

# David Varodayan

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varodayan@stanford.edu  
www.stanford.edu/~divad

## Objective

Fulltime research engineering at the intersection of machine learning and image/video processing

## Education and Research

**Ph.D. Electrical Engineering** Stanford, California  
Stanford University **2005–2009 (defended June 2009)**

Solved novel data compression problems using machine learning and error correcting codes, and applied these methods to practical systems: multiview image compression for large camera arrays; low-complexity video compression; image/audio tampering detection; video quality monitoring. Developed Matlab/C software that was adopted into video codec of EU project *Discover DVC*. Published 2 journal papers and 24 conference papers, and granted US Patent 20090055651.

**M.S. Electrical Engineering** Stanford, California  
Stanford University **2003–2005**

GPA 4.00. Image/video compression; digital image/video processing; machine learning; statistical inference; graphical models; convex optimization; information theory; error correcting codes; human vision; interpersonal influence and leadership; managing groups and teams; and more.

**B.A.Sc. Engineering Science** Toronto, Canada  
University of Toronto **1999–2003**

GPA 3.92. Graduated with honor standing. Wrote thesis on error correcting code performance.

## Awards

Best paper finalist (first author), Picture Coding Symposium (2007)  
Best student paper award, EURASIP European Signal Processing Conference (2007)  
Best student paper award (first author), IEEE Multimedia Signal Processing Workshop (2006)  
Division of Engineering Science academic excellence award, University of Toronto (2003)  
Honorable mention (ranked 53<sup>rd</sup> in North America), Putnam Mathematical Competition (2000)  
Australian students prize, Government of Australia (1998)  
Premier's trophy for excellence, Government of New South Wales (1998)  
Bronze medal, Asian-Pacific Mathematical Olympiad (1997)

## Scholarships

School of Engineering fellowship, Stanford University (2003)  
First Garnet W. McKee – Lachlan Gilchrist geophysics scholarship, University of Toronto (2001)  
University of Toronto scholar, University of Toronto (2000)  
Faculty of Applied Science and Engineering admission scholarship, University of Toronto (1999)  
New South admission scholarship, University of New South Wales (1999)  
Full academic Grainger scholarship, Sydney Grammar School (1993–1998)

## Work Experience

**Research Engineer Intern** Palo Alto, California  
DoCoMo Communications Laboratories USA **Summer 2007**

Devised better methods for traitor detection in image/video/audio watermarking systems using convex optimization. Published IEEE conference paper and filed provisional patent application.

**Researcher** Toronto, Canada  
University of Toronto **Summer 2003, Summer 2004**

Devised novel DSL precoders to minimize crosstalk interference. Published IEEE journal paper.

**Program Manager Intern** Redmond, Washington  
Microsoft Corporation **Summer 2002**

Designed APIs and wrote specifications for SQL Server's XML data access interfaces.

## Work Experience (continued)

**Researcher** Toronto, Canada  
University of Toronto **Summer 2001**  
Implemented efficient methods for automatic error correction of DNA sequencing.

**Researcher** Toronto, Canada  
University of Toronto **Summer 2000**  
Tested and debugged software for translation of C into register transfer level VHDL.

## Teaching Experience

**Teaching Assistant (graduate level)** Stanford, California  
Stanford University **2006–2008**  
Taught 4 quarters of image/video compression. Proposed class projects and mentored groups of up to 3 students, including winner of best project award. Created homework questions.

**Teaching Assistant (undergraduate level)** Toronto, Canada  
University of Toronto **2000–2003**  
Taught 5 semesters of freshman calculus; linear algebra; data structures and algorithms.

## Skills

Operating Systems: Windows, Unix/Linux  
Programming: C/C++, Matlab, Haskell, VHDL  
Software: LaTeX, Image processing tools

## Journal Papers

1. **D. Varodayan**, D. Chen, M. Flierl and B. Girod, “Wyner-Ziv coding of video with unsupervised motion vector learning,” *EURASIP Signal Processing: Image Communication Journal, Special Issue on Distributed Video Coding*, vol. 23, no. 5, pp. 369-378, June 2008. Invited paper.
2. **D. Varodayan**, A. Aaron and B. Girod, “Rate-adaptive codes for distributed source coding,” *EURASIP Signal Processing Journal, Special Section on Distributed Source Coding*, vol. 86, no. 11, pp. 3123-3130, November 2006.
3. W. Yu, **D. Varodayan** and J. Cioffi, “Trellis and convolutional precoding for transmitter-based interference pre-subtraction,” *IEEE Transactions on Communications*, vol. 53, no. 7, pp. 1220-1230, July 2005.

## Conference Papers

4. Y.-C. Lin, **D. Varodayan** and B. Girod, “Video quality monitoring for mobile multicast peers using distributed source coding,” *Proc. International Mobile Multimedia Communications Conference, MobiMedia 2009*, London, UK, September 2009.
5. Y.-C. Lin, **D. Varodayan** and B. Girod, “Distributed source coding authentication of images with contrast and brightness adjustment and affine warping,” *Proc. Picture Coding Symposium, PCS 2009*, Chicago, Illinois, May 2009.
6. Y.-C. Lin, **D. Varodayan** and B. Girod, “Distributed source coding authentication of images with affine warping,” *Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing, ICASSP 2009*, Taipei, Taiwan, April 2009.
7. Y.-C. Lin, **D. Varodayan** and B. Girod, “Authenticating cropped and resized images using distributed source coding and expectation maximization,” *Proc. IS&T/SPIE Electronic Image, Media Forensics and Security XI*, San Jose, California, January 2009.
8. Y.-C. Lin, **D. Varodayan**, T. Fink, E. Bellers and B. Girod, “Localization of tampering in contrast and brightness adjusted images using distributed source coding and expectation maximization,” *Proc. IEEE International Conference on Image Processing, ICIP 2008*, San Diego, California, October 2008.

## Conference Papers (continued)

9. D. Chen, **D. Varodayan**, M. Flierl and B. Girod, "Wyner-Ziv coding of multiview images with unsupervised learning of disparity and Gray code," *Proc. IEEE International Conference on Image Processing, ICIP 2008*, San Diego, California, October 2008.
10. **D. Varodayan**, D. Chen and B. Girod, "Network image coding for multicast," *Proc. IEEE International Workshop on Multimedia Signal Processing, MMSP 2008*, Cairns, Australia, October 2008.
11. Z. Li, Y.-C. Lin, **D. Varodayan**, P. Baccichet and B. Girod, "Distortion-aware retransmission and concealment of video packets using a Wyner-Ziv-coded thumbnail," *Proc. IEEE International Workshop on Multimedia Signal Processing, MMSP 2008*, Cairns, Australia, October 2008.
12. D. Chen, **D. Varodayan**, M. Flierl and B. Girod, "Wyner-Ziv coding of multiview images with unsupervised learning of two disparities," *Proc. IEEE International Conference on Multimedia and Expo, ICME 2008*, Hannover, Germany, June 2008.
13. Y.-C. Lin, **D. Varodayan**, T. Fink, E. Bellers and B. Girod, "Authenticating contrast and brightness adjusted images using distributed source coding and expectation maximization," *Proc. IEEE International Conference on Multimedia and Expo, ICME 2008*, Hannover, Germany, June 2008.
14. K. Chono, Y.-C. Lin, **D. Varodayan**, Y. Miyamoto and B. Girod, "Reduced-reference image quality estimation using distributed source coding," *Proc. IEEE International Conference on Multimedia and Expo, ICME 2008*, Hannover, Germany, June 2008.
15. **D. Varodayan** and C. Pépin, "Collusion-aware traitor tracing in multimedia fingerprinting using sparse signal approximation," *Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing, ICASSP 2008*, Las Vegas, Nevada, April 2008.
16. **D. Varodayan**, Y.-C. Lin and B. Girod, "Audio authentication based on distributed source coding," *Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing, ICASSP 2008*, Las Vegas, Nevada, April 2008.
17. D. Chen, **D. Varodayan**, M. Flierl and B. Girod, "Distributed stereo image coding with improved disparity and noise estimation," *Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing, ICASSP 2008*, Las Vegas, Nevada, April 2008.
18. A. Mavlankar, **D. Varodayan** and B. Girod, "Region-of-interest prediction for interactively streaming regions of high resolution video," *Proc. IEEE International Packet Video Workshop, PV 2007*, Lausanne, Switzerland, November 2007.
19. **D. Varodayan**, Y.-C. Lin, A. Mavlankar, M. Flierl and B. Girod, "Wyner-Ziv coding of stereo images with unsupervised learning of disparity," *Proc. Picture Coding Symposium, PCS 2007*, Lisbon, Portugal, November 2007. **Best Paper Finalist.**
20. Y.-C. Lin, **D. Varodayan** and B. Girod, "Spatial models for localization of image tampering using distributed source codes," *Proc. Picture Coding Symposium, PCS 2007*, Lisbon, Portugal, November 2007.
21. Y.-C. Lin, **D. Varodayan** and B. Girod, "Image authentication and tampering localization using distributed source coding," *Proc. IEEE International Workshop on Multimedia Signal Processing, MMSP 2007*, Crete, Greece, October 2007.
22. Y.-C. Lin, **D. Varodayan** and B. Girod, "Image authentication based on distributed source coding," *Proc. IEEE International Conference on Image Processing, ICIP 2007*, San Antonio, Texas, September 2007. Invited Paper.
23. A. Mavlankar, P. Baccichet, **D. Varodayan** and B. Girod, "Optimal slice size for streaming regions of high resolution video with virtual pan/tilt/zoom functionality," *Proc. European Signal Processing Conference, EUSIPCO 2007*, Poznan, Poland, September 2007. **Best Student Paper Award.**
24. **D. Varodayan**, A. Mavlankar, M. Flierl and B. Girod, "Distributed grayscale stereo image coding with unsupervised learning of disparity," *Proc. IEEE Data Compression Conference, DCC 2007*, Snowbird, Utah, March 2007.

### Conference Papers (continued)

25. **D. Varodayan**, A. Mavlankar, M. Flierl and B. Girod, “Distributed coding of random dot stereograms with unsupervised learning of disparity,” *Proc. IEEE International Workshop on Multimedia Signal Processing, MMSP 2006*, Victoria, Canada, October 2006. **Best Student Paper Award.**
26. **D. Varodayan**, A. Aaron and B. Girod, “Exploiting spatial correlation in pixel-domain distributed image compression,” *Proc. Picture Coding Symposium, PCS 2006*, Beijing, China, April 2006.
27. A. Aaron, **D. Varodayan** and B. Girod, “Wyner-Ziv residual coding of video,” *Proc. Picture Coding Symposium, PCS 2006*, Beijing, China, April 2006.
28. **D. Varodayan**, A. Aaron and B. Girod, “Rate-adaptive distributed source coding using low-density parity-check codes,” *Proc. Asilomar Conference on Signals, Systems, and Computers 2005*, Pacific Grove, CA, November 2005.

### Patents

1. B. Girod, Y.-C. Lin and **D. Varodayan** “Authenticated media communication system and approach,” *US Patent 20090055651 (A1)*, February 2009.

### Invited Talks

1. “Learning motion in distributed video coding,” *DISCOVER Workshop on Recent Advances in Distributed Video Coding*, Lisbon, Portugal, November 2007.
2. “Rate-adaptive distributed source coding using low-density parity-check codes,” *Max Planck Center for Visual Computing and Communication Workshop*, Saarbrücken, Germany, November 2005.