

Nan Ma

CONTACT INFORMATION	Department of Electrical and Computer Engineering, Boston University Room 401A, 8 St. Mary's St., Boston, MA 02215 Tel: (617) 412-7324, Email: nanma@bu.edu Homepage: http://people.bu.edu/nanma/		
RESEARCH INTERESTS	Network Information Theory, Network Coding, Communications, Distributed Computation, Data/Sensor Networks, Distributed Signal Processing, and Image and Video Processing		
EDUCATION	Boston University , (Boston, Massachusetts, USA)	Sep. 2005 to date	GPA: 4.0/4.0
	<u>Ph. D., Electrical and Computer Engineering</u>		<u>Expected Graduation Date: May 2010</u>
	<u>Thesis: Interactive Source Coding for Function Computation in Networks</u>		
	<u>Advisor: Prof. Prakash Ishwar</u>		
	Tsinghua University , (Beijing, P.R.China)	Sep. 2002 to Jan. 2005	GPA: 3.8/4.0
	<u>M.S., Electronic Engineering</u> , Jan. 2005		
	<u>Thesis: Study on Transmission Performance in 40Gbps Transmission Systems</u>		
	<u>Advisor: Prof. Shizhong Xie</u>		
	Tsinghua University , (Beijing, P.R.China)	Sep. 1998 to Jul. 2002	GPA: 3.9/4.0
	<u>B.E. in Electronic Engineering</u> , Jul. 2002		
	<u>Thesis: Study on Modulation Formats in High-Speed Optical Transmission Systems.</u>		
	<u>Advisor: Prof. Ye Dong</u>		
WORK EXPERIENCE	Research Assistant	<i>ECE Dept., Boston University</i>	Jun. 2006 to date
	<i>Research Supervisor: Prof. Prakash Ishwar</i>		
	1) <i>Infinite-message Interactive Function Computation</i> Characterized the ultimate limit of interactive function computation using <i>an infinite number of infinitesimal-rate messages</i> in terms of the convex-geometric properties of the minimum sum-rate functional. This has opened up to a new dimension for asymptotic analysis in distributed source coding. An iterative algorithm is provided to efficiently evaluate the minimum sum-rate.		
	2) <i>Interactive Distributed Lossy Source Coding</i> Answered a long-standing question that was unresolved for 25 years by providing the first example for which two messages <i>strictly improves</i> the performance of the traditional one-message Wyner-Ziv lossy source coding scheme.		
	3) <i>Delayed Sequential Coding of Correlated Sources</i> Characterized the benefit of encoder/decoder frame-delays in the problem of sequential coding of correlated sources which is motivated by video coding applications. Under suitable conditions, the sum-rate performance of sequential coding with <i>only one frame-delay</i> can match the performance of joint coding which potentially requires <i>infinite frame-delays</i> .		
	4) <i>Distributed Field Reconstruction with One-bit Sensors</i> Proved that almost all spatio-temporal fields can be reconstructed to arbitrary accuracy using a sufficiently dense network of unreliable noisy <i>one-bit</i> sensors. The proposed reconstruction scheme achieves the optimal scaling law with respect to sensor density for certain class of fields. (with colleague Ye Wang)		
	Research Intern	<i>Bell Laboratories, Alcatel-Lucent</i>	Jul. 2008 to Aug. 2008
	<i>Mentor: Dr. Piyush Gupta</i>		
	<i>Interactive Distributed Function Computation in Collocated Networks</i>		
	Studied the multi-round function computation problem in large wireless sensor networks. Obtained a conceptual understanding that <i>the structure of the communication network inevitably reveals a certain type of information which is not demanded in the function computation</i> . Uncovered a new family of lower bounds for collocated		

networks using the new conceptual understanding which are order-wise better than cut-set bounds. The new bounds lead to optimal scaling laws of the sum-rate for different types of symmetric functions.

Research Assistant *Tsinghua University* Jan. 2002 to Jan 2005

Research Supervisor: Prof. Shizhong Xie

Performance of 40Gbps optical transmission systems using different modulation formats:

Analyzed the impact of modulation formats on the performance of 40Gbps optical transmission systems using both numerical simulation and experiments.

Graduate Teaching Fellow *ECE Department, Boston University* Fall 2005, Spring 2006

Electromagnetic Systems, Fall 2005

Held weekly discussion sessions and office hours

Electric Circuit Theory, Spring 2006

Held discussion sessions, lab sessions, and office hours

Substitute Instructor *ECE Department, Boston University* 2008, 2009

Gave two substitute lectures on *Introduction to Information Theory* (graduate level) and a substitute lecture on *Digital Communication* (graduate level).

ADVANCED
COURSEWORK

Functional Analysis, Complex Analysis, Stochastic Processes, Linear & Nonlinear Optimization, Pattern Recognition, Machine Learning, Wireless Communications, Information Theory, Image Restoration and Reconstruction, Randomized Network Algorithms, Photonics, Optical Communication Systems, Quantum Mechanics

COURSE
PROJECTS

Introduction to Information Theory: *Duality and Matching between Source and Channel Coding*

Randomized Network Algorithms: *Analysis of Ant Routing Algorithms*

PUBLICATIONS

Journal Papers:

1. **Nan Ma** and Prakash Ishwar, "On Delayed Sequential Coding of Correlated Sources," submitted to *IEEE Trans. Inf. Theory* in Sep. 2008, under review, arXiv:cs/0701197v2.
2. **Nan Ma** and Prakash Ishwar, "Distributed Source Coding for Interactive Function Computation," submitted to *IEEE Trans. Inf. Theory* in Nov. 2008, under review, arXiv:0801.0756v4.
3. **Nan Ma** and Prakash Ishwar, "Infinite-message Distributed Source Coding for Interactive Function Computation," in preparation, will be submitted to *IEEE Trans. Inf. Theory* by Apr. 2010, arXiv:0908.3512v2.
4. **Nan Ma**, Piyush Gupta and Prakash Ishwar, "Interactive Function Computation in Collocated Networks," in preparation, will be submitted to *IEEE Trans. Inf. Theory* by Apr. 2010.

Conference Papers:

1. **Nan Ma** and Prakash Ishwar, "Interaction Strictly Improves the Wyner-Ziv Rate-distortion Function," submitted to *IEEE Internat. Symp. Information Theory 2010 (ISIT'10)*, arXiv:1001.2781v1.
2. **Nan Ma** and Prakash Ishwar, "Infinite-message Interactive Function Computation in Collocated Networks," submitted to *IEEE Internat. Symp. Information Theory 2010 (ISIT'10)*, arXiv:1001.1763v1.
3. **Nan Ma** and Prakash Ishwar, "Infinite-message Distributed Source Coding for Two-terminal Interactive Computing," in *Proc. 47th Annu. Allerton Conf. Communication, Control, Computing*, Monticello, IL, Sep. 30–Oct. 7, 2009.
4. **Nan Ma**, Prakash Ishwar and Piyush Gupta, "Information-Theoretic Bounds for Multiround Function Computation in Collocated Networks," in *Proc. IEEE Int. Symp. Information Theory (ISIT'09)*, Seoul, Korea, Jun. 28–Jul. 3, 2009, pp. 2306 – 2310.
5. **Nan Ma** and Prakash Ishwar, "Two-terminal Distributed Source Coding with Alternating Messages for Function Computation," in *Proc. IEEE Int. Symp. Information Theory (ISIT'08)*, Toronto, Canada, Jul. 6–11, 2008, pp. 51–55.
6. **Nan Ma** and Prakash Ishwar, "The Value of Frame-Delays in the Sequential Coding of Correlated Sources," in *Proc. IEEE Int. Symp. Information Theory (ISIT'07)*, Nice, France, Jun. 24–29, 2007, pp. 1496–1500.
7. **Nan Ma**, Ye Wang and Prakash Ishwar, "Delayed Sequential Coding of Correlated Sources," in *Proc.*

Information Theory and Applications workshop (ITA'07), San Diego, Jan. 2007.

8. Ye Wang, **Nan Ma**, Manqi Zhao, Prakash Ishwar and Venkatesh Saligrama, "On Universal Distributed Estimation of Noisy Fields with One-bit Sensors," in *Proc. 44th Annu. Allerton Conf. Communication, Control, Computing, Monticello, IL, Sep. 27–Sep. 29, 2006*.
9. **Nan Ma**, Minghua Chen and Shizhong Xie, "Study on Optimization of Transmission Profile of Filter in Pre-Filtering 40Gbps Transmission," in *Proc. Asia-Pacific Optical Communications conference (APOC)*, Beijing, China, Nov. 9, 2004

Book Chapters:

1. Ye Wang, **Nan Ma**, Manqi Zhao, Prakash Ishwar and Venkatesh Saligrama, "Distributed field estimation with one-bit sensors," *Networked Sensing Information and Control*, Springer, Jan 2008.

INVITED PRESENTATIONS OF RESEARCH WORK

1. "Interactive Distributed Source Coding for Network Function Computation," *Information Theory and Applications workshop (ITA'10), Graduation Day*, San Diego, Feb. 2010.
2. "Kaspi's Two-Way Source Coding Question Resolved," *Information Theory and Applications workshop (ITA'10)*, San Diego, CA, Feb. 2010.
3. "Two-terminal distributed source coding for interactive function computation with finite or infinite messages," *Signals, Information, and Algorithms Laboratory Seminar, MIT*, Cambridge, MA, Nov. 2009.
4. "Bounds for Interactive Computation in Collocated Networks," *School of Information Theory*, Evanston, IL, Aug. 2009.
5. "Two-terminal Distributed Source Coding with Alternating Messages for Function Computation," *Tsinghua University*, Beijing, China, May 2009.
6. "Distributed Coding for Interactive Computing," *Workshop on the Frontiers in Distributed Communication, Sensing, and Control, Yale University*, New Haven, CT, Oct. 2008.
7. "Delayed Sequential Coding of Correlated Sources," *BU Science and Technology Day*, Boston, MA, May 2007
8. "Delayed Sequential Coding of Correlated Sources," *Information Theory and Applications workshop (ITA'07)*, San Diego, CA, Jan. 2007.

PEER REVIEWING

- IEEE Transactions on Information Theory
- IEEE International Symposium on Information Theory (ISIT) 2010
- IEEE International Symposium on Information Theory (ISIT) 2009
- IEEE International Symposium on Information Theory (ISIT) 2008
- IEEE International Symposium on Information Theory (ISIT) 2007
- IEEE Conference on Decision and Control (CDC) 2008
- IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP) 2009
- IEEE International Conference on Distributed Computing in Sensor Systems (DCOSS) 2009
- IEEE Conference on Computer Communications (INFOCOM) 2010

HONORS AND AWARDS

- **ITA 2010 Graduation Day talk:** Selected as the sole representative from Boston University to present an expository research talk in the prestigious Graduation Day event hosted by the Fifth International Workshop on Information Theory and Applications (ITA), University of California, San Diego, February, 2010. Only exceptional graduate students and recently graduated postdocs seeking academic positions in 2010 were invited to present their research.
- Selected to participate and present a research poster in the Second Annual North American School of Information Theory, Northwestern University, August, 2009.
- Excellent Bachelor Thesis Award, Tsinghua University
- Excellent Graduate Award, Tsinghua University

REFERENCES

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