

Daniel Freedman

Work Address

Department of Computer Science
Rensselaer Polytechnic Institute
110 8th Street
Troy, NY 12180-3590

Phone: +972-52-4467138
Email: freedman@cs.rpi.edu
Web: <http://www.cs.rpi.edu/~freedd/>

Personal Data

Born June 4, 1971.
Married, four children.
American, Canadian, and Israeli citizenship.

Current Position

Associate Professor with tenure, Computer Science Department, Rensselaer Polytechnic Institute.
Senior Research Scientist, Hewlett-Packard (HP) Laboratories, Israel.

Research Interests

- Computer Vision: tracking; segmentation; graph cuts; geometric partial differential equations; learning.
- Geometric Algorithms: computational algebraic topology; combinatorial manifold reconstruction.
- Biomedical Applications: medical imaging; image-guided radiation therapy.

Education

2000	PhD	Harvard University	Engineering Sciences
1996	AM	Harvard University	Economics
1993	AB	Princeton University	Physics

Professional Experience

2006 -	Associate Professor with tenure, Department of Computer Science, Rensselaer Polytechnic Institute
2008-9	Senior Research Scientist, Hewlett-Packard (HP) Laboratories, Haifa, Israel
2007-8	Visiting Professor, Department of Computer Science and Applied Mathematics, Weizmann Institute of Science
2000 - 2006	Assistant Professor, Department of Computer Science, Rensselaer Polytechnic Institute
1996 - 2000	Research Assistant, Harvard University
1995 - 2000	Teaching Fellow, Harvard University
Summer, 1992	Research Assistant, Hebrew University of Jerusalem (Israel)
Summer, 1990, 1991	Research Assistant, National Research Council of Canada

Honours and Awards

- Fulbright Fellowship, 2007-8.
- US National Science Foundation (NSF) CAREER Award 2002.
- Robert L. Wallace Prize Fellowship, 1998-1999.
- Harvard University Fellowship, 1996-1998,1999-2000.
- Social Sciences and Humanities Research Council of Canada Doctoral Fellowship, 1995.
- Graduated Magna Cum Laude in physics (Princeton University, 1993).
- Phi Beta Kappa (Princeton University, 1993).
- Sigma Xi (Princeton University, 1993).

Grants

- *From Generic to Model-Based Segmentation of Images, with Applications to Medicine*, Fulbright Fellowship. *Award Period: September, 2007 – June, 2008*, Award Value: **\$55,000**.
- co-Principal Investigator, *Virtual Patients for Computing Radiation Doses (R01 Grant)*, G. Xu, D. Freedman, M. Stabin, W. Bolch, H. Paganetti. National Institutes of Health (NIBIB, NCI). *Award Period: September, 2005 – August, 2008*, Award Value: **\$2,170,000**.
- co-Principal Investigator, *Army INSCOM Virtual Modeling Project: 3D Modeling and Tracking from Distributed, Mobile Sensors*, C.V. Stewart, D. Freedman, R.J. Radke, L. Gerhardt. DOD-INSCOM, *Award Period: March, 2004 - March, 2009*, Award Value: **\$2,704,472**.
- Principal Investigator, *CAREER: Combined Shape- and Intensity-Based Methods for Visual Tracking*, National Science Foundation (CISE - IIS - Robotics and Computer Vision Program). *Award Period: May, 2002 – April, 2008*, Award Value: **\$349,994**.

Current Students

- Chao Chen. *Algorithms for Computational Homology*, PhD expected 2009.

Former Students

- Matthew Turek (PhD, 2007). *Combinatorial Optimization in Computer Vision: Optical Flow, Segmentation, and Multiscale Algorithms*. Position: Research Scientist, Kitware.
- Yushin Cho (PhD, 2005). *Resolution Scalable and Random Access Decodable Image Coding with Low Time Complexity*. Position: Senior Engineer, Sony.
- Tao Zhang (PhD, 2005). *Visual Tracking by Density Matching: Theory, Algorithms and Applications*. Position: Research Scientist, Thomson.
- Mehmet Kocamaz (MS, 2007). *Fast Segmentation for Ultrasound Images*.
- Harmeet Goindi (MS, 2003). *Image Restoration Using Graph Cut Methods*.

Professional Societies

Member, Institute of Electrical and Electronic Engineers
Member, Sigma Xi

Conference Organization, Reviewing and Refereeing

- General Chair, *Aspects of Geometric Computing*, 2006. Troy, NY, Oct 20, 2006.
- Program committees: ICCV 2009, CVPR 2009, EMMCVPR 2009, ICCV 2007, EMMCVPR 2007, CVPR 2007, CVPR 2006, ECCV 2006, CVPR 2005, EMMCVPR 2005.
- Panel reviews: NSF *ad hoc* Proposal Review, DMS, 2005; NSF *ad hoc* Proposal Review, CISE, 2003; NSF, CISE-DMS program panel, 2003; NSF, CISE-DMS program panel, 2001.
- Referee for IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), International Journal of Computer Vision (IJCV), Computer Vision and Image Understanding (CVIU), IEEE Transactions on Image Processing, SIAM Review, ACM SIGGRAPH, Pattern Recognition, International Journal of Robotics Research (IJRR), IEEE Transactions on Biomedical Engineering, Scientific Programming, IEEE Transactions on Information Technology in Biomedicine.

Courses Taught

Computational Vision
Data Structures and Algorithms
Topics in Computational Geometry

Publications (Refereed)

- **D. Freedman** and C. Chen. Algebraic topology for computer vision. Submitted to *SIAM Journal on Imaging Sciences*.
- **D. Freedman**. Stability of the modes of a density estimate under sampling, with applications to clustering. Submitted to *International Journal of Foundations of Computer Science*.
- C. Chen and **D. Freedman**. Hardness results for optimal homology bases. Submitted to *Discrete and Computational Geometry*.
- **D. Freedman** and P. Kisilev. KDE paring and a faster mean shift algorithm. Submitted to *SIAM Journal on Imaging Sciences*.
- C. Chen and D. Freedman. Hardness results for homology localization. In *Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 2010.
- P. Kisilev and **D. Freedman**. Computing color transforms. In *Proceedings of the Seventeenth IS&T Color Imaging Conference (CIC)*, 2009.
- C. Chen and **D. Freedman**. Measuring and computing natural generators for homology groups. *Computational Geometry: Theory and Applications*, 43(2):169-181, 2010. (DOI: 10.1016/j.comgeo.2009.06.004)
- **D. Freedman** and M. Turek. Graph cuts with many-pixel interactions: theory and applications to shape modeling. *Image and Vision Computing*, DOI:10.1016/j.imavis.2009.07.006, 2009.

- Z. Karni, **D. Freedman** and C. Gotsman. Energy-based shape deformation. *Computer Graphics Forum*, 28(5):1257-1268, 2009.
- **D. Freedman** and P. Kisilev. Fast mean shift by compact density representation. In *Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 1818-1825, 2009.
- **D. Freedman** and P. Kisilev. Fast data reduction via KDE compression. In *Proceedings of the IEEE Data Compression Conference (DCC)*, 2009.
- C. Chen and **D. Freedman**. Quantifying homology classes. In *Proceedings of the International Symposium on Theoretical Aspects of Computer Science (STACS 08)*, pages 169-180, 2008.
- A. Ayvaci and **D. Freedman**. Joint segmentation-registration of organs using geometric models. In *Proceedings of the International Conference of the IEEE Engineering in Medicine and Biology Society*, pages 5251-5254, 2007.
- **D. Freedman**. An incremental algorithm for reconstruction of surfaces of arbitrary codimension. *Computational Geometry: Theory and Applications*, 36(2):106-116, 2007.
- M. Turek and **D. Freedman**. Multiscale modeling and constraints for max-flow/min-cut problems in computer vision. In *Proceedings of the IEEE Computer Society Workshop on Perceptual Organization in Computer Vision (in conjunction with IEEE CVPR 2006)*.
- **D. Freedman** and P. Drineas. Energy minimization via graph cuts: settling what is possible. In *Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)*, volume 2, pages 939-946, 2005. [**Acceptance Rate: 26.8%**]
- **D. Freedman** and M. Turek. Illumination-invariant tracking via graph cuts. In *Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)*, volume 2, pages 10-17, 2005. [**Acceptance Rate, Oral Presentation: 6.2%**]
- **D. Freedman** and T. Zhang. Interactive graph cut based segmentation with shape priors. In *Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)*, volume 1, pages 755-762, 2005. [**Acceptance Rate: 26.8%**]
- **D. Freedman**, R. J. Radke, T. Zhang, Y. Jeong, D. M. Lovelock, and G. T. Y. Chen. Model-based segmentation of medical imagery by matching distributions. *IEEE Transactions on Medical Imaging*, 24(3):281-292, 2005.
- T. Zhang and **D. Freedman**. Improving performance of distribution tracking through background mismatch. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 27(2):282-287, 2005.
- **D. Freedman**. Surface reconstruction, one triangle at a time. In *Proceedings of the Sixteenth Canadian Conference of Computational Geometry (CCCG)*, pages 15-19, 2004.
- **D. Freedman**, R.J. Radke, T. Zhang, Y. Jeong, and G.T.Y. Chen. Model-based multi-object segmentation via distribution matching. In *Proceedings of the Third IEEE Workshop on Articulated and Nonrigid Motion (in conjunction with IEEE CVPR 2004)*, 2004
- **D. Freedman** and T. Zhang. Active contours for tracking distributions. *IEEE Transactions on Image Processing*, 13(4):518-526, 2004.

- T. Zhang and **D. Freedman**. Tracking objects using density matching and shape priors. In *Proceedings of the Ninth IEEE International Conference on Computer Vision (ICCV)*, volume 2, pages 1056-1062, 2003. [**Acceptance Rate: 20.7%**]
- **D. Freedman**. Effective tracking through tree-search. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 25(5):604-615, 2003.
- **D. Freedman**. Combinatorial curve reconstruction in Hilbert Spaces: a new sampling theory and an old result revisited. *Computational Geometry: Theory and Applications*, 23(2):227-241, 2002.
- Y. Shao, M. Magdon-Ismael, **D. Freedman**, S. Akella, M. Zaki, and C. Bystroff. Compression of protein conformational space. In *6th Annual International Conference on Research in Computational Molecular Biology (RECOMB02)*, Washington, DC, April 2002.
- **D. Freedman**. Efficient simplicial reconstructions of manifolds from their samples. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 24(10):1349 -1357, 2002.
- **D. Freedman**. Manifold reconstruction from unorganized points. In *Proceedings of the Thirty Fourth Annual Asilomar Conference on Signals, Systems, and Computers*, volume 2, pages 1744-1748, 2000.
- **D. Freedman** and M. S. Brandstein. Provably fast algorithms for contour tracking. In *Proceedings of the 2000 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)*, volume 1, pages 139-144, 2000.
- **D. Freedman** and M. S. Brandstein. Contour tracking in clutter: a subset approach. *International Journal of Computer Vision*, 38(2):173-186, 2000.
- **D. Freedman** and M. S. Brandstein. Methods of global optimization in contour tracking. In *Proceedings of the Thirty Third Annual Asilomar Conference on Signals, Systems, and Computers*, volume 1, pages 725-729, 1999.
- **D. Freedman** and M. S. Brandstein. A subset approach to contour tracking in clutter. In *Proceedings of the Seventh IEEE International Conference on Computer Vision (ICCV)*, volume 1, pages 242-247, 1999. [**Acceptance Rate: 31%**]
- R. Taylor, A. Sachrajda, **D. Freedman**, and P. Kelly. Density of electrons in a lateral quantum dot by semi-classical trajectory analysis. *Solid State Communications*, 89(7):579-582, 1994.

Invited Lectures

- Bar Ilan University, School of Engineering, Ramat Gan, Israel. May 6, 2009.
- Weizmann Institute of Science, Department of Applied Mathematics and Computer Science, Rehovot, Israel. April 30, 2009.
- Hewlett-Packard Laboratories, Haifa, Israel. March 26, 2009.
- Technion (Israel Institute of Technology), Image Processing Seminar, Haifa, Israel. March 24, 2009.
- Google Research, Tel Aviv, Israel. January 10, 2008.
- Interdisciplinary Center (IDC), Department of Computer Science, Herzliya, Israel. December 6, 2007.

- Bar Ilan University, Department of Computer Science, Ramat Gan, Israel. November 29, 2007.
- Tel Aviv University, Department of Computer Science, Tel Aviv, Israel. November 11, 2007.
- Weizmann Institute of Science, Department of Applied Mathematics and Computer Science, Rehovot, Israel. November 8, 2007.
- Hebrew University, Department of Computer Science, Jerusalem, Israel. October 29, 2007.
- Rensselaer Polytechnic Institute, Mathematical Sciences Department, Troy, NY. April 16, 2007.
- Hebrew University, Computer Science Department, Jerusalem, Israel. December 25, 2005.
- Weizmann Institute of Science, Department of Applied Mathematics and Computer Science, Rehovot, Israel. December 22, 2005.
- University of Southern California Computer Science Department, Los Angeles, CA. April 8, 2005.
- University of Toronto Computer Science Department, Toronto, Canada. March 4, 2005.
- McGill University Computer Science Department, Montreal, Canada. February 28, 2005.
- University of Pennsylvania Computer Science Department, Philadelphia, PA. February 10, 2005.
- Princeton University Computer Science Department, Princeton, NJ. February 9, 2005.
- UCLA Computer Science Department, Los Angeles, CA. January 3, 2005.
- American Association of Physicists in Medicine (AAPM) Annual Meeting, Pittsburgh, PA. July 31, 2004.
- Department of Medical Physics, Memorial Sloan-Kettering Cancer Centre, New York, NY. June 2, 2003.
- DIMACS Workshop on Surface Reconstruction, Rutgers University, Piscataway, NJ. May 1, 2003.
- Columbia University Computer Science Department, New York, NY. April 11, 2003.
- GE Centre for Research and Development, Schenectady, NY. November 9, 2001.
- UCLA Mathematics Department, Los Angeles, CA. July 16, 2001.
- Harvard Industrial Partnership for Information Technology Workshop, Cambridge, MA. October 13, 1999.