

# Gauri Joshi

<http://andrew.cmu.edu/user/gaurij>

Email: [gaurij@andrew.cmu.edu](mailto:gaurij@andrew.cmu.edu)

## EMPLOYMENT

---

<b>Carnegie Mellon University</b> Assistant Professor of Electrical and Computer Engineering	Sept 2017 – present Pittsburgh PA
<b>IBM T. J. Watson Research Center</b> Research Staff Member	July 2016 – Aug 2017 Yorktown Heights NY

## EDUCATION

---

<b>Massachusetts Institute of Technology</b> Ph.D in Electrical Engineering & Computer Science, GPA 5.0/5.0 (minor in Finance) <i>Thesis:</i> Using Redundancy to Reduce Latency in Cloud Systems <i>Committee:</i> Gregory Wornell (advisor), Emina Soljanin, Devavrat Shah	Sept 2012– Jun 2016
<b>Massachusetts Institute of Technology</b> S.M. in Electrical Engineering & Computer Science, GPA 5.0/5.0 <i>Thesis:</i> On Playback Delay in Streaming Communication <i>Advisors:</i> Gregory Wornell, Yuval Kochman	Sept 2010– Jun 2012 <b>Best Thesis Award</b>
<b>Indian Institute of Technology Bombay</b> B. Tech & M. Tech in Electrical Engineering; GPA 9.72/10.0 <i>Thesis:</i> On Relay-Assisted Cellular Networks <i>Advisor:</i> Abhay Karandikar	Jul 2005–Jun 2010 <b>Institute Gold Medal</b>

## RESEARCH INTERESTS

---

Probabilistic Modeling, Stochastic Processes  
Statistical Inference, Machine Learning  
Information Theory, Coding

## SELECTED AWARDS AND HONORS

---

### Awards/Honors

William Martin Memorial Award for <b>Best Masters Thesis</b> in Computer Science, MIT	2012
Morris Joseph Levin Award for <b>Outstanding Oral Thesis Presentation</b> , MIT	2012
<b>Institute Gold Medal</b> 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 <b>Faculty for the Future Fellowship</b> (\$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

- 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 - Jun 2016
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**

- [J4] 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
- [J3] G. Joshi, E. Soljanin, G. Wornell, “Efficient Redundancy Techniques to Reduce Latency in Cloud Systems”, *ACM Transactions on Modeling and Performance Evaluation of Computing Systems*, volume 2, issue 2, May 2017, arXiv:1508.03599
- [J2] D. Wang, G. Joshi, G. Wornell, “Efficient Straggler Replication in Parallel Computing”, under submission, arXiv:1503.03128
- [J1] G. Joshi, Y. Kochman, G. Wornell, “On Throughput-Smoothness Trade-offs in Streaming Communication”, under submission, arXiv:1511.08143

**Conference**

- [C14] G. Joshi, “Boosting Service Capacity via Adaptive Task Replication”, *ACM Sigmetrics MAMA workshop*, June 2017.
- [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

---

### **Efficient Redundancy Techniques to Reduce Latency in Cloud Systems**

Rutgers University, New Brunswick NJ	Mar 2017
Indian Institute of Technology Bombay, Mumbai	Dec 2016
Tata Institute of Fundamental Research, Mumbai	Dec 2016
Texas A&M University TX	Oct 2016
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

### **Using Coding to Reduce Delay in Content Access**

Joint Mathematics Meeting, Atlanta	Jan 2017
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
<b>Throughput-Smoothness Trade-offs in Streaming Communication</b>	
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

ICERM Women in Data Science and Math, Brown Univ.	July 2017
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, Journal of Operations Research, Performance Evaluation, IEEE Transactions on Services Computing

### 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

---

## STUDENT LEADERSHIP ACTIVITIES

EECS Visiting Committee, 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