Gauri Joshi

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EMPLOYMENT

IBM T. J. Watson Research Center	July 2016 –
Research Staff Member	Yorktown Heights NY

EDUCATION

Massachusetts Institute of Technology Sept 2012– Jun 2016 (expected)

Ph.D in Electrical Engineering & Computer Science, GPA 5.0/5.0 (minor in Finance)
Thesis: Using Redundancy to Reduce Latency in Cloud Systems
Committee: Gregory Wornell (advisor), Emina Soljanin, Devavrat Shah

Massachusetts Institute of Technology Sept 2010– Jun 2012

S.M. in Electrical Engineering & Computer Science, GPA 5.0/5.0
Thesis: On Playback Delay in Streaming Communication **Best Thesis Award**
Advisors: Gregory Wornell, Yuval Kochman

Indian Institute of Technology Bombay Jul 2005–Jun 2010

B. Tech & M. Tech in Electrical Engineering; GPA 9.72/10.0 **Institute Gold Medal**
Thesis: On Relay-Assisted Cellular Networks
Advisor: Abhay Karandikar

RESEARCH INTERESTS

Probabilistic Modeling, Stochastic Processes

Statistical Inference, Machine Learning

Information Theory, Coding

AWARDS, HONORS, AND SCHOLARSHIPS

Awards/Honors

Invited to the **Rising Stars in EECS** workshop for women pursuing academic careers	2015
Graduate Women of Excellence Award, MIT	2013
William Martin Memorial Award for **Best Masters Thesis** in Computer Science, MIT	2012
Morris Joseph Levin Award for **Outstanding Oral Thesis Presentation**, MIT	2012
Institute Gold Medal for highest GPA in the undergraduate class, IIT Bombay	2010
Institute Silver Medal for highest GPA in the masters class, IIT Bombay	2010
Best student in Communications & Signal processing Award, IIT Bombay	2009
Selected among top 50 students in India for the International Chemistry Olympiad camp	2005

Scholarships

Claude E. Shannon Research Assistantship, MIT (full tuition+stipend)	2015–2016
Schlumberger **Faculty for the Future Fellowship** ($50000 funding per year)	2011–2015
Irwin and Joan Jacobs Presidential Fellowship, MIT (full tuition+stipend)	2010–2011
HP fellowship, MIT (summer funding)	2011
Boeing scholarship for academic excellence, IIT Bombay	2010
World Quant scholarship for academic excellence, IIT Bombay	2009

RESEARCH AND INDUSTRIAL EXPERIENCE

Massachusetts Institute of Technology, Cambridge MA   Sept 2012 - present
Using Redundancy to Reduce Latency in Cloud Storage and Computing

– Used mathematical analysis of queues with redundancy, and introduced the (n, k) fork-join queueing framework to study the trade-off between latency and cost of computing time

– Identified surprising regimes where latency and computing cost can be reduced simultaneously

– Proposed cost-efficient redundancy strategies and tested them on Google cluster traces

Massachusetts Institute of Technology, Cambridge MA   Sept 2010 - May 2014
Throughput-Smoothness Trade-offs in Streaming Communication

– Developed bandwidth-efficient erasure codes that minimize interruptions in playback

– Analyzed the effect of frequency of feedback, and multiple users on the trade-offs

Google Inc., Mountain View CA   Summer 2014
Optimizing Data Placement Across Cells in Blobstore   Mentors: Arif Merchant, Alex Shraer

– Designed and implemented a simulator to evaluate data placement algorithms

– Proposed new algorithm that reduced number of cells exceeding CPU quota by $> 77\%$.

Google Inc., Mountain View CA   Summer 2013
Canary Validation Using Signal Processing   Mentors: Brett Schein, Xinyi Zhang

– Devised and implemented an anomaly detection algorithm to validate whether a signal measured from a canary matches with the production build.

– The method is robust to outliers and transients and detects anomalies with $> 95\%$ accuracy

Bell Labs Alcatel-Lucent, Murray Hill NJ   Summer 2012
Erasure Coding for Fast Content Download   Mentor: Emina Soljanin

– Analyzed the download time of a file coded over chunks called generations to reduce complexity

– Proposed a novel coding scheme to overlap generations that reduced download time by $> 20\%$

Qualcomm Corporate R&D, San Diego CA   Summer 2009
Performance Analysis of Active Hand-off in Femtocells   Mentors: Mehmet Yavuz, Chirag Patel

– Analyzed and improved a method to use reverse link signal measurements to perform active hand-off from a CDMA base station to a femtocell

– Demonstrated how multiple RL measurements can reduce the probability of hand-off error

IIT Bombay, Dual Degree Thesis Jun 2009-Jun 2010
Analysis of relays in cellular networks

– Optimized the relay placement radius to maximize cellular coverage area

– Determined the Erlang capacity of a relay-assisted cellular OFDMA system

TEACHING AND MENTORSHIP

EECS REFS, Conflict Management and Mentorship in EECS, MIT	Jan 2014 -present
Complete a 40-hour training course in conflict management and mediation, MIT	Jan 2014
Completed a semester-long Graduate Teaching Certificate Program offered by MIT	Spring 2013

Teaching Assistant (formulating and grading assignments and exams, teaching recitations)

– Introduction to Inference (undergraduate), MIT	Fall 2012
– Wireless & Mobile Communication, IIT Bombay	Spring 2010
– Digital Message Transmission, IIT Bombay	Fall 2009

Homework grader

– Algorithms for Inference, MIT	Fall 2013, 2014
– Inference and Information, MIT	Spring 2013, 2015
– Introduction to Inference	Spring 2014
– Signals and Systems	Spring 2012
Project Mentor for two summer interns at InfoNet Lab, IIT Bombay	2010
Institute Student Mentor for freshmen, IIT Bombay	2008–2010

PUBLICATIONS

Journal

[J5] G. Joshi, Y. Liu, E. Soljanin, "On the Delay-Storage Trade-off in Coded Distributed Storage Systems", *IEEE Journal on Selected Areas of Communications*, volume 32, number 5, May 2014, arXiv:1305.3945, based on [C5]

[J4] G. Joshi, E. Soljanin, G. Wornell, "Efficient Redundancy Techniques to Reduce Latency in Cloud Systems", *submitted to ACM Transactions on Modeling and Performance Evaluation of Computing Systems*, 2015, arXiv:1508.03599, based on [C12], [C13]

[J3] D. Wang, G. Joshi, G. Wornell, "Efficient Straggler Replication in Parallel Computing ", under submission, arXiv:1503.03128, based on [C8], [C11]

[J2] G. Joshi, Y. Kochman, G. Wornell, "On Throughput-Smoothness Trade-offs in Streaming Communication", under submission, arXiv:1511.08143, based on [C7], [C9]

[J1] K. Mahadaviani, G. Joshi, A. Khisti, G. Wornell, "Playback Delay in Real-time and On-demand Streaming Communication", in preparation, based on [C4], [C10]

Conference

[C13] G. Joshi, E. Soljanin, G. Wornell, "Efficient Task Replication to Reduce Latency in Cloud Systems", *Allerton Conference on Communication, Control and Computing*, Sep 2015.

[C12] G. Joshi, E. Soljanin, G. Wornell, "Queues with Redundancy: Latency-Cost Analysis", *SIGMETRICS Workshop on Mathematical Modeling and Analysis*, Jun 2015.

[C11] D. Wang, G. Joshi, G. Wornell, "Using Straggler Replication to Reduce Latency in Large-scale Parallel Computing", *SIGMETRICS Workshop on Distributed Cloud Computing*, Jun 2015.

[C10] K. Mahadaviani, A. Khisti, G. Joshi, G. Wornell, "Playback Delay in Streaming Communication with Feedback *International Symposium on Information Theory (ISIT)*, Jun 2015.

[C9] G. Joshi, Y. Kochman, G. Wornell, "Throughput-Smoothness Trade-offs in Multicasting of an Ordered Packet Stream", *International Symposium on Network Coding (NetCod)*, Jun 2014.

[C8] D. Wang, G. Joshi, G. Wornell, "Efficient Job Replication for Fast Response Times in Parallel Computation", *ACM SIGMETRICS*, Jun 2014.

[C7] G. Joshi, Y. Kochman, G. Wornell, "The Effect of Block-wise Feedback on the Throughput-Delay Trade-off in Streaming", *INFOCOM Workshop on Communication and Networking Techniques for Contemporary Video*, Apr 2014.

[C6] G. Joshi, E. Soljanin, "Round-robin Overlapping Generations Coding for Fast Content Download", *International Symposium on Information Theory (ISIT)*, Jul 2013.

[C5] G. Joshi, Y. Liu, E. Soljanin, "Coding for Fast Content Download", *Invited Paper, Allerton Conference on Communication, Control and Computing*, Oct 2012.

[C4] G. Joshi, Y. Kochman, G. Wornell, "On Playback Delay in Streaming Communication", *International Symposium on Information Theory (ISIT)*, Jul 2012.

[C3] G. Joshi, A. Karandikar, "Optimal Relay Placement for Cellular Coverage Extension", *National Conference on Communications, India*, Jan 2011.

[C2] G. Joshi, H. Maral, A. Karandikar, "Downlink Erlang Capacity of cellular OFDMA", *National Conference on Communications, India*, Jan 2011.

[C1] G. Joshi, M. Yavuz, C. Patel, "Performance Analysis of Handoff in CDMA2000 Femtocells", *National Conference on Communications, India*, Jan 2010.

INVITED TALKS

Using Efficient Redundancy to Reduce Latency in Cloud Systems

Carnegie Mellon University, Pittsburgh PA	Mar 2016
University of Southern California, Los Angeles, CA	Mar 2016
IBM T. J. Watson Research Center, Yorktown Heights NY	Feb 2016
Princeton University, EE Departmental Seminar, NJ	Feb 2016
Graduation Day, Information Theory and Applications Workshop UCSD	Feb 2016
IBM Research Student Workshop on Cloud and Data Services, NY	Dec 2015
Rising Stars in EECS, academic workshop for women, MIT	Nov 2015
Mobile Networked Systems Group, MIT	Sept 2014
Google Headquarters, Mountain View, CA	Aug 2014
University of California Berkeley CA	Aug 2014
DIMACS Workshop on Green Data Storage, Rutgers NJ	Dec 2013

Throughput-Smoothness Trade-offs in Streaming Communication

BIRS Workshop on Mathematical Coding Theory for Streaming	Oct 2015
University of Toronto, Canada	May 2014
Indian Institute of Technology (IIT) Bombay	Aug 2012

Professional Activities

Invited Participant

Information Theory and Applications Workshop, UCSD	Feb 2016
IBM Research Student Workshop on Cloud and Data Services, NY	Dec 2015
Rising Stars in EECS, academic workshop for women, MIT	Nov 2015
BIRS Workshop on Coding Techniques for Multimedia Streaming, Banff, Canada	Oct 2015
DIMACS Workshop on Green Data Storage, Rutgers NJ	Dec 2013

Journal Reviewer

IEEE Transactions on Communications, IEEE Transactions on Information Theory, IEEE Journal of Selected Areas of Communications, IEEE Transactions on Wireless Communications, IEEE Communication Letters, IEEE Wireless Communication Letters, IEEE/ACM Transactions on Networking

Conference Reviewer

International Symposium on Information Theory (ISIT), Information Theory Workshop (ITW), International Conference on Communications (ICC), Conference on Learning Theory (COLT)

Selected Coursework

Machine Learning	Inference and Information	Algorithms for Inference
Discrete Stochastic Processes	Information Theory	Coding Theory
Data Structures and Algorithms	Linear Algebra	Optimization Methods

Programming Skills

Experienced: MATLAB, Python   **Proficient:** Java, C++, SQL

Student Leadership Activities

EECS Visiting Committtee, Student member	2013, 2015
Co-President, Graduate Women in EECS, MIT	2013
President, Sangam, Indian Students Association, MIT	2012–2013
Vice-President, Sangam, Indian Students Association, MIT	2011–2012
Institute Academic Reforms Committee, IIT Bombay	2009
Hostel Music and Dance Secretary, IIT Bombay	2007