DA WANG

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EDUCATION

MIT, Electrical Engineering & Computer Science Ph.D **2010–2014**
Advisor: Gregory W. Wornell GPA: 5.0/5.0
Major: Electrical Engineering, *Minor:* Finance

MIT, Electrical Engineering & Computer Science Master of Science **2010**
Advisor: Gregory W. Wornell GPA: 5.0/5.0

University of Toronto, Electrical Engineering Bachelor of Applied Science **2008**
Major: Electrical Engineering, *Minor:* Mathematics GPA: 3.95/4

RESEARCH EXPERIENCES

Signals, Information & Algorithms Lab, Research Laboratory of Electronics (RLE), MIT
Advisor: Prof. G. W. Wornell

Efficient task replication in large-scale parallel computation

- Analyzed the impact of task replication on latency and computing cost via extreme value theory and order statistics.
- Proposed algorithms for optimal task replication.
- Showed that a proper amount of replication could reduce latency and computing cost simultaneously.

Compression in the Space of Permutations

- Characterized the rate-distortion function for lossy compression of permutations under a variety of common metrics.
- Analyze the lossless compression of permutations from the Mallows model.
- Drew implicating to ranking data storage and approximate sorting algorithms.

Fundamental limits of joint source-channel coding

- Investigated behavior of joint source-channel coding at finite block-length and characterized the *joint source-channel dispersion*.
- Demonstrated the advantage of joint source-channel coding over any separation-based scheme at finite block length.
- Proved the exponentially strong converse for joint source-channel coding.
- Evaluated the dispersion of unequal error protection channel coding as a side result.

Asynchronous communication with application to sparse communication

- Investigated the fundamental performance limits of frame synchronization in the presence of noise.
- Proposed an slotted asynchronous channel model and identified the inefficiency in existing training-based schemes, where synchronization is separated from data transmission.
- Proposed a joint synchronization-communication scheme that leads to significant performance gain in the high communication rate regime in terms of error exponents.
- Discovered alternative converse proofs for single-message unequal error protection as a side result.

Flash ADC design with noisy comparators

- Formulated the problem as scalar quantization with noisy partition points.
- Characterized quantization error using high resolution analysis.
- Derived optimal partition point densities for Gaussian and Uniform input distributions with significant resolution gain over existing designs.

Compression with Local Access and Editing

- Develop simple compression algorithms that supports efficient insertion, read and editing to arbitrary sub-sequences without decompression.

- Algorithm achieves near optimal compression ratio with little overhead for local access and editing.

Electrical & Computer Engineering, University of Toronto

Multicast capacity of network coding in broadcast-mode

- Mentor: Prof. F. R. Kschischang
- Proposed an efficient protocol to counter the pollution attack in network coding.

Webpage prefetching in wireless heterogeneous networks

- Mentor: Prof. B. Liang
- Proposed the optimal strategy for web prefetching in heterogeneous wireless networks.

WORK EXPERIENCES

Two Sigma Investments — New York, NY
Research Analyst — Aug. 2014–present

- Conducted behavioral finance research based on unstructured data.
- Designed scheduling algorithms to reduce latency in distributed parallel computing.
- Architected systems for unstructured data storage, retrieval, and processing.

Two Sigma Investments — New York, NY
Quantitative Research Intern — Jun. 2013–Aug. 2013

- Conducted quantitative behavioral research for equity markets.

OANDA Corp. — Toronto, ON
Quantitative Analyst Intern — Jun. 2012–Aug. 2012

- Researched high frequency currency data at OANDA, a global forex market marker.
- Developed prediction algorithms to reduce the transaction cost of currency rejections.
- Investigated dynamic exposure hedging strategies for currency risk management.

Swipely Inc. — Providence, RI
Intern Engineer — Jun. 2011–Aug. 2011

- Developed a statistical inference algorithm to identify merchants from highly noisy and heterogeneous credit/debit card transaction records, with significant accuracy improvement over the existing system for a large number of banks.

Bain Capital Absolute Return Capital (ARC) — Boston, MA
Intern Analyst — Jun. 2010–Aug. 2010

- Developed software for *large scale option data management* and *option pricing analysis*.

Mitsubishi Electric Research Lab (MERL) — Cambridge, MA
Intern Researcher — Jun. 2009–Aug. 2009

- Researched and implemented in Python a constraint satisfaction algorithm named "divide and concur", and applied it to *infer 3D human motion from 2D video segments*.

Altera Corporation: Toronto Technology Center — Toronto, ON, Canada
Intern Engineer — May 2006–May 2007

- FPGA CAD development in C++ and FPGA-based embedded system development.

THESES

1. **D. Wang**, "Computing with Unreliable Resources: Design, Analysis and Algorithms", Ph.D. thesis, Department of Electrical Engineering and Computer Science, MIT, May 2014
2. **D. Wang**, "Distinguishing Codes from Noise: Fundamental Limits and Applications to Sparse Communication" S.M. thesis, Department of Electrical Engineering and Computer Science, MIT, May 2010

PUBLICATIONS

1. **D. Wang**, A. Mazumdar, and G. W. Wornell, "Compression in the Space of Permutations," *IEEE Transactions on Information Theory*, vol 61, issue 12, pp. 6417-6431, December 2015.
2. **D. Wang**, G. Joshi, G. W. Wornell, "Using Straggler Replication to Reduce Latency in Large-scale Parallel Computing," *ACM SIGMETRICS Performance Evaluation Review*, vol 43, issue 3, pp. 7-11, December 2015
3. **D. Wang**, Y. Polyanskiy, G. W. Wornell, "Scalar Quantization with Noisy Partitions and its Application to Flash ADC Design," *Proc. IEEE International Symposium of Information Theory*, Honolulu, HI, 2014
4. **D. Wang**, A. Mazumdar, and G. W. Wornell, "Lossy Compression of Permutations," *Proc. IEEE International Symposium of Information Theory*, Honolulu, HI, 2014
5. H. Zhou, **D. Wang**, and G. W. Wornell, "A Simple Class of Efficient Compression Schemes Supporting Local Access and Editing," *Proc. IEEE International Symposium of Information Theory*, Honolulu, HI, 2014
6. **D. Wang**, G. Joshi, and G. W. Wornell, "Efficient Job Replication for Fast Response Times in Parallel Computation," *ACM SIGMETRICS*, Austin, TX, 2014
7. **D. Wang**, A. Mazumdar, and G. W. Wornell, "A Rate-distortion Theory for Permutation Spaces," *Proc. IEEE International Symposium of Information Theory*, Istanbul, Turkey, 2013
8. **D. Wang**, V. Chandar, S.-Y. Chung and G. W. Wornell, "On Reliability Functions for Single-Message Unequal Error Protection," *Proc. IEEE International Symposium of Information Theory*, Cambridge, MA, 2012
9. **D. Wang**, A. Ingber, Y. Kochman, "A Strong Converse for Joint Source-Channel Coding," *Proc. IEEE International Symposium of Information Theory*, Cambridge, MA, 2012
10. A. Ingber, **D. Wang**, Y. Kochman, "Dispersion Theorems via Second Order Analysis of Functions of Distributions," *Proc. 46th Annual Conference on Information Sciences and Systems (CISS)*, Princeton, NJ, 2012
11. **D. Wang**, A. Ingber, Y. Kochman, "The Dispersion of Joint Source-Channel Coding," *Proc. 49th Annual Allerton Conference on Communication, Control, and Computing*, Monticello, IL, 2011.
12. **D. Wang**, V. Chandar, S.-Y. Chung and G. W. Wornell, "Error Exponents in Asynchronous Communication," *Proc. IEEE International Symposium on Information Theory*, St. Petersburg, Russia, 2011
13. **D. Wang**, D. Silva and F. R. Kschischang, "Robust Network Coding in the Presence of Untrusted Nodes," *IEEE Transactions on Information Theory*, vol 56, issue 9, pp. 4532-4538, September 2010.
14. B. Liang, S. Drew, and **D. Wang**, "Performance of Multiuser Network-aware Prefetching in Heterogeneous Wireless Systems," *ACM/Springer Wireless Networks*, vol 15, no. 1, pp. 99-110, January 2009.
15. **D. Wang**, D. Silva, F. R. Kschischang, "Constricting the Adversary: A Broadcast Transformation for Network Coding," *Proc. 45th Annual Allerton Conference on Communication, Control, and Computing*, Monticello, IL, 2007.

SUBMITTED MANUSCRIPTS

1. J. Tang, **D. Wang**, Y. Polyanskiy, G. Wornell, "Defect Tolerance: Fundamental Limits and Examples," submitted to *IEEE International Symposium of Information Theory*, Barcelona, Spain, 2016

Reports

1. G. Joshi, JB. Rhim, J. Sun, **D. Wang**, "Fountain Codes," *Report for Principles of Digital Communication II*, MIT, December 2010.

Talks and Presentations

1. "Rank compression" (invited), *48th Annual Conference on Information Sciences and Systems (CISS)*, Princeton, NJ, March 2014
2. "Flash ADC design with noisy comparators", *RLE Immersion—Information Science and Systems*, MIT, Cambridge, MA, March 2014
3. "Distinguishing Codes from Noise", *2010 North American School of Information Theory*, University of Southern California, Los Angeles, CA, August 2010
4. "Coding and Analysis for Sparse Communication", *EECS Masterworks*, MIT, Cambridge, MA, April 2010
5. "Constricting the Adversary: A Broadcast Transformation for Network Coding", *Network Coding Day*, University of Toronto, Toronto, ON, Canada, November 2007

Professional Services

- Reviewer for *IEEE Transaction on Information Theory*
- Reviewer for *IEEE Transaction on Communications*
- Reviewer for *IEEE Communications Letters*
- Reviewer for *SAIEE Africa Research Journal*
- Reviewer for IEEE International Symposium on Information Theory (ISIT)
- Reviewer for IEEE International Symposium on Network Coding (NetCod)
- Reviewer for IEEE International Conference on Communications (ICC)
- Reviewer for IEEE Global Communication Conference (GLOBALCOM)
- Reviewer for IEEE Wireless Communication and Networking Conference (WCNC)

Teaching Experience

6.437 Inference and Information — EECS, MIT
Teaching Assistant — Spring 2011

- **Instructors**: Prof. P. Golland, Prof. G. W. Wornell
- Led recitations, wrote problem sets and exams, and held office hours for the graduate-level statistical inference course.

Awards and Honors

- **Wellington and Irene Loh Fund Graduate Fellowship**, MIT — 2013
- **Claude E. Shannon Research Assistantship**, MIT — 2011
- **NSERC Postgraduate Scholarship (Master & Doctoral level)**, Natural Sciences and Engineering Research Council of Canada — 2009 & 2010
- **Hewlett Packard Fellowship**, MIT — 2009
- **Irwin M. Jacobs and Joan K. Jacobs Presidential Fellowship**, MIT — 2008
- **William L. Everitt Student Award of Excellence**, International Engineering Consortium — 2008
- **J.E. Reid Memorial Prize**, University of Toronto — 2008
- **NSERC Undergraduate Summer Research Award**, University of Toronto — 2005 & 2007

- **CSUA Broadcast Technology Scholarship**, Canadian Satellite Users Association (CSUA) (now Canadian Broadcast Distribution Association (CBDA)) 2007
- **CPAC TD Meloche Monnex Scholarship**, Chinese Professionals Association of Canada (CPAC) 2007
- **The Adel S. Sedra Outstanding Student Awards**, Department of Electrical and Computer Engineering, University of Toronto 2006
- **IEEE Canada-Toronto Section Scholarship**, IEEE Canada, Toronto Section 2006
- **Andrew Alexander Kinghorn Scholarship**, Applied Science and Engineering Faculty, University of Toronto 2006
- **Nortel Institute Undergraduate Scholarship**, University of Toronto 2006

AFFILIATIONS & ACTIVITIES

- EECS representative, MIT *Graduate Student Council (GSC)* Fall 2012–Spring 2012
- Co-organizer, *RLE Information & Signals Seminar Series (ISSS)* Spring 2010–Fall 2011
- VP Academic, EECS Graduate Student Association (GSA), MIT 2010
  - Led a five-member team to organize academic and career events for EECS graduate students.
- Student organizer, *6.454 Graduate Seminar in Area I*, MIT Fall 2009