

VARUN GUPTA

Associate Professor of
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RESEARCH INTERESTS

Stochastic modeling and optimization; applied probability; algorithm design and analysis; mechanism design with applications to:

- Learning and Control in Non-stationary environments
- Energy management/load balancing algorithms for cloud computing
- Spatial queueing and matching in transportation systems
- Operations of online platforms
- Influence propagation in social networks

EDUCATION

Ph.D. Computer Science, May 2011.

Carnegie Mellon University, Pittsburgh, PA, USA.

Thesis: *Stochastic Models and Analysis for Resource Management in Server Farms*

Advisor: Prof. Mor Harchol-Balter

Committee Members: David Andersen (CMU); Anupam Gupta (CMU); Alan Scheller-Wolf (Tepper School of Business, CMU); Devavrat Shah (EECS, LIDS and ORC, MIT); Don Towsley (UMass., Amherst)

B.Tech. Computer Science and Engineering, *President's Gold Medal winner*, August 2004.
Indian Institute of Technology, New Delhi, India.

Thesis: *Algorithms for Computational Biology: Sequence Analysis*

Advisor: Prof. S.N. Maheshwari

WORK EXPERIENCE

| | |
|---|--------------------|
| University of Chicago, Booth School of Business | Chicago, IL |
| Associate Professor of Operations Management | July 2016– Present |

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| University of Chicago, Booth School of Business | Chicago, IL |
| Assistant Professor of Operations Management | July 2012– June 2016 |

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| Google Inc. | New York, NY |
| PostDoctoral Researcher | August 2011– June 2012 |

Carnegie Mellon University
Graduate Research Assistant
Prof. Mor Harchol-Balter

Pittsburgh, PA
August 2004–May 2011

Bell Laboratories, Alcatel-Lucent
Research Intern
Host: Sem Borst

Murray Hill, NJ
Summer 2008

Microsoft Research Ltd.
Research Intern
Host: Milan Vojnovic

Cambridge, UK
Summer 2006

PUBLICATIONS

Journal Publications

1. “Greedy Algorithm for Multiway Matching with Bounded Regret.” V. Gupta. Forthcoming in *Operations Research*.
2. “Dynamic Regret Minimization for Non-Stationary LQR Control.” *Proceedings of the ACM on Measurement and Analysis of Computing Systems*. 2022. Vol. 6, No. 1. Y. Luo, V. Gupta, and M. Kolar.
3. “Diffusion Approximation and Optimal Control for State-dependent Limited Processor Sharing Queues.” *Stochastic Systems*. 2022. Vol. 12, No. 2. V. Gupta, and J. Zhang.
4. “On the Optimal Design of Bipartite Matching Queueing System.” *Operations Research*. 2022. Vol. 70, No. 1. P. Afeche, R. Caldentey, and V. Gupta.
5. “Interior-Point Based Online Stochastic Bin Packing.” *Operations Research*. 2020. Vol. 68, No. 5. V. Gupta, and A. Radovanovic.
6. “Estimation of a Low-rank Topic-Based Model for Information Cascades.” *Journal of Machine Learning Research*. 2020. Vol. 21, No. 71. M. Yu, V. Gupta, and M. Kolar.
7. “Greed Works - Online Algorithms For Unrelated Machine Stochastic Scheduling.” *Mathematics of OR*. 2020. Vol. 45, No. 2. V. Gupta, B. Moseley, M. Uetz, and Q. Xie.
8. “Load Balancing in the Non-Degenerate Slowdown Regime.” *Operations Research*. 2019. Vol. 67, No. 1. V. Gupta, and N. Walton.
9. “Search among Queues under Quality Differentiation.” *Management Science*. 2019. Vol. 65, No. 8. L. Yang, L. Debo, and V. Gupta.
10. “Trading Time in a Congested Environment.” *Management Science*. 2016. Vol. 63, No. 7. L. Yang, L. Debo, and V. Gupta.
11. “Stability of the Bipartite Matching Model.” *Advances in Applied Probability*. 2013. Vol. 45, No. 2. A. Busic, V. Gupta, and J. Mairesse.
12. “On Markov-Krein Characterization of the Mean Sojourn Time in $M/G/K$ and other Queueing Systems.” *Queueing Systems*. 2011. Vol. 68, Issue 3. V. Gupta and T. Osogami.

13. “Optimality Analysis of Energy-Performance Trade-off for Server Farm Management.” *Performance Evaluation*. 2010. Vol. 67, Issue 11. V. Gupta, A. Gandhi, M. Harchol-Balter, and M. Kozuch.
14. “Analysis of Scheduling Policies under Correlated Job Sizes.” *Performance Evaluation*. 2010. Vol. 67, Issue 11. V. Gupta, M. Burroughs, and M. Harchol-Balter.
15. “On the inapproximability of $M/G/K$: Why two moments of job size distribution are not enough.” *Queueing Systems*. 2010. Vol. 64, Issue 1. V. Gupta, J. Dai, M. Harchol-Balter, and B. Zwart.
16. “Sampling Strategies for Epidemic-style Information Dissemination.” *IEEE Transactions on Networking*. 2010. Vol. 18, No. 4. M. Vojnovic, V. Gupta, T. Karagiannis, and C. Gkantsidis.
17. “Analysis of Join-the-Shortest-Queue Routing for Web Server Farms.” *Performance Evaluation*. 2007 Vol. 64, Issues 9-12. V. Gupta, M. Harchol-Balter, K. Sigman, and W. Whitt.

Working Papers

18. “Designing Service Menus for Bipartite Matching Queueing Systems.” R. Caldentey, V. Gupta, and L. Hillas. *Under revision at Operations Research*.
19. “Managing Resources for Shared Micromobility: Approximate Optimality in Large-Scale Systems.” T. Akturk, O. Candogan, and V. Gupta. *Available at SSRN*.
20. “Reneging and Balking in Resource Sharing Systems.” *Available at SSRN*.
21. “Inducing Optimal Scheduling with Selfish Users.” L. Debo, P. Enders, A. Gandhi, V. Gupta, M. Harchol-Balter, and A. Scheller-Wolf.

Work In Progress

22. “Dynamic Auctions for Truckload Marketplaces.”
23. “Trade-offs in Preferential Access Auctions.” N. Thakurele, and V. Gupta.
24. “Oracle Bounds for Forecasting in Time-Varying Environments.” V. Gupta, and M. Molinaro.

Conference and Workshop publications

25. “Look Before, Before You Leap: Online Vector Load Balancing with Few Reassignments.” *ITCS 2023*. V. Gupta, R. Krishnaswamy, S. Sandeep, and J. Sundaresan.
26. “Approximation Schemes for Multiperiod Binary Knapsack Problems.” *International Computer Science Symposium in Russia 2021*. Z. Gao, J. Birge, and V. Gupta.
27. “Permutation Strikes Back: The Power of Resource in Online Metric Matching.” *APPROX 2020*. V. Gupta, R. Krishnaswamy, and S. Sandeep.
28. “Information Models: Creating and Preserving Value in Volatile Cloud Resources” *International Conf. on Cloud Engineering (IC2E) 2019*. C. Zhang, V. Gupta, and A. Chien.
29. “Learning Influence-Receptivity Network Structure with Guarantee” *AISTATS 2019*. M. Yu, V. Gupta, M. Kolar.
30. “Stochastic Online Scheduling on Unrelated Machines” *Integer Programming and Combinatorial Optimization (IPCO) 2017*. V. Gupta, B. Moseley, M. Uetz, and Q. Xie.

31. “An Influence-Receptivity Model for Topic based Information Cascades.” *ICDM 2017*. M. Yu, V. Gupta, and M. Kolar.
32. “Statistical Inference for Pairwise Graphical Models Using Score Matching” *NIPS 2016*. M. Yu, V. Gupta, and M. Kolar.
33. “Lagrangian-Based Online Stochastic Bin Packing.” *ACM SIGMETRICS 2015*. V. Gupta, and A. Radovanovic.
34. “Distributed Caching Algorithms for Content Distribution Networks.” *IEEE INFOCOM 2010*. S. Borst, V. Gupta, and A. Walid.
35. “Robust and Flexible Power-proportional Storage.” *Symposium on Cloud Computing (SOCC) 2010*. H. Amur, J. Cipar, V. Gupta, M. Kozuch, G. Ganger, and K. Schwan.
36. “Self-Adaptive Admission Control Policies for Resource-Sharing Systems.” *ACM SIGMETRICS/Performance 2009*. V. Gupta and M. Harchol-Balter.
37. “Sampling Strategies for Epidemic-style Information Dissemination.” *IEEE INFOCOM 2008*. M. Vojnovic, V. Gupta, T. Karagiannis, and C. Gkantsidis.
38. “Fundamental Characteristics of Queues with Fluctuating Load.” *ACM SIGMETRICS/Performance 2006*. V. Gupta, M. Harchol-Balter, A. Scheller-Wolf, and U. Yechiali.
39. “The Effect of Higher Moments of Job Size Distribution on the Performance of an $M/G/s$ queueing systems.” *ACM SIGMETRICS Performance Evaluation Review*. Vol. 35 Issue 2. V. Gupta, J. Dai, M. Harchol-Balter, and B. Zwart.
40. “Fluid Level in a Reservoir with an On-Off Source.” *ACM SIGMETRICS Performance Evaluation Review*. Vol. 36 Issue 2. V. Gupta and P. Harrison.
41. “Finding the Optimal Quantum Size: Sensitivity Analysis of the $M/G/1$ Round-Robin Queue.” *ACM SIGMETRICS Performance Evaluation Review*. Vol. 36 Issue 2. V. Gupta

Book Chapters

42. “Risk-Aware Demand Management of Aggregators Participating in Energy Programs with Utilities” (S. Meyn et al., eds. *Energy Markets and Responsive Grids: Modeling, Control, and Optimization*. Vol. 162. Springer, 2018. W. Heavlin, V. Gupta, A. Radovanovic, S. You

CONFERENCE TALKS

1. “Analysis of Scheduling Policies under Correlated Job Sizes.” *Performance 2010*. November 17, 2010.
2. “Self-Adaptive Admission Control Policies for Resource Sharing Systems.” *ACM SIGMETRICS 2009*. June 18, 2009.
3. “Finding the Optimal Quantum Size: Sensitivity Analysis of the $M/G/1$ Round-Robin Queue.” *MAMA 2008*. June 2, 2008.
4. “Fluid Level in Tandem Queues with an ON/OFF Source.” *MAMA 2008*. June 2, 2008.
5. “Analysis of the Join-the-Shortest-Queue Policy for web server farms.” *Performance 2007*. October 4, 2007.
6. “Fundamental Characteristics of Queues with Fluctuating Load.” *ACM SIGMETRICS 2006*. June 29, 2006.

INVITED TALKS

1. “Designing Service Menus for Bipartite Queueing Systems” *Stochastic Networks Conference, Carnegie Mellon (Tepper), Northwestern (IEMS), Tata Institute of Fundamental Research, UIUC (ISE)*. 2021-2022.
2. “Online Control Under Non-Stationarity: Dynamic Regret Minimization for the LQR System.” *SNAPP Online Seminar series*. 2021.
3. “Designing Load Balancing and Admission Control Policies – Lessons From NDS Regime.” *Young European Queueing Theorists Workshop (YEQT IX), Purdue, Stanford, Duke*. 2015-2017.
4. “Online Stochastic Bin Packing.” *NYU Stern, IBM Research, Kellogg, Cornell ORIE. INFORMS Applied Probability Society Conference. Mostly OM (Tsinghua)*. 2011-2016.
5. “Robust Moments-based Bounds for Queueing Systems.” *Eurandom Workshop on Robust Optimization in Applied Probability*. 2015.
6. “Energy-efficient Dynamic Capacity Provisioning in Server Farms.” *INFORMS 2010*. November 8, 2010.
7. “Optimal Routing Policies for Heterogeneous Server Farms.” *INFORMS 2010*. November 9, 2010.
8. “Self-Adaptive Admission Control Policies for Resource Sharing Systems.” *INFORMS APS 2009*. July 13, 2009.
9. “Optimizing Resource Sharing Systems.” *University of Washington*. June 12, 2009.
10. “The Effect of Higher Moments of Job Size Distribution on the Performance of an $M/G/k$ Queueing System.” *INFORMS APS 2007*. July 9, 2007.
11. “Fundamental Characteristics of Queues with Fluctuating Load.” *INFORMS 2006*. November 7, 2006.

TEACHING

Instructor Spring 2017-2022
BUSF 40902: Online Optimization and Decision Making under Uncertainty. (PhD Course)
University of Chicago

Instructor Winter 2014
BUSF 40901/CMSC 34901: Stochastic Performance Modeling. (PhD Course)
University of Chicago

Instructor Spring 2013-2022
BUSW 36106: Managerial Decision Modeling. (MBA Course)
University of Chicago

Teaching Assistant Fall 2010
15-359: Probability and Computing. (Undergraduate Course)
Instructor: Prof. Avrim Blum and Prof. Venkat Guruswami
Carnegie Mellon University

Teaching Assistant
15-451: Algorithm Design and Analysis. (Undergraduate Course)
Instructor: Prof. Avrim Blum and Prof. Manuel Blum
Carnegie Mellon University

Fall 2006

Teaching Assistant
15-849: Performance Modeling. (Graduate Course)
Instructor: Prof. Mor Harchol-Balter
Carnegie Mellon University

Spring 2005

PROFESSIONAL SERVICE

- Associate Editor: Operations Research (Area: Stochastic Models) 2020-2023
- General chair: IFIP Performance 2023
- Chair: Rising Star Award Committee, ACM SIGMETRICS 2023
- INFORMS Junior Faculty Interest Group Paper Competition Committee 2022
- INFORMS Applied Probability Society Student Paper Competition Committee 2020-2021
- Co-chair: Manufacturing and Service Operations Management (MSOM) 2016 – SIG on Service Management
- Program Committee member : ACM SIGMETRICS (2012, 2013, 2015, 2018, 2022, 2023)
- Program Committee member : IFIP Performance (2014, 2015)
- Student activities chair: ACM SIGMETRICS (2014)
- *Refereeing*: Operations Research; Management Science; M&SOM; POMS; Queueing Systems; IEEE Transactions on Parallel and Distributed Systems; IEEE Transactions on Automatic Control; IEEE Transactions on Computers; Performance Evaluation; Annals of Operations Research; INFORMS Journal on Computing; European Journal of Operations Research; IEEE Transactions on Multimedia.

AWARDS & HONORS

- 2022 INFOCOM Test of Time award for the paper *Distributed Caching Algorithms for Content Distribution Networks*.
- 2020 Best paper award for Service Management SIG of the Manufacturing and Service Operations Management (MSOM) Society for the paper *Trading Time in a Congested Environment*.
- 2016 Simons Institute Research Fellow, Special Semester on *Algorithms and Uncertainty*
- Intel Research Fellow for Summer 2010.
- Awarded the President's Gold Medal for the highest CGPA at the end of undergraduate studies, Indian Institute of Technology, New Delhi, 2004.
- Awarded the R. Vibhakar Memorial Award for the best student of third year during the 2002-03 session, Indian Institute of Technology, Delhi.
- Secured All India Rank 22 at the Indian Institute of Technology Joint Entrance Examination (IITJEE 2000) and All India Rank 10 at Roorkee Entrance Test 2000 (now IIT Roorkee).

- Secured 2nd rank (senior level) in Delhi region at the Regional Mathematics Olympiad 1997 organised by National Board for Higher Mathematics (NBHM). Consequently, I was selected for the Nurture Program to receive training for Indian National Mathematics Olympiad (INMO).

REFERENCES

Prof. Amy Ward

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of Operations Management
Booth School of Business
The University of Chicago.
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Prof. Itai Gurvich

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Kellogg School of Management
Northwestern University.
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Prof. Mor Harchol-Balter

Dr. Bruce J. Nelson Professor of Computer Science
Computer Science Department
Carnegie Mellon University.
412.268.7893
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Prof. Alan Scheller-Wolf

Richard M. Cyert Professor
of Operations Management
Tepper School of Business
Carnegie Mellon University.
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Prof. Rene Caldentey

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of Operations Management
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University of Chicago.
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Prof. Jim Dai

Leon C. Welch Professor of Engineering
School of Operations Research
and Industrial Engineering
Cornell University.
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