

Desmond S. Lun

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EDUCATION

- Massachusetts Institute of Technology** Cambridge, Massachusetts
Doctor of Philosophy in Electrical Engineering and Computer Science with minor in Mathematics, June 2006
- Thesis: Efficient operation of coded packet networks
- Master of Science in Electrical Engineering and Computer Science, September 2002*
- Thesis: Error exponents for multipath fading channels: A strong coding theorem
- University of Melbourne** Melbourne, Australia
Bachelor of Engineering (Honours), Computer Engineering, July 2001
- Thesis: Near-Shannon-limit channel coding using woven convolutional codes
- Bachelor of Science, Mathematics, July 2001*
- Université de Bordeaux I** Bordeaux, France
Exchange Student, January–June 2001
- University of California, Berkeley** Berkeley, California
Exchange Student, January–May 1999

RESEARCH EXPERIENCE

- Department of Genetics, Harvard Medical School** Boston, Massachusetts
Research Fellow, June 2007–present
- Adviser: Prof. George Church
 - Developing design tools for synthetic biology, focusing particularly on finding optimal perturbations of *Escherichia coli* for biofuel production using flux-balance metabolic modeling.
- Broad Institute of MIT and Harvard** Cambridge, Massachusetts
Computational Biologist, October 2006–present
- Developed method for inferring extracellular conditions from gene expression data using flux-balance metabolic modeling.
 - Conducted various computational analyses relating to *Mycobacterium tuberculosis*, including flux-balance metabolic modeling and mapping of transcription factor binding targets using ChIP-seq.
- Coordinated Science Laboratory, University of Illinois at Urbana-Champaign** Urbana, Illinois
Postdoctoral Research Associate, June–September 2006
- Adviser: Prof. Ralf Koetter
 - Examined, in further depth, various network coding issues, particularly those relating to its use in multi-hop wireless networks.
- Laboratory for Information and Decision Systems, MIT** Cambridge, Massachusetts
Research Assistant, September 2001–June 2006
- Adviser: Prof. Muriel Médard
 - Proposed, analyzed, and simulated novel techniques for operating wireline and wireless packet networks using network coding. This work was among the first to introduce an optimization framework to network coding and to consider packet losses analytically.

- Undertook interdisciplinary research involving members of the Department of Chemistry and the Broad Institute.
- Analyzed the performance of a certain peaky signaling scheme for multipath fading channels.
- Showed that, for a certain class of channels, feedback affects channel capacity only through power control.
- Co-supervised two undergraduate students and one master's student.

Department of Electrical Engineering, University of Melbourne Melbourne, Australia
Undergraduate Research Student, March–December 2000

- Adviser: Dr. Margreta Kuijper
- Evaluated, by simulation, the performance of woven convolutional codes operating over an additive white Gaussian noise channel.

Research Centre for Theoretical Astrophysics, University of Sydney Sydney, Australia
Summer Vacation Scholarship Student, December 1999–February 2000

- Advisers: Prof. Don Melrose and Dr. Qinghuan Luo
- Conducted a literature survey on theoretical models of pulsar emission.

Astrophysics and Supercomputing Group, Swinburne University Melbourne, Australia
Undergraduate Research Assistant, September 1997–October 1999

- Adviser: Prof. Matthew Bailes
- Wrote software to detect anomalous giant pulses in pulsar observations.
- Wrote software to dedisperse radio-telescope data using multiple workstations operating in parallel.

Astronomy Department, University of California at Berkeley Berkeley, California
Undergraduate Research Assistant, May–July 1999

- Adviser: Prof. Don Backer
- Assisted in analyzing measurements of pulsar emissions to infer properties of the interstellar medium.

TEACHING EXPERIENCE

Harvard School of Public Health Boston, Massachusetts
Teaching Assistant, An Introduction to Computational Genomics for Infectious Disease, January 2007

- Supervised computer laboratory classes and assisted in the preparation of teaching materials.

Department of Electrical Engineering and Computer Science, MIT Cambridge, Massachusetts
Head Teaching Assistant, 6.041 Probabilistic Systems Analysis, February–May 2005

- Co-ordinated and directed activities of teaching staff consisting of 16 members.
- Prepared teaching materials including problem sets and exams.

Teaching Assistant, 6.431 Applied Probability, September–December 2002

- Conducted tutorial classes and graded problem sets and exams.

Mathematics and Statistics Department, University of Melbourne Melbourne, Australia
Tutor, 620-121 Mathematics A (Advanced), March–June 2000

- Conducted tutorial classes and graded problem sets and exams.

Tutor, 620-123 Applied Mathematics (Advanced), August–November 2000

- Conducted tutorial classes and graded problem sets and exams.

OTHER EXPERIENCE

Gene Network Sciences, Inc.

Cambridge, Massachusetts

Consultant, February–May 2007

- Assessed technology platform for systems biology, and recommended and implemented a belief propagation algorithm to infer mRNA expression and cell environmental conditions from partial observations.

Vanu, Inc.

Cambridge, Massachusetts

Intern, June–August 2002

- Developed novel algorithm for fast detection of training sequences in sampled data.

AWARDS AND PRIZES

- AT&T Asia Pacific Leadership Award, 2002
- Baudin Travel Grant (la bourse Baudin) for tertiary studies in French universities, 2000
- Agilent Technologies Scholarship, 2000
- Study Abroad Scholarship, University of Melbourne, 1999, 2001
- Engineering Undergraduate Scholarship, University of Melbourne, 1997–2000

PUBLICATIONS

- Books and book chapters:
 1. T. Ho and D. S. Lun. *Network Coding: An Introduction*. Cambridge University Press, Cambridge, U.K., 2008.
 2. D. S. Lun, T. Ho, N. Ratnakar, M. Médard, and R. Koetter. Network coding in wireless networks. In F. H. P. Fitzek and M. Katz, editors, *Cooperation in Wireless Networks: Principles and Applications*. Springer, Dordrecht, The Netherlands, 2006.
- Journal articles:
 1. D. S. Lun, M. Médard, R. Koetter, and M. Effros. On coding for reliable communication over packet networks. *Physical Communication*, 1(1):3–20, March 2008.
 2. D. S. Lun, L. D. Jennings, R. Koetter, S. Licht, and M. Médard. An information-based computational technique for estimation of chromatographic peak purity. *J. Chem. Inf. Model.*, 47(5):1973–1978, September 2007.
 3. J.-S. Park, M. Gerla, D. S. Lun, Y. Yi, and M. Médard. CodeCast: A network coding based ad hoc multicast protocol. *IEEE Wireless Commun. Mag.*, 13(5):76–81, October 2006.
 4. D. S. Lun, N. Ratnakar, M. Médard, R. Koetter, D. R. Karger, T. Ho, and E. Ahmed. Minimum-cost multicast over coded packet networks. *IEEE Trans. Inform. Theory*, 52(6):2608–2623, June 2006.
 5. D. S. Lun, M. Médard, and I. C. Abou-Faycal. On the performance of peaky capacity-achieving signaling on multipath fading channels. *IEEE Trans. Commun.*, 52(6):931–938, June 2004.
- Conference papers:
 1. F. Zhao, M. Médard, D. Lun, and A. Ozdaglar. Convergence rates of min-cost subgraph algorithms for multicast in coded networks. In *Proc. 45th Annual Allerton Conference on Communication, Control, and Computing*, September 2007.

2. F. Zhao, D. S. Lun, M. Médard, and E. Ahmed. Decentralized algorithms for operating coded wireless networks. In *Proc. 2007 IEEE Information Theory Workshop (ITW 2007)*, September 2007.
3. D. Traskov, D. S. Lun, R. Koetter, and M. Médard. Network coding in wireless networks with random access. In *Proc. 2007 IEEE International Symposium on Information Theory (ISIT 2007)*, June 2007.
4. C. Fragouli, D. S. Lun, M. Médard, and P. Pakzad. On feedback for network coding. In *Proc. 2007 Conference on Information Sciences and Systems (CISS 2007)*, March 2007.
5. A. Eryilmaz and D. S. Lun. Control for inter-session network coding. In *Proc. 2007 Information Theory and Applications Workshop (ITA 2007)*, January-February 2007.
6. J.-S. Park, D. S. Lun, F. Soldo, M. Gerla, and M. Médard. Performance of network coding in ad hoc networks. In *Proc. IEEE Milcom 2006*, October 2006.
7. J.-S. Park, U. Lee, S. Oh, M. Gerla, and D. S. Lun. Emergency related video streaming in VANETs using network coding. In *Proc. 3rd ACM international workshop on vehicular ad hoc networks (VANET 2006)*, September 2006.
8. P. Maymounkov, N. J. A. Harvey, and D. S. Lun. Methods for efficient network coding. In *Proc. 44th Annual Allerton Conference on Communication, Control, and Computing*, September 2006.
9. D. Traskov, N. Ratnakar, D. S. Lun, R. Koetter, and M. Médard. Network coding for multiple unicasts: An approach based on linear optimization. In *Proc. 2006 IEEE International Symposium on Information Theory (ISIT 2006)*, pages 1758–1762, July 2006.
10. D. S. Lun, P. Pakzad, C. Fragouli, M. Médard, and R. Koetter. An analysis of finite-memory random linear coding on packet streams. In *Proc. 4th International Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOpt '06)*, April 2006.
11. D. S. Lun, M. Médard, and R. Koetter. Network coding for efficient wireless unicast. In *Proc. 2006 International Zurich Seminar on Communications (IZS 2006)*, February 2006. Invited paper.
12. D. S. Lun, M. Médard, R. Koetter, and M. Effros. Further results on coding for reliable communication over packet networks. In *Proc. 2005 IEEE International Symposium on Information Theory (ISIT 2005)*, pages 1848–1852, September 2005.
13. C. Luo, M. Médard, L. Zheng, and D. S. Lun. Multi-tone FSK with feedback. In *Proc. 2005 IEEE International Symposium on Information Theory (ISIT 2005)*, pages 112–116, September 2005.
14. D. S. Lun, M. Médard, and R. Koetter. Efficient operation of wireless packet networks using network coding. In *Proc. International Workshop on Convergent Technologies (IWCT) 2005*, June 2005. Invited paper.
15. S. Deb, M. Effros, T. Ho, D. Karger, R. Koetter, D. S. Lun, M. Médard, and N. Ratnakar. Network coding for wireless applications: A brief tutorial. In *Proc. International Workshop on Wireless Ad-hoc Networks (IWWAN) 2005*, May 2005. Invited paper.
16. D. S. Lun, M. Médard, and D. R. Karger. On the dynamic multicast problem for coded networks. In *Proc. WINMEE, RAWNET, and NETCOD 2005 workshops*, April 2005.
17. D. S. Lun, N. Ratnakar, R. Koetter, M. Médard, E. Ahmed, and H. Lee. Achieving minimum cost multicast: A decentralized approach based on network coding. In *Proc. IEEE Infocom 2005*, volume 3, pages 1607–1617, March 2005.
18. D. S. Lun, M. Médard, T. Ho, and R. Koetter. Network coding with a cost criterion. In *Proc. 2004 International Symposium on Information Theory and its Applications (ISITA 2004)*, October 2004.
19. D. S. Lun, M. Médard, and M. Effros. On coding for reliable communication over packet networks. In *Proc. 42nd Annual Allerton Conference on Communication, Control, and Computing*, September–October 2004. Invited paper.

20. D. S. Lun and M. Médard. On the sufficiency of power control for a class of channels with feedback. In *Proc. 2004 IEEE International Symposium on Information Theory (ISIT 2004)*, page 73, June–July 2004.
 21. D. S. Lun, M. Médard, and I. C. Abou-Faycal. Error exponents for capacity-achieving signaling on wideband Rayleigh fading channels. In *Proc. 2002 International Symposium on Information Theory and its Applications (ISITA 2002)*, October 2002.
 22. D. S. Lun, M. Médard, and I. C. Abou-Faycal. An upper bound on the error probability of capacity-achieving signaling on broadband Rayleigh fading channels. In *Proc. 56th IEEE Vehicular Technology Conference (VTC 2002-Fall)*, volume 1, pages 577–581, September 2002.
 23. D. S. Lun, M. Médard, and I. C. Abou-Faycal. Error exponents for wideband multipath fading channels — a strong coding theorem. In *Proc. 2002 Conference on Information Sciences and Systems (CISS 2002)*, March 2002.
- Forthcoming:
 1. J.-S. Park, U. Lee, S. Y. Oh, M. Gerla, D. S. Lun, W. W. Ro, and J. Park. Delay analysis of car-to-car reliable data delivery strategies based on data mulling with network coding. *IEICE Trans. Inf. & Syst.* To appear.
 2. A. Eryilmaz and D. S. Lun. Control for inter-session network coding. *IEEE Trans. Inform. Theory*. Submitted.
 3. A. Brandes¹, D. S. Lun¹, J. Zucker, C. Colijn, M. R. Farhat, B. K. Weiner, and J. E. Galagan. Inferring extracellular environment from gene expression profiles using metabolic flux balance models. *Mol. Syst. Biol.* Submitted.
 4. C. Colijn, D. S. Lun, B. K. Weiner, A. Brandes, J. Zucker, M. R. Farhat, M. Murray, and J. E. Galagan. Interpreting expression data with metabolic flux models: Predicting *M. tuberculosis* mycolic acid production. *Mol. Syst. Biol.* Submitted.
 5. L. D. Jennings, D. S. Lun, M. Médard, and S. Licht. ClpP hydrolyzes a protein substrate processively and indendently of the ClpA ATPase: Mechanistic studies of ATP-indendent processive proteolysis. *Biochemistry*. Submitted.
 6. K. Eswaran, B. K. Weiner, D. S. Lun, and J. E. Galagan. Flexible framework for operon prediction via conditional random fields. In preparation.

PATENTS

- D. S. Lun, M. Médard, T. Ho, R. Koetter, and N. Ratnakar. Minimum-cost routing with network coding. U.S. Patent Application No. 20060146716.

PROFESSIONAL MEMBERSHIPS

- Member, Institute of Electrical and Electronic Engineers (IEEE)
- Member, American Association for the Advancement of Science (AAAS)
- Member, Sigma Xi Scientific Research Society

SERVICE

- TPC member, IEEE International Workshop on Wireless Network Coding (WiNC) 2008

¹These authors contributed equally.

- Co-chair, Organizing Committee for Laboratory for Information and Decision Systems (LIDS) Colloquium 2004/2005
- Member, Organizing Committee for Laboratory for Information and Decision Systems (LIDS) Student Conference 2003, 2005, 2006

LANGUAGES

English, French, Cantonese