

Manu Kumar Gupta

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Employment

CIMI Research Fellow

August, 2017 - present

Institut de Recherche en Informatique de Toulouse (IRIT)

Centre International de Mathématiques et Informatique de Toulouse (CIMI)

Research: *Multi-armed restless bandits*

Supervisors: Prof. Urtzi Ayesta and Prof. Maaike Verloop

Postdoctoral Researcher

July, 2016 - July, 2017

Singapore University of Technology and Design

Research: *Game theoretic approach for (health-care) operations management*

Supervisors: Prof. Shrutivandana Sharma and Prof. Ying Xu

Education

Master of Science (M.Sc.) + Doctor of Philosophy (Ph.D.) Dual Degree

July, 2009 - July, 2016

Indian Institute of Technology, Bombay

Department: Industrial Engineering and Operations Research

Research: Optimization of stochastic systems (CGPA: 8.66/10)

Advisors: Prof. N. Hemachandra and Prof. J. Venkateswaran

Bachelor of Science (B.Sc.)

July, 2006 - June, 2009

Lucknow Christian Degree College, Lucknow

Discipline: Statistics, Mathematics and Computer Applications (Grade 71%)

Research Interest

Theory, applications and algorithms in optimization and stochastic systems.

PhD Thesis and Research Focus¹

PhD Thesis Title: *Dynamic Priority Scheduling in Multi-class Queues: Pricing, Achievable Regions and Applications*

Main contribution of the thesis is in the field of solving optimal control problems in multi-class queues. Apart from settling a conjecture from generic pricing and scheduling model, pricing in the context of pre-emptive scheduling is explored. *Completeness* is one of the important notion for solving optimal control problems in multi-class queues. Thesis identifies the completeness and equivalence of different types of parametrized dynamic priority schemes and also introduces the notion of *2-moment completeness* in single class queue. Various implications/applications of these ideas have been pursued in the thesis.

From a bird's eyes view, my research provides optimal and efficient design for complex random (also deterministic) systems/networks motivated from various application domains, and uses theory of stochastic systems and optimization as the solution tools. Apart from this, my research interest include pricing mechanism design and game theoretic approaches for service systems. I am currently working on multi-armed restless bandits problem within the theme of sequential decision making. More broadly, I am excited in research at the intersection of mathematics, statistics, computer science and its applications in scientific discovery.

¹Please refer to research statement for detailed research focus.

Research Publications

Working paper(s):

- W2: Manu K. Gupta, S. Sharma and Ying Xu, "Pricing Scheme and Equilibrium Analysis for Controlling Emergency Crowd in Hospitals" (*Preliminary version: MSOM-2017 conference*).
- W1: U. Ayesta, Manu K. Gupta and I. M. Verloop, "A unifying computation of Whittle's Index for Markovian bandits" (*Preliminary version: ISMP-2018 conference*).

Submitted papers:

- S3: U. Ayesta, Manu K. Gupta and I. M. Verloop, "Load-balancing with heterogeneous schedulers.", <https://arxiv.org/pdf/1810.07782.pdf>, (Submitted).
- S2: V. Kavitha, Manu K. Gupta, V. Capdevielle, R. Kishor and M. Haddad, "Speed Based Optimal Power Control in Small Cell Networks", <https://arxiv.org/pdf/1812.03862.pdf>, (Submitted), 2nd round of revision in Computer Communication.
- S1: Manu K. Gupta, N. Hemachandra and J. Venkateswaran, "Some Parametrized Dynamic Priority Policies for 2-class M/G/1 Queues: Completeness and Applications", <https://arxiv.org/pdf/1804.03564.pdf>, (Submitted), 2nd round of revision in ACM TOMPECS.

Refereed Journals:

- J1: Manu K. Gupta, N. Hemachandra and J. Venkateswaran, "Optimal Revenue Management in Two Class Pre-emptive Delay Dependent Markovian Queues", **Applied mathematical modelling**, 45 (2017), 31-54.

Refereed International Conference/Workshop Proceedings:

- C9: Manu K. Gupta and N. Hemachandra, "On a Conjecture for Dynamic Priority Queues and Nash Equilibrium for Quality of Service Sensitive Markets", In Proceedings, Performance Evaluation Methodologies and Tools (**ValueTools**), Palma de Mallorca, Spain, 2019.
- C8: U. Ayesta, Manu K. Gupta and I. M. Verloop, "A unifying computations of Whittle's Index for Markovian bandits", International Symposium on Mathematical Programming (**ISMP**), Bordeaux, France, 2018.
- C7: Manu K. Gupta, S. Sharma and Y. Xu. "How patient's perception and self-interest affect emergency crowding?", Manufacturing and Service Operations Management (**MSOM**) Conference, UNC, Chapel Hill, USA 2017.
- C6: Manu K. Gupta and N. Hemachandra. "On 2-moment completeness of non pre-emptive, non anticipative work conserving scheduling policies in some single class queues", In Proceedings, International Symposium on Modelling and Optimization in Mobile, Ad Hoc, and Wireless Networks (**WiOpt**), Mumbai, India, 05/2015.
- C5: Manu K. Gupta and N. Hemachandra. "On a conservation law and the achievable region for waiting time tail probabilities in 2-class M/G/1 queueing systems", In Proceedings, International Workshop on Resource Allocation, Cooperation and Competition in Wireless Networks (**RAWNET**), Mumbai, India 05/2015.
- C4: P. Mayekar, J. Venkateswaran, Manu K. Gupta and N. Hemachandra. "Performance analysis and decomposition results for some dynamic priority schemes in 2-class queues", International Workshop on Device-to-Device Communications (**D2D**), Mumbai, India, 05/2015.
- C3: Manu K. Gupta, N. Hemachandra and J. Venkateswaran. "On mean waiting time completeness and equivalence of EDD and HOL-PJ dynamic priority in 2-class M/G/1 queue", In Proceedings, Performance Evaluation Methodologies and Tools (**ValueTools**), Bratislava, Slovakia, 12/2014.
- C2: A. Rawal, V. Kavitha and Manu K. Gupta, "Optimal Surplus Capacity Utilization in Polling Systems via Fluid Models", In Proceedings, International Symposium on Modelling and Optimization in Mobile, Ad Hoc, and Wireless Networks (**WiOpt**), Hammamet, Tunisia, 05/2014.

C1: V. Kavitha, V. Capdevielle and Manu K. Gupta, “Small Cell Networks: Speed Based Power Allocation”, In Proceedings, Allerton Conference on Communication, Control and Computing (**ALLERTON**), UIUC, Allerton Retreat Center, Monticello, Illinois, 10/2013

Other Conferences/Talks:

- T5: Manu K. Gupta, “On 2-moment completeness of scheduling policies in some single class queues” Workshop on Modeling and performance evaluation of networks, ENSEEIHT, Toulouse, 2017.
- T4: Manu K. Gupta, “What is Industrial Engineering and Operations Research” Supply Chain Practitioner’s Council (SCPC) meet, IIT Bombay, 05/2015
- T3: Ratnaji Vanga, Manu K. Gupta, and J. Venkateswaran. “Performance Evaluation of Bat Algorithm to Solve Deterministic and Stochastic Optimization Problems”, International Simulation Conference of India (ISCI), IIT Madras, Chennai, 02/2013
- T2: Manu K. Gupta, N. Hemachandra and J. Venkateswaran, Optimal pricing and pre-emptive scheduling in exponential server with two classes of customers, International Conference on Optimization, Computing and Business Analytics, Allied Publishers, pp. 103-108, 12/2012
- T1: Manu K. Gupta, “Pricing server’s surplus capacity” IEOR day, IIT Bombay, 11/2012

Teaching Experience

as a Teaching Assistant

Indian Institute of Technology Bombay, India

- Modelling and Computational Lab (Autumn 2011)
- IEOR Lab (Spring 2012)
- Selected Applications of Stochastic processes (Autumn 2012)
- Analysis and Control of Queues (Spring 2013)
- Introduction to Stochastic Models (Autumn 2013)

Organized workshop for SAS and L^AT_EX. Conducted *tutorials* for “Introduction to Stochastic Models” in Autumn 2013, Autumn 2014. Co-taught a *course* titled “Selected applications of stochastic models” with Prof. N. Hemachandra in Autumn 2015.

Professional Activities

- Reviewer for the journal: Sadhana - Academy Proceedings in Engineering Science, Quality technology and quantative management, Computers and Operations Research, Opsearch.
- Web-administration for IFIP Performance-2018 and ISCI-2015.
- Organization of Young European Queueing Theorists (YEQT) workshop 2018.
- Technical program committee of operations research society of India (ORSI) conference 2018.

Awards and Achievements

- Received CIMI fellowship on a research proposal jointly written with Prof. Urtzi Ayesta.
- Received Post-doctoral fellowship for research in service systems, funded by SUTD-MIT international design center at Singapore University of Technology and Design, under the supervision of Prof. Shrutivandana Sharma.
- Institute award for excellence in PhD research at 55th convocation in IIT Bombay.
- All Indian Rank (AIR) 82 in JAM exam conducted by IITs in 2009.
- Silver Medal in undergraduate (B.Sc.) studies (06-09).

Computer Knowledge

Programming	Python, MATLAB, C, ARENA, Easy-Fit, CPLEX, R, AnyLogic
Operating Systems	GNU/Linux (Ubuntu, Fedora, Debian), Microsoft Windows
Typesetting	L ^A T _E X(This CV has been prepared using L ^A T _E X!)
Webhosting	HTML, PHP

Major Courses³

Probability: Probabilistic Models, Introduction to Stochastic Models, Engineering Statistics, Selected Applications of Stochastic Systems, Analysis and Control of Queues, Discrete Event System Simulation, Markov chains and Queueing Theory

Optimization: Optimization Models, Integer Programming, Optimization Techniques, Industrial Scheduling

Computation: Computer Programming and Algorithms, Modelling and Computational lab, IEOR lab, Introduction to Mathematical Software, High Performance Scientific Computing.

Position of Responsibility³

- Research Scholar Companion (2011 - 2012)
- Library Secretary for Hostel 12 (2012 - 2013)
- Web Secretary for Hostel 12 (2013 - 2014)
- Election Officer for Departmental Council Election 2014

Other Activities

Long distance running, Volleyball, Swimming and Literature

References

Available on request.

³At IIT Bombay