI: Aaron Hipp). Overall project budget \$275,000. 2/2014 – 1/2016
NSF	\$516,000	“ImageQuest: Citizen Science Approaches to Calibrated and Validated Biological Imaging”, PI. Collaborative project with University of Arizona, University of Vermont, and Univ. California - San Diego. Overall project budget approximately \$1,200,000. 9/2010 - 9/2013.
Wash. U. URSA	\$25,000	“Capture of Outdoor Scenes to Evaluate and Validate Physical Activity Policy and Built Environment Change.”, co-PI, Aaron Hipp (Brown School) is PI. Overall project budget \$25,000. 1/2012 - 2/2013.
Boeing	\$50,000	“Compression and Modeling of Aerial Video”, PI. 2/2013 – 10/2013.
NSF CAREER	\$516,000	“CAREER: What Can be Learned by a Stationary Observer”, PI. 3/3006 - 2/2012
AFOSR	\$30,000	“SBIR Phase I: Enterprise Scalable Perception (ESP)”, Wash U. PI. 1/2011 - 9/2011
AFOSR	\$281,456	“SBIR Phase II: Enhanced Detection of Hidden Targets Using Multi-Discriminant Ladar”, Wash U PI. Project led by SDI Inc, total budget \$850,000, 8/2007 - 10/2011
ARL	\$5,000	“SBIR Phase I: LADAR Light Reflection Analysis for Target Surface Characterization”, co-PI, (Jody O’Sullivan is Wash U. PI, project is collaborative with SDI Inc.). 10/2010 - 7/2011, Total Wash. U funding, \$25,000
ONR	\$180,000	“INTERTRACK: Visual Algorithms for Interactive Tracking in Surveillance Networks”, Wash U. PI, project led by the Naval Research Laboratory with total budget of \$750,000. 6/3008 - 2/2011
DARPA/DHS	\$490,000	“Applications of Laser Doppler Vibrometry”, co-PI (Project led by John Rohrbaugh, with total funding exceeding \$5,000,000). 4/2004-8/2011
Lockheed Martin	\$100,000	“Persistent Surveillance: Combining Activity and Context Descriptors”, Wash U. PI. 12/2009 - 12/2010
AFOSR	\$230,000	“Propagation of Uncertainty in Anticipatory Image Exploitation Using Polynomial Chaos Random Process Representations”, Wash U PI., teaming with Barron and Associates, total project budget \$850,000, 8/2007 - 2/2011
NSF CISE-IIS	\$300,000	“Non-Parametric Models of Actions and Behaviors in Video”, PI. 11/2004 - 11/2007

SAIC	\$500,000	“Fast Semantic Content Processing”, co-PI (John Lockwood, PI). 7/2005-12/2005
Boeing Inc. Phantomworks	\$450,000	“Measurement of optical distortion in aircraft windscreens”, co-PI (Bill Smart, PI). 1/2004 - 12/2006
Washington Univ. Bear Cub	\$30,000	“Video Anomaly Detection and Localization”, PI. 12/2003 - 12/2005
NSF REU	\$178,000	“Research Experience for Undergraduates”, PI. 5/2002 - 4/2004

Selected Invited Talks

XXVII Sibgrapi Conference on Graphics, Patterns and Images, Keynote, “Searching for Images to Measure the World”, August 29, 2014, Rio de Janeiro, Brazil.

Microsoft Research, “The shadowy life of many webcams”, April 25, 2014, Cambridge, UK

IEEE Winter Vision Meeting Plenary Talk, “Re-Purposing all the Worlds Webcams with Applications to Environmental Measurement”, Clearwater Florida, Jan 18, 2013.

MIRU - International Workshop on Computer Vision, “Manifold Learning and Medical Imaging”, Karuizawa, Japan, July 28, 2008

City College of New York, “Passive Vision: A Year in the Life of 1000 OutdoorWebcams”, November 8, 2007

Johns Hopkins University, Center for Imaging Science, “Learning Image Manifolds != Manifold Learning”, May 2, 2006

Washington University, Mathematics Department Colloquium, “Parameterizing Natural Video through Manifold Learning”, December 8, 2005

Carnegie-Mellon, VASC seminar series, “Learning Image Manifolds != Manifold Learning”, December 5, 2005

Naval Research Laboratories, “Passive Vision”, November 14, 2005

Dartmouth University, Computer Science Department Colloquium “Persistent Surveillance”, March, 2005

UC Berkeley, Computer Vision Laboratory, “Data driven methods for surveillance and non-rigid motion analysis”, November 23, 2004

University of Pennsylvania, GRASP laboratory, “Video representations for surveillance and deformable motion analysis”, October 25, 2004

CICATA-IPN Queretaro, Mexico, “Real time methods for video surveillance”, August 31, 2004

Professional Service

Journal Associate Editor

Machine Vision and Applications, 2009 – present
Computerized Medical Imaging and Graphics, 2007 – 2013

Journal Reviewer

Journal of the Optical Society of America,
Pattern Analysis and Machine Intelligence,
Computer Vision and Image Understanding,
Image and Vision Computing,
International Journal of Computer Vision,
Photogrammetric Engineering and Remote Sensing
CVPR, ICCV, ICPR, ECCV, ICIP

Workshop Chair

Program Chair, IEEE Winter Conference on Applications of Computer Vision, 2016.
Chair, IEEE Workshop on Motion and Video Computing, Snowbird, Utah, 2009.
Chair, MICCAI Workshop in Manifolds in Medical Imaging, New York City, 2008.
Chair, IEEE International Workshop on Omnidirectional Vision and Camera Networks, with CVPR in Madison, Wisconsin, 2003.

Area Chair

ACCV 2009, 2010
CVPR 2014, 2015

Program Committees

Computer Vision and Pattern Recognition (CVPR) 2004–2013
IEEE Workshop on Motion and Video Computing (2007, 2011)
International Conference on Computer Vision (ICCV) 2004, 2007, 2009, 2011, 2013
European Conference on Computer Vision (ECCV) 2004, 2006, 2008, 2010, 2012
International Conference on Image Processing (ICIP) 2006
Workshop on Omnidirectional Vision and Camera Networks (Omnivis) 2004, 2005, 2010
IEEE Workshop on Advanced 3D Imaging for Safety and Security (A3DISS 2005)
Second International Workshop on Real Time 3D Sensors and Their Use, 2005
AAAI 2004
ACM Workshop on Geographic Information Systems, ACM-GIS, 2005
International Conference on Image Processing, (ICIP) 2004

Research Proposal Review

NSF IIS Panel, NSF CAREER Panel, (several times)
Department of Homeland Security Grant Review Panel

Teaching and Training:

Awards

Faculty of the Year, (voted by School of Engineering student body), 2009
Emerson Electric Excellence in Teaching Award (top teaching award at Washington University), 2006

Classes Taught

CSE 441/541	Advanced Algorithms	Fall 2008, 2015
CSE 555	Computational Photography	Spring 2015
CSE 201/240	Logic and Discrete Mathematics	Fall 2014–2009, 2006–2001
CSE 511	Artificial Intelligence	Spring 2013
CSE 559	Computer Vision	Spring 2012, 2010, 2008, 2006, 2004, 2002, 2000
CSE 546	Computational Geometry	Spring 2011, 2009, 2007, 2005, 2003, 2001
CSE 513	AI Project Class, Focus on Netflix Challenge	Fall 2008
CSE 200	Engineering and Scientific Computing	Fall 2007

Doctoral Student Advising

Richard Souvenir	DSc, Computer Science 2006, Thesis Title: “Image Manifold Clustering”, currently Associate Professor, UNC-Charlotte
Qilong Zhang	PhD, Computer Science 2007. Thesis Title: “Segmenting Biomedical Image Sequences”, currently at Nomura, formerly with Lehman Brothers
Nathan Jacobs	PhD, Computer Science 2010. Thesis Title: “The Global Network of Outdoor Cameras”, currently Assistant Professor, University of Kentucky
Manfred Georg	PhD, Computer Science 2010. Thesis Title: “Manifold Structure of High-Dimensional Time Series”, currently at Google
Zachary Freudenburg	PhD, Computer Science, 2012. Thesis Title: “Reading your own mind: Dynamic visualization of real-time neural signals”. Now at UMC-Utrecht
Austin Abrams	Graduated, 2014. Thesis Title: “The Geometry and Photometry of Outdoor Webcams”. Now at Google Research
David Lu	Graduated 2015. Co-advised with Bill Smart. Thesis Title: “Contextualized Robot Navigation”. Now at Bossa Nova Robotics.
Ian Schillebeeckx	Expected Graduation, 2016
Brendan Kelly	Expected Graduation, 2017
Abby Stylianou	Expected Graduation, 2017

Masters Thesis Advising

Kylia Miskell	Graduated, 2015
Agata Kargol	Graduated, 2015
Adina Stoica	Graduated 2014, currently at Cerner
Rachel Tannenbaum	2009, “Superpixel Segmentation of Webcam Scenes to Infer Scene Structure”, current at FactSet
Richard Speyer	2009, “Using Regression Techniques to Predict Weather Signals from Webcam Images”, currently at Microsoft
Joe Izraelevitz	2009, “Automated Archeological Survey of Ancient Irrigation Canals”, currently serving in the US Army
Kory Postma	2005, “Computing all nearest neighbors for high dimensional point sets”, currently at Applied Physics Laboratory, MD
Jacob Perkins	2005, “WUGLE: An abstraction of logical expressions with applications to automatic generation of online pedagogical tools for discrete mathematics”, currently CTO of weotta.com

Roman Garnett	2004, “Approximate Expectation Maximization for streaming data processing”, PhD from Oxford, 2010, currently at CMU
David Jurgens	2004, “Automated functional attribution in video using spatio-temporal filter responses”, currently in PhD program at UCLA
John Larson	2003, “A Probabilistic Framework for Stereo”
Songbai Ji	2003, “Strain Field Analysis of MRI Imagery”, currently faculty at Dartmouth

Students Thesis Committee Service (not as primary advisor)

Tom Erez	PhD. Computer Science and Engineering, 2011, “Optimal Control for Autonomous Motor Behavior”, with William Smart
Sasakthi Abeysingh	PhD. Computer Science and Engineering, 2010, “A Geometric Approach for Deciphering Protein Structure from Cryo-EM Volume”, with Tao Ju
Nuzhet Atay	PhD. Computer Science and Engineering, 2008, “Connectivity Maintenance and Task Allocation for Mobile Wireless Sensor Network”, with Burchan Bayazit
Reynold Bailey	DSc. Computer Science and Engineering, 2007, “Perception-Guided Image Manipulation”, with Cindy Grimm
Nick Tustison	DSc. Biomedical Engineering, 2004, with Amir Amini
Brandon Westover	DSc. Physics, 2004, ”Image Representation and Pattern Recognition in Brains and Machines”, with Joseph O’Sullivan
Paolo Favaro	DSc. Electrical Engineering, 2003, ”Shape From Defocus in Computer Vision”, with Stefano Soatto
Hailin Jin	DSc. Electrical Engineering, 2003, ”Variational Methods for Shape Reconstruction in Computer Vision”, with Stefano Soatto
Dan Dooly	DSc. Computer Science, 2001, with Sally Goldman

<i>Awards Won By Students</i>	NSF Fellowship, 2003	Richard Souvenir
	Barry Goldwater Fellowship, 2008	Nathaniel Roman
	Best student paper award, AIPR 2008	Nathan Jacobs
	PhD Forum Prize, ICDSC, 2009	Nathan Jacobs
	NSF Fellowship, 2011	Brandon Kerr
	NSF Fellowship, 2011	Kylia Miskell
	NSF Fellowship, 2012	Agata Kargol
	Best Paper Award, International Conference on Imaging in Crime Detection and Prevention, 2013	Abby Stylianou

Outreach and Education

- Science on Tap, Citizen Science: How You Can Find Aliens, Fold Proteins, Measure Galaxies, and More..., May 25, 2011
- Science on Tap, Video Surveillance: Fact and Fiction, February 27, 2008

Wednesday Club, St. Louis, MO, “Keeping your computer secure, an extended analogy”, January 12, 2005

Development and advising projects in “Interactive Technology Installation”, a joint class with Computer Science Department and the School of Art, 2003, 2004.

International Outreach

Washington University International Program Outreach. Meeting with 12 officials from the Uzbekistan National Security Service and Human Rights office. December 13, 2004.

Recent Collaborators

Yiannis Aloimonos, Univ. of Maryland (Advisor);
Patrick Baker, Univ. of Maryland;
Phil Bayly, Washington University;
William Freeman, MIT;
Guy Genin, Washington University;
Chris Gill, Washington University;
Cindy Grimm, Washington University;
Andrew Hope, University of Toronto;
Nathan Jacobs, University of Kentucky;
Tao Ju, Washington University;
Stephen Kobourov, University of Arizona
Chenyang Lu, Washington University;
Mark Miller, Washington University;
Joseph O’Sullivan, Washington University;
Hanspeter Pfister, Harvard;
Andrew Richardson, Harvard;
Ian Simon, Microsoft;
Noah Snaveley, Cornell;
Richard Souvenir, Univ. of North Carolina, Charlotte;
William Smart, Washington University;
Ruth West, UC San Diego;
Guoliang Xing, Michigan State University;
Bernd H. Zinselmeyer, NIH.

Professional References

William Freeman, MIT (billf@mit.edu)
Stefano Soatto, UCLA (soatta@cs.ucla.edu)
Hany Farid, Dartmouth (farid@cs.dartmouth.edu)
Chuck Stewart, RPI (stewart@cs.rpi.edu)