

David Minnen

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EDUCATION

Georgia Institute of Technology

Ph.D. in Computer Science (GPA: 3.96 / 4.0)

Thesis: Unsupervised Discovery of Activity Primitives from Multivariate Sensor Data

Atlanta, GA

August 2008

Georgia Institute of Technology

Master of Science in Computer Science (GPA: 4.0 / 4.0)

Atlanta, GA

December 2006

Georgia Institute of Technology

Bachelor of Science in Computer Science (GPA: 3.73 / 4.0)

Minor: Cognitive Science

Atlanta, GA

May 2001

PROFESSIONAL EXPERIENCE

Google

Senior Software Engineer

Mountain View, CA 94043

September 2013 - Present

- **Machine Learning for Image & Video Compression:** Developed deep learning architectures for image and video compression including RNN-based progressive models, hierarchical autoencoders, and compressible optical flow.
- **Multimedia Content Analysis for Android:** Designed and implemented the machine learning core for real-time frame analysis in the Android camera app used for best shot detection and frame selection for automatic action GIFs and collages.

Belkin International

Director of Machine Learning

Playa Vista, CA 90094

September 2012 - September 2013

- **Energy Disaggregation:** Led team developing energy disaggregation software to detect individual appliance usage and power draw statistics from a custom, whole-home power meter.

Oblong Industries

Director of Computer Vision

Los Angeles, CA 90013

September 2008 - September 2012

- **Hand Tracking & Gesture Recognition from a Depth Sensor:** Led team that developed a hand tracking and pose detection system based on real-time analysis of depth data used to drive an interactive gestural interface.
- **Real-time motion capture for interactive gesture control:** Developed algorithms for multi-camera calibration and real-time motion capture to enable room-size gestural interfaces based on high-speed IR cameras and fiducial tracking.

IBM T.J. Watson Research Center

Research Intern - Pervasive Computing Solutions Group (Mentor: Gopal Pingali)

Hawthorne, NY 10532

Summer 2005

Mitsubishi Electric Research Lab (MERL)

Research Intern (Mentor: Chris Wren)

Cambridge, MA 02139

Summer 2003

Microsoft

Software Development Engineer - AutoPC Group (Mentor: Richard Bailey)

Redmond, WA 98052

Summer 2000

Microsoft

Software Development Engineer in Test - USB Driver Team

Redmond, WA 98052

Fall 1999

Real3D

Software Development Engineer - Graphics Driver Development Team

Orlando, FL 32822

Spring & Fall 1998

1. **D. Minnen** and S. Singh, “Channel-wise autoregressive entropy models for learned image compression,” in *Int. Conf. on Image Processing (ICIP)*, 2020
2. J. Ballé, P. Chou, **D. Minnen**, S. Singh, N. Johnston, E. Agustsson, S. Hwang, and G. Toderici, “Nonlinear transform coding,” in *IEEE Journal of Selected Topics in Signal Processing*, (under review), 2020
3. E. Agustsson, **D. Minnen**, N. Johnston, J. Ballé, S. Hwang, and G. Toderici, “Scale-space flow for end-to-end optimized video compression,” in *Computer Vision and Pattern Recognition (CVPR)*, 2020
4. J. Ballé, N. Johnston, and **D. Minnen**, “Integer networks for data compression with latent-variable models,” in *Int. Conf. on Learning Representations (ICLR)*, 2019
5. **D. Minnen**, J. Ballé, and G. Toderici, “Joint autoregressive and hierarchical priors for learned image compression,” in *Advances in Neural Information Processing Systems (NeurIPS)*, Montreal, Canada, 2018
6. **D. Minnen**, G. Toderici, S. Singh, S. J. Hwang, and M. Covell, “Image-dependent local entropy models for image compression with deep networks,” in *Int. Conf. on Image Processing (ICIP)*, 2018
7. T. Chinen, J. Ballé, C. Gu, S. J. Hwang, S. Ioffe, N. Johnston, T. Leung, **D. Minnen**, S. O’Malley, C. Rosenberg, and G. Toderici, “Towards a semantic perceptual image metric,” in *Int. Conf. on Image Processing (ICIP)*, 2018
8. J. Ballé, **D. Minnen**, S. Singh, S. J. Hwang, and N. Johnston, “Variational image compression with a scale hyperprior,” in *Int. Conf. on Learning Representations (ICLR)*, 2018
9. N. Johnston, D. Vincent, **D. Minnen**, M. Covell, S. Singh, T. Chinen, S. J. Hwang, J. Shor, and G. Toderici, “Improved lossy image compression with priming and spatially adaptive bit rates for recurrent networks,” in *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*, 2018
10. **D. Minnen**, G. Toderici, M. Covell, T. Chinen, N. Johnston, J. Shor, S. J. Hwang, D. Vincent, and S. Singh, “Spatially adaptive image compression using a tiled deep network,” *Int. Conf. on Image Processing (ICIP)*, 2017
11. G. Toderici, D. Vincent, N. Johnston, S. J. Hwang, **D. Minnen**, J. Shor, and M. Covell, “Full resolution image compression with recurrent neural networks,” in *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*, 2017
12. G. Toderici, S. M. O’Malley, S. J. Hwang, D. Vincent, **D. Minnen**, S. Baluja, M. Covell, and R. Sukthankar, “Variable rate image compression with recurrent neural networks,” in *Int. Conf. on Learning Representations (ICLR)*, 2016
13. P. Zang, P. Zhou, **D. Minnen**, and C. Isbell, “Discovering options from example trajectories,” in *Int. Conf. on Machine Learning (ICML)*, 2009, pp. 1217–1224
14. R. Mappus, **D. Minnen**, and C. Isbell, “Dimensionality reduction for improved source separation in fMRI data,” in *Proceedings of the Int. Conf. on Bio-inspired Systems and Signal Processing (BIOSIGNALS)*, Jan. 2008
15. **D. Minnen**, I. Essa., C. L. Isbell, and T. Starner, “Detecting subdimensional motifs: An efficient algorithm for generalized multivariate pattern discovery,” in *IEEE Int. Conf. on Data Mining (ICDM)*, Omaha, NE, Oct. 2007
16. **D. Minnen**, C. L. Isbell, I. Essa, and T. Starner, “Discovering multivariate motifs using subsequence density estimation and greedy mixture learning,” in *AAAI Conference on Artificial Intelligence*, Vancouver, Canada, Jul. 2007
17. **D. Minnen**, T. Starner, I. Essa, and C. L. Isbell, “Improving activity discovery with automatic neighborhood estimation,” in *Int. Joint Conf. on Artificial Intelligence (IJCAI)*, Hyderabad, India, Jan. 2007
18. **D. Minnen**, T. Starner, I. Essa, and C. L. Isbell, “Discovering characteristic actions from on-body sensor data,” in *Int. Symposium on Wearable Computing (ISWC)*, (Nominated for a Best Paper Award), Montreux, CH, Oct. 2006
19. C. R. Wren, **D. Minnen**, and S. G. Rao, “Similarity-based analysis for large networks of ultra-low resolution sensors,” *Pattern Recognition*, vol. 39, no. 10, pp. 1918–1931, Oct. 2006

20. Y. Shi, Y. Huang, **D. Minnen**, A. Bobick, and I. Essa, "Propagation networks for recognizing partially ordered sequential actions," in *Comp. Vision and Pattern Recog. (CVPR)*, Washington D.C., Jun. 2004
21. **D. Minnen** and C. R. Wren, "Finding temporal patterns by data decomposition," in *Sixth Int. Conf. on Automatic Face and Gesture Recognition*, Seoul, Korea, May 2004
22. **D. Minnen**, I. Essa, and T. Starner, "Expectation grammars: Leveraging high-level expectations for activity recognition," in *Computer Vision and Pattern Recognition (CVPR)*, Madison, WI, Jun. 2003
23. T. Starner, B. Leibe, **D. Minnen**, T. Westyn, A. Hurst, and J. Weeks, "The perceptive workbench: Computer vision-based gesture tracking, object tracking, and 3d reconstruction for augmented desks," *Machine Vision and Applications*, vol. 14, no. 1, pp. 59–71, 2003

WORKSHOPS & OTHER PUBLICATIONS

1. **D. Minnen** and Z. Zafrulla, "Towards robust cross-user hand tracking and shape recognition," in *Workshop at Int. Conf. on Computer Vision (ICCV Workshops)*, 2011, pp. 1235–1241
2. **D. Minnen**, P. Zang, C. L. Isbell, and T. Starner, "Boosting diverse learners for domain agnostic time series classification," in *Workshop and Challenge on Time Series Classification at SIGKDD*, San Jose, CA, Aug. 2007
3. **D. Minnen**, T. Starner, I. Essa, and C. L. Isbell, "Pattern discovery for locating motifs in multivariate, real-valued time-series data," in *The Learning Workshop (Snowbird)*, Snowbird, Utah, 2007
4. **D. Minnen**, T. Westeyn, D. Ashbrook, P. Presti, and T. Starner, "Recognizing soldier activities in the field," in *4th Int. Workshop on Wearable and Implantable Body Sensor Networks*, vol. 13, Aachen, Germany: Springer, 2007
5. Y. Medynskiy, S. Gov, A. Mazalek, and **D. Minnen**, "Wearable RFID for Play," in *Tangible Play Workshop at the Int. Conf. on Intelligent User Interfaces (IUI)*, Honolulu, HI, Jan. 2007
6. **D. Minnen**, T. Westeyn, T. Starner, J. Ward, and P. Lukowicz, "Performance metrics and evaluation issues for continuous activity recognition," in *Performance Metrics for Intelligent Systems (PerMIS)*, Gaithersburg, MD, Aug. 2006
7. **D. Minnen**, T. Starner, I. Essa, and C. Isbell, "Activity discovery: Sparse motifs from multivariate time series," in *The Learning Workshop (Snowbird)*, Snowbird, Utah, Apr. 2006
8. **D. Minnen**, T. Starner, J. Ward, P. Lukowicz, and G. Troester, "Recognizing and discovering human actions from on-body sensor data," in *IEEE International Conference on Multimedia and Expo (ICME)*, Amsterdam, Jul. 2005
9. C. R. Wren and **D. Minnen**, "Activity mining in sensor networks. advances in neural information," in *Workshop on Activity Recognition and Discovery at NIPS*, Vancouver, Canada, Dec. 2004
10. B. Leibe, **D. Minnen**, J. Weeks, and T. Starner, "Integration of wireless gesture tracking, object tracking, and 3d reconstruction in the perceptive workbench," in *Second Int. Workshop on Computer Vision Systems (ICVS)*, Vancouver, Canada, Jul. 2001
11. **D. Minnen** and N. Nersessian, "Searching for solutions: Exploring the validity of laboratory studies and search-based problem solving," in *Contemporary Psychology: APA Review of Books*, Invited review of *Exploring Science: The Cognition and Development of Discovery Processes* by David Klahr. Cambridge, MA: MIT Press, 2000., Jun. 2003

PATENTS

1. Troy Chinen, Sung Jin Hwang, Saurabh Singh, Nick Johnston, Johannes Ballé, George Toderici, and **D. Minnen**. *Data Compression Using Conditional Entropy Models*. USPTO serial number US16/515,586, assignee: Google, filed July 18, 2019.

2. Sung Jin Hwang, Saurabh Singh, Nick Johnston, Michele Covell, Joel Shor, George Toderici, **D. Minnen**, and Damien Vincent. *Tiled Image Compression Using Neural Networks*. USPTO serial number US16/617,484, assignee: Google, filed May 29, 2018.
3. Sung Jin Hwang, Saurabh Singh, Michele Covell, George Toderici, and **D. Minnen**. *Data Compression by Local Entropy Encoding*. USPTO serial number US15/985,340, assignee: Google, filed May 21, 2018.
4. G. Toderici, S. O'Malley, R. Sukthankar, S.J. Hwang, D. Vincent, N. Johnston, **D. Minnen**, J. Shor, and M. Covell. *Image compression with recurrent neural networks*. U.S. Patent 10,192,327, assignee: Google, issued January 29, 2019.
5. P. Yarin and **D. Minnen**. *Visual collaboration interface*. U.S. Patent 9,990,046, assignee: Oblong Industries, issued June 5, 2018.
6. P. Yarin and **D. Minnen**. *Remote devices used in a markerless installation of a spatial operating environment incorporating gestural control*. U.S. Patent 9,317,128, assignee: Oblong Industries, issued April 19, 2016.
7. **D. Minnen**. *Fast fingertip detection for initializing a vision-based hand tracker*. U.S. Patent 8,896,531, assignee: Oblong Industries, issued November 25, 2014.
8. **D. Minnen**. *Cross-User Hand Tracking and Shape Recognition User Interface*. U.S. Patent 8,890,813, assignee: Oblong Industries, issued November 18, 2014.
9. C. R. Wren and **D. Minnen**. *Determining temporal patterns in sensed data sequences by hierarchical decomposition of hidden Markov models*. U.S. Patent 7,542,949, assignee: Mitsubishi Electric Research Laboratories, issued June 2, 2009.
10. B. Leibe, T. Starner, J. Weeks, and **D. Minnen**. *The Perceptive Workbench*. Provisional patent filed October, 2000.

ACADEMIC EXPERIENCE

Graduate Research Assistant <i>Computational Perception Lab & Contextual Computing Group</i>	Georgia Institute of Technology <i>College of Computing</i> 2002 - 2008
Graduate Research Assistant <i>Wearable Computing Lab</i>	Swiss Federal Institute of Technology (ETH) <i>Electronics Laboratory (IfE)</i> June - Dec 2002
Graduate Teaching Assistant <i>Intro. to Artificial Intelligence (CS 4600)</i>	Georgia Institute of Technology <i>College of Computing</i> 2001
Undergraduate Research Assistant <i>Contextual Computing Group</i>	Georgia Institute of Technology <i>College of Computing</i> 2000 - 2001
Undergraduate Teaching Assistant <i>Intro. to Programming (CS 1502, 1502X)</i>	Georgia Institute of Technology <i>College of Computing</i> 1998-200

EVENTS, HONORS, AND AWARDS

- Invited talk on learned image compression at the Google Workshop at the Int. Conf. on Image Processing (ICIP) 2017 & 2018.
- Demonstration of Markerless Hand Tracking and Gesture Recognition system at NASA Johnson Space Center Innovation Day, May 2012
- Participated in SXSW Panel Interface Technology: Gesture Systems and Beyond, March 2012

- Invited presentation and panelist at the International Workshop on Human Computer Interaction in conjunction with ICCV, November 2011
- Real-time motion capture code ran live during Oblong's TED talk *Pointing to the future of UI*, February 2010
- National Science Foundation Graduate Research Fellowship for Artificial Intelligence, June 2002 – May 2005
- Georgia Tech Graduate President's Scholarship, 2001 – 2006
- Undergraduate Research Opportunities in Computing 3rd place judge's award for work on the *Perceptive Workbench*, April 2001
- ACM Collegiate Programming Contest - placed first in the Southeast Regional competition in 1998 and 1999, 3rd in 2000; each time earning a spot in the annual world finals