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Pavithra Harsha

RESEARCH INTERESTS

Modeling, optimization, decision-making under uncertainty, AI/ML with applications to cloud, supply chain, pricing and revenue management.

EDUCATION

- **Massachusetts Institute of Technology (MIT)**   Sep 2003 - Sep 2008
  Doctor of Philosophy (PhD), Operations Research
  Thesis : Mitigating Airport Congestion: Market Mechanisms and Airline Response Models
  Advisors : Prof. Cynthia Barnhart (MIT) & Prof. David Parkes (Harvard)

- **Indian Institute of Technology (IIT) Madras**   Jul 1999 - May 2003
  Bachelor of Technology (BTech)
  Major : Mechanical Engineering
  Minor : Operations Research (OR)

EMPLOYMENT

- **Principal Research Staff Member, IBM Research, Yorktown Heights**   May 2021 - Present
- **Research Staff Member, IBM Research, Yorktown Heights**   May 2011 -April 2021
- **Technical Assistant, Yorktown Heights**   Sept 2018 - Sept 2019
  Technical Assistant to Dr. Kathryn Guarini, Vice President of IBM Industry Research
- **Postdoctoral Associate, MIT, Cambridge**   Aug 2009 - April 2011
  Hosted by Prof. Munther Dahleh at the Laboratory for Information and Decision Systems (LIDS).
- **Scientist, Analytical Services, Oracle Retail, Cambridge**   Oct 2008 - July 2009

HONORS AND AWARDS

- *Finalist* in the *2022 INFORMS M&SOM Society Award for Best Paper in M&SOM journal* for the paper "A data-driven approach for personalized bundle pricing and recommendation" in collaboration with Markus Ettl, Anna Papush and Georgia Perakis.

- *IBM Research Outstanding Technical Achievement Award 2021* for contributions to the development of Personalized Pricing and Promotions Analytics.

- *Second place* in the *2019 INFORMS Service Science Best Paper Award* for the paper "Learning Personalized Product Recommendations with Customer Disengagement" in collaboration with Hamsa Bastani, Georgia Perakis and Divya Singhvi.

- *IBM Research Outstanding Innovation Award 2019* for contributions to the IBM Research Spring Strategy and the Research Transformation.

- *IBM Research Outstanding Technical Achievement Award 2018* for science contributions to Energy Storage.

- *First place* in the *2017 INFORMS Service Science Best Cluster Paper Award Competition* for the paper "A data-driven approach for personalized bundle pricing and recommendation" in collaboration with Markus Ettl, Anna Papush and Georgia Perakis.

- *Winner* of the *2017 INFORMS Revenue Management Practice Award* for the work on "Omnichannel markdown optimization" in collaboration with Markus Ettl, Shivaram Subramanian and Joline Uichanco.
- *Honorable mention* in the *2017 M&SOM practice-based research competition* for the paper "Dynamic Pricing of omnichannel inventories" in collaboration with Shivaram Subramanian and Joline Uichanco.
- *IBM Research Outstanding Technical Achievement Award 2015* for Omni-channel Pricing analytics under the category of accelerated market introduction resulting in significant level of realized revenue to IBM attributable to the research asset(s).
- Selected as a *2015 Technology Rising Star* by the Women of Color (WoC) magazine in recognition for the accomplishments in the STEM community.
- Eighth *IBM Invention Plateau* awards, one for every fourth patent applications submitted.
- *Honorable mention* for the *Aviation's Applications Dissertation Prize*, INFORMS 2009.
- *Honorable mention* for the *Transportation Science & Logistics Society Dissertation Prize*, INFORMS 2009
- *Alfred P. Sloan Foundation Fellowship, 2006–07*, awarded through the MIT Global Airline Industry Program.
- *Banco Foundation Prize, 2003*, awarded for the best academic record in Mechanical Engineering at IIT Madras.
- *Dr. S. Chandrasekhar Memorial Prize, 2002* and *Raghavendra Memorial Prize, 2001*, awarded for the best academic record in the first six and four semesters respectively in Mechanical Engineering at IIT Madras.
- *Summer Research Fellow 2001*, Jawaharlal Nehru Center for Advanced Scientific Research, India.
- *Prathibha Merit Scholarship 1999–2003*, given by the state government of Andhra Pradesh (AP) in India to the top six women students from AP in the IIT-Joint Entrance Exam. It covered half the undergraduate tuition.

OTHER EXPERIENCES

• **Visiting Scientist, Massachusetts Institute of Technology, Cambridge**	April 2013 - Present
• **Research Affiliate, Massachusetts Institute of Technology, Cambridge**	May 2011 - April 2013
• **Intern, Emptoris, Burlington**	Jun 2006 - Aug 2006
• **Teaching Assistant, Massachusetts Institute of Technology, Cambridge**	Sep 2005 - May 2006
• **Intern, Hewlett-Packard Research Labs, Palo Alto**	Jun 2005 - Aug 2005
• **Research Assistant, Operations Research Center, MIT, Cambridge**	Sep 2003 - Sep 2008
• **Intern, Toyota Kirloskar Automotive Parts, Bangalore, India**	May 2002 - Jul 2002

PUBLICATIONS

- Theses
  1. Pavithra Harsha, "Mitigating Airport Congestion: Market Mechanisms and Airline Response Models," *Ph.D. Thesis*, Sloan School of Management, Massachusetts Institute of Technology, February 2009.
  2. Pavithra Harsha, "Numerical Modelling of Water Jet Peening," *B.Tech Thesis*, Department of Mechanical Engineering, Indian Institute of Technology Madras, May 2003.

- Book Chapters
  3. Pavithra Harsha and Shivaram Subramaniam, "Censored demand estimation of choice models for omnichannel pricing" in Precision Retailing, Editors: Maxime Cohan, Nathan Yang and Bassem Monla *Forthcoming 2024.*

- Jounral and Referred Conference Publications (Submitted and/or published)
  4. Pavithra Harsha, Shivaram Subramanian, Ali Koc, Mahesh Ramakrishna, Brian Quanz, Dhruv Shah, and Chandrashekar Narayanaswami, "An Optimistic-Robust Approach for Dynamic Positioning of Omnichannel Inventories." *Submitted 2023.*

5. Rares Cristian, Pavithra Harsha, Georgia Perakis, Brian Quanz and Ioannis Spantidakis, "Tractable inventory allocation using fulfillment rules." *Submitted 2023*.

6. Rares Cristian, Pavithra Harsha, Georgia Perakis, and Brian Quanz, "End-to-End Learning for Optimization via Constraint-Enforcing Approximators," *Submitted 2023*.

7. Pavithra Harsha, Ashish Jagmohan, Retsef Levi, Elisabeth Paulson and Georgia Perakis, "Overcoming Uncertainty in Supplier Reliability: The Value of Coarsened Information Sharing," *Submitted 2023*.

8. Pavithra Harsha, Ashish Jagmohan, Jayant Kalagnanam, Brian Quanz and Divya Singhvi, "Math Programming based Reinforcement Learning for Multi-Echelon Inventory Management" *Submitted 2022*.

9. Arindam Jati, Vijay Ekambaram, Shaonli Pal, Brian Quanz, Wesley Gifford, Pavithra Harsha, Stuart Siegel, Sumanta Mukherjee, Chandra Narayanaswami, "Hierarchical Proxy Modeling for Improved HPO in Time Series Forecasting ," *Proceedings of the 29th ACM SIGKDD Conference on Knowledge Discovery and Data Mining, pp 891–900, 2023*.

10. Rares Cristian, Pavithra Harsha, Georgia Perakis, Brian Quanz and Ioannis Spantidakis, "End-to-End Learning for Optimization via Constraint-Enforcing Approximators," *Proceedings of the AAAI Conference on Artificial Intelligence, 37(6), 7253-7260, 2023*.

11. Hamsa Bastani, Pavithra Harsha, Georgia Perakis and Divya Singhvi, "Sequential Learning of Product Recommendations With Customer Disengagement" *M&SOM Journal Volume 24, Issue 4, pp 2010–2028, 2022*.

12. Shivaram Subramanian and Pavithra Harsha "Demand modeling in the presence of unobserved lost sales" *Management Science* Volume 67, Issue 6, pp 3803–3833, 2020.

13. Pavithra Harsha, Ramesh Natarajan and Dharmashankar Subramanian,"A Prescriptive Machine-Learning Framework to the Price-Setting Newsvendor Problem" *INFORMS Journal on Optimization*, Volume 3, Issue 3, pp 227–314, 2021.

14. Pavithra Harsha, Shivaram Subramanian and Markus Ettl, "A Practical Price Optimization Approach for Omni-channel Retailing." *INFORMS Journal of Optimization* Volume 1, Issue 3, pp 185–264, 2019.

15. Pavithra Harsha, Shiva Subramanian and Joline Uichanco, "Dynamic pricing of omnichannel inventories" *M&SOM Journal*, Volume 21, Issue 1, pp 47–65, February 2019.

16. Markus Ettl, Pavithra Harsha, Anna Papush and Georgia Perakis, "A data-driven approach for personalized bundle pricing and recommendation" *M&SOM Journal*, Volume 22, Issue 3, pp 461–480, 2020.

17. Maxime Cohen and Pavithra Harsha "Designing Price Incentives in a Network with Social Interactions." *M&SOM Journal*, Volume 22, Issue 2, pp 292–309, 2020.

18. Pavithra Harsha and Munther Dahleh, "Optimal management and sizing of energy storage under dynamic pricing for the efficient integration of renewable energy." *IEEE Transactions on Power Systems*, Volume 30, Issue 3, pp 1164-1181, May 2015.

19. Pavithra Harsha, Mayank Sharma, Ramesh Natarajan and Soumyadip Ghosh,"A framework for the analysis of probabilistic demand response schemes." *IEEE Transactions on Smart Grid*, Volume 4, Issue 4, pp 2274-2284, December 2013.

20. Pavithra Harsha and Munther Dahleh, "Optimal sizing of energy storage for efficient integration of renewable energy," *50th IEEE Conference on Decision and Control and European Control Conference (CDC-ECC)*, December 2011.

21. Pavithra Harsha, Cynthia Barnhart, David C.Parkes and Haoqi Zhang, "Strong activity rules for iterative combinatorial auctions," in *Computers and Operations Research*, Volume 37, Issue 7, pp 1271–1284, July 2010.

22. Tad Hogg, Pavithra Harsha and Kay-Yut Chen, "Quantum Auctions," in *International Journal of Quantum Information*, Volume 5, Issue 5, pp 751–780, October 2007.

- Working papers

23. Pavithra Harsha, Zachery Leung and Georgia Perakis "Markdown Optimization for an e-tailer". *Working paper*.

24. Pavithra Harsha and Georgia Perakis,"Tractable markdown optimization under uncertainty." *Working paper*.

25. Pavithra Harsha, Cynthia Barnhart and David C.Parkes, "Auctions for airport landing slots: the bidder problem." *Working paper*.

- Workshop Publications

  26. Rares Cristian, Pavithra Harsha, Georgia Perakis, Brian Quanz and Ioannis Spantidakis, "End-to-End Learning via Constraint-Enforcing Approximators for Linear Programs with Applications to Supply Chains" *AI for Decision Optimization Workshop, AAAI 2022.*
  27. Pavithra Harsha, Ashish Jagmohan, Jayant Kalagnanam, Brian Quanz and Divya Singhvi, "Math Programming based Reinforcement Learning for Multi-Echelon Inventory Management" *Deep Reinforcement Learning Workshop, NeurIPS 2021.*

- Granted Patents

  28. Managing cross-channel fulfillment impact within shared inventory demand systems, US10755232B2.
  29. Distributed optimization method for realtime omnichannel retail operations, US9626646B1.
  30. Allocating a product inventory to an omnichannel distribution supply chain, US10423923B2.
  31. Real time personalized pricing for limited inventory assortments in a high-volume business environment, US11074601B2.
  32. Upstream visibility in supply-chain, US11341457B2.
  33. Supply-chain simulation, US11488099B2.
  34. Automated hybrid propensity decision vector generation using artificial intelligence, US11321762B2.

Talks: Invited Conference, Seminar and other

- "An Optimistic-Robust Approach for Dynamic Positioning of Omnichannel Inventories"

  - *INFORMS Annual Meeting*, October 2023.
  - *INFORMS Manufacturing and Service Operations Management (M&SOM) Conference*, June 2023.

- "Innovations in Inventory Management: Optimistic Robust and Learning-Based methods"

  - *Business Analytics class, Columbia University*, April 2023.
  - *McCoombs Business School, UT Austin*, February 2023..

- "Omnichannel Retail Operations: Pricing and Inventory Management"

  - *Indian Institute of Management, Ahmedabad*, November 2022.

- "Omnichannel inventory replenishment optimization"

  - *INFORMS Annual Meeting*, November 2022.
  - *INFORMS Annual Meeting*, November 2021.
  - *INFORMS Annual Meeting*, November 2020.

- "Application of AI to the multi-echelon inventory optimization problems"

  - *INFORMS Annual Meeting*, November 2020.

- "Blockchain Based Visibility and Supply Chain Gains"

  - *INFORMS Annual Meeting*, November 2019.

- "Dynamic pricing of omnichannel inventories"

  - *Math and Industrial seminar series, Purdue University*, April 2021
  - *Business Analytics class in Wharton Business School, University of Pennsylvania*, November 2020
  - *Seminar series in Johnson College of Business, Cornell University*, July 2020
  - *Supply Chain class in IEOR, Columbia University*, May 2019
  - *Business Analytics class in IEOR, Columbia University*, May 2019
  - *INFORMS Business Analytics Conference*, April 2019.
  - *Kellog Seminar Series*, November 2018.
  - *NYC Operations Research Day*, May 2018.

- *Revenue management practice award at RM&P Conference*, July 2017.
- *Practice-based research competition at M&SOM Conference*, June 2017.
- *Business Analytics class in IEOR, Columbia University*, April 2017.
- *Operations Research Colloquium, Penn State*, September 2016.
- *POMS Conference*, May 2016.
- *MBA class on supply chain logistics, University of Michigan*, March 2016.
- *INFORMS Annual Meeting*, November 2015.
- *International Symposium on Mathematical Programming*, July 2015.
- *INFORMS Revenue Management and Pricing Conference*, June 2015.
- *MBA class on business analytics, University of Michigan*, March 2015.

- "Demand modeling in unobserved lost sales settings"

  - *INFORMS Annual Meeting*, November 2017.

- "A prescriptive machine learning approach for the price-setting newsvendor problem with applications"

  - *INFORMS Revenue Management and Pricing Conference*, June 2018.
  - *INFORMS Revenue Management and Pricing Conference*, June 2013.
  - *International Symposium on Mathematical Programming*, August 2012.
  - *INFORMS Annual Meeting*, October 2012.

- "A novel approach to omni-channel demand modeling and price optimization for non-perishable items"

  - *INFORMS Annual Meeting*, November 2014.
  - *INFORMS Manufacturing and Service Operations Management (M&SOM) Conference*, June 2014.
  - *Operations Research Colloquium, Penn State*, March 2014.
  - *INFORMS Annual Meeting*, October 2013.
  - *Operations Management Fall Seminar Series, MIT*, October 2013.

- "A framework for the analysis of probabilistic demand response schemes"

  - *INFORMS Annual Meeting*, October 2012.

- "Optimal sizing and management of energy storage with intermittent supply in the presence of dynamic pricing"

  - *INFORMS Manufacturing and Service Operations Management (M&SOM) Conference*, June 2012.
  - *50th IEEE Conference on Decision and Control and European Control Conference*, December 2011.
  - *INFORMS Annual Meeting*, November 2011.

- "Tractable markdown optimization for multiple items under uncertainty"

  - *INFORMS Annual Meeting*, November 2011.
  - *INFORMS Manufacturing and Service Operations Management (M&SOM) Conference*, June 2011.
  - *INFORMS Revenue Management and Pricing Conference*, June 2011.

- "Optimal sizing and operations of a storage facility with intermittent supply"

  - *INFORMS Annual Meeting*, November 2010.
  - *INFORMS Manufacturing and Service Operations Management (M&SOM) Conference*, June 2011.

- "Tractable markdown optimization under uncertainty"

  - *Operations Management Fall Seminar Series, MIT*, December 2010.
  - *Operations Research Colloquium, Penn State*, November 2010.
  - *INFORMS Annual Meeting*, November 2010.
  - *IBM T.J. Watson Research Labs*, November 2010.
  - *INFORMS Manufacturing and Service Operations Management (M&SOM) Conference*, June 2010.
  - *INFORMS Revenue Management and Pricing Conference*, June 2010.

- "Mitigating airport congestion: market mechanisms and airline response models"
    - *INFORMS Annual Meeting*, October 2009 as part of the *Aviation's Application Dissertation Award*.
    - *Oracle Retail*, November 2010.

- "Activity rules for budget constrained bidders in ascending price combinatorial auctions," *INFORMS Annual Meeting*, November 2007.

- "Scalability of the auction model: 250K bids," *Emptoris*, August 2006.

- "Auctions for airport landing slots"
    - *INFORMS Annual Meeting*, November 2005.
    - *HP Research Labs*, June 2005.

- "Quantum auctions," *HP Research Labs*, August 2005.

Funding

- Contributed towards the NSF funding in Service Enterprise Engineering Program on "Dynamic Pricing for the Retail Industry." Collaborator: Georgia Perakis. Grant $ 75K/year. Duration: 3 years.

- Contributed towards Oracle Retail funding "Advanced Price Optimization algorithms." Collaborator: Georgia Perakis. Grant $ 75K. Duration: 1 year.

- Contributed towards MITEI Seed Fund 2011 "Towards efficient integration of renewables using energy storage: Optimal sizing and management." Collaborator: Munther Dahleh. Grant $ 150K. Duration: 2 years.

Professional Activities

- Department Editor for the Practice Platform area in the INFORMS M&SOM Journal, 2021-Present.

- Associate editor for the INFORMS M&SOM Journal, (2021-Present), INFORMS Service Science Journal (2019–2022), Naval Research Logistics Journal (2018–2021), Journal of Revenue & Pricing Management, (2011–2015).

- Award committee member for the INFORMS DEI Best Student Paper Award, 2023.

- Reviewer for the IBM Goldstein Fellow (2021, 2022, 2023); IBM PhD Fellowships & AI Residency Program (2020).

- Award committee member for the Revenue Management and Pricing Practice Award, 2022.

- Award committee member of the INFORMS Wagner Prize, 2019-2021.

- Award committee member of the POMS Best Student Paper Award Competition, 2019.

- Member of the INFORMS Professional Committee Member, 2018.

- Secretary and treasurer for the INFORMS Revenue Management and Pricing section, Oct 2017– Oct 2018.

- Invited panelist at the Industrial Mathematics Workshop: Collaboratively Tackling Emerging Problems in Industry in the University of Minneapolis on the "Grand Challenges in Retail Analytics and Inventory Management".

- Head of the INFORMS Undergraduate Operations Research Prize Committee 2016 and member of the same committee in 2015.

- Served as the IBM Yorktown Lab advocate for the Global Technology Outlook 2017.

- Organizing the Commerce Seminar Series 2015-2016 at IBM Watson Research Center.

- Invited panelist at the 2015 INFORMS Doctoral Colloquium on the topic: "OR/Analytics industry opportunities and preparing for the industry job market".

- Mentored multiple interns during their summer internships at IBM Research: Maxime Cohen, He Wang, Anna Papush, Hari Bandi, Divya Singhvi, Peter Zhang, Ioannis Spantidakis, Xinyi Zhao.

- Co-advised Anna Papush, doctoral student at MIT, for their her dissertation. Anna won the INFORMS Best Revenue Management and Pricing Dissertation Award 2018. Co-advised doctoral student Zachary Leung for his dissertation. He graduated in 2014.

- Reviewer for papers in the following journals and conferences: M&SOM Journal, Management Science, Operations Research, Transportation Science, Journal on Computing, Journal of Applied Analytics, Naval Research Logistics, Annals of Operations Research, Revenue & Pricing Management, Operations Research Perspectives, IBM Journal on Smarter Commerce, IEEE Journal on Selected Areas in Communications, IEEE Journal on Power Systems, IEEE Journal on Sustainable Energy, IEEE Journal of Smart Grid, M&SOM conference, IEEE SmartGridComm, IEEE International Conference on Communication

- Organizer, Operations Research Center(ORC) Spring Seminar Series, Spring 2006

SKILLS

- Programming and scripting: Java, Python, Matlab, SQL.
- Optimization and statistics packages: CPLEX, R