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Pavithra Harsha

RESEARCH INTERESTS

Modeling, optimization including network optimization, mixed-integer programming and large-scale optimization, algorithms, game theory, auction theory and mechanism design with applications including transportation, aviation, retail and energy.

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)
GPA : 4.9/5.0
- **Indian Institute of Technology (IIT) Madras** Jul 1999 - May 2003
Bachelor of Technology (BTech)
Major : Mechanical Engineering
Minor : Operations Research (OR)
CGPA : 9.58/10.00

EMPLOYMENT

- **Postdoctoral Associate, MIT, Cambridge** Aug 2009 - Present
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

- *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 highest CGPA in the first six and four semesters respectively in Mechanical Engineering at IIT Madras in a class of 118 students.
- *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, India to the top six women students from the state in the IIT-Joint Entrance Exam.

RESEARCH EXPERIENCE

- **Postdoctoral Associate, LIDS, MIT, Cambridge** Aug 2009 - Present
Researching into demand-based pricing, response behavior to pricing and wide-scale integration of renewable sources in the energy sector. This is a joint project with the Masdar University towards the development of a carbon-neutral Masdar City.

- **Research Assistant, Operations Research Center, MIT, Cambridge** Sep 2003 - Sep 2008

Auctions and exchanges to allocate landing slots: Proposed an auction framework as a strategic demand-management technique to mitigate airport congestion and developed a network-based airline response model that helps airlines bid in landing slot auctions. This model was then tested and validated using real airline data. Further proposed design principles for real-time inter-airline trading of slots, an operational demand-management strategy, to recover from sudden drops in airport capacities due to bad weather. A study of the impact of the auction on the different stakeholders - airport, airlines and passengers is on-going.

Strong activity rules for iterative combinatorial auctions: Developed the theory of activity rules, which are checks made by the auctioneer to suppress strategic behavior by bidders, by introducing the notion of strong activity rules, which characterizes straightforward bidding strategies while suppressing all preventable strategic behavior. Designed such rules specifically for budget-constrained bidders, who play a vital role in many market environments, including slot auctions, and are hindered from bidding straightforwardly under previous activity rules. Demonstrated the improvement in efficiency and revenue up to 4% and 10% respectively in the clock-proxy auction.

- **Intern, Hewlett-Packard Research Labs, Palo Alto** Jun 2005 - Aug 2005

Quantum Auctions: Developed the (first) quantum auction protocol for implementing a variety of classical auctions on a quantum computer. We studied the game-theoretical behavior of the quantum protocol for the simple case of the a sealed-bid auction and showed how a suitably designed search reduces the possibilities for bidders to game the auction. This protocol offers the benefits of a compact bidding language for partnership bidding and privacy of bids.

WORK EXPERIENCE

- **Scientist, Analytical Services, Oracle Retail, Cambridge** Oct 2008 - July 2009

Providing analytical services to large fashion retailers in implementing the Markdown Optimization solution that provides price-ladder recommendations, timing and depth of markdowns that need to be taken using demand forecasting techniques, in order to clear merchandise at stores by the end of every season. Exposed to other solutions implemented by retailers such as size profiles and case pack allocation for fashion retailers and regular price optimization (pricing) for grocery chains.

- **Intern, Emptoris, Burlington** Jun 2006 - Aug 2006

Developed and prototyped customized large scale optimization techniques (Benders Decomposition) to scale the e-procurement auction algorithms from 50K to 250K bids in the auction. Observed an improvement in the running time by a factor of 10. This is a part of their current software release.

- **Teaching Assistant, Massachusetts Institute of Technology, Cambridge** Sep 2005 - May 2006

Introduction to Mathematical Programming, School of Engineering, Fall'05

Systems Optimization: Models and Computation, Sloan School of Management, Spring'06

- **Intern, Toyota Kirloskar Automotive Parts, Bangalore, India** May 2002 - Jul 2002

PUBLICATIONS

- Theses

– Pavithra Harsha, “Mitigating Airport Congestion: Market Mechanisms and Airline Response Models”, *Ph.D. Thesis*, Sloan School of Management, Massachusetts Institute of Technology, February 2009.

– Pavithra Harsha, “Numerical Modelling of Water Jet Peening”, *B.Tech Thesis*, Department of Mechanical Engineering, Indian Institute of Technology Madras, May 2003.

- Journal Publications

– Pavithra Harsha, Cynthia Barnhart, and David C.Parkes, “Auctions for airport landing slots: the bidder problem”. *In preparation*.

- Pavithra Harsha, Cynthia Barnhart, David C.Parkes, and Haoqi Zhang, “Strong activity rules for iterative combinatorial auctions”. *to appear in Computers and Operations Research (pre-print available on request)*.
- Tad Hogg, Pavithra Harsha, and Kay-Yut Chen, “Quantum Auctions”, in *International Journal of Quantum Information*, Volume 5, Number 5, pp 751–780, October 2007.

- Conference Publications

- Pavithra Harsha, Vikram Gavini, and Ramesh N. Babu, “Analytical approach for selection of optimal feed rate in efficient machining of sculptured surfaces”, in *Proc. International Conference on Manufacturing Automation*, 10–12 December, 2002, Hong Kong, pp 227–236.

INVITED TALKS

- “Mitigating Airport Congestion: Market Mechanisms and Airline Response Models”, *INFORMS Annual Meeting*, October 2009 as part of the *Aviation’s Application Dissertation Award*
- “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.
- “Quantum auctions”, *HP Research Labs*, August 2005.
- “Auctions for airport landing slots”, *HP Research Labs*, June 2005.

RELEVANT COURSEWORK

- *Massachusetts Institute of Technology, Cambridge*: Introduction to Mathematical Programming, Transportation and Logistics Planning, Non-Linear Programming, Analysis, Game Theory and Equilibrium Analysis, Integer and Combinatorial Optimization, Dynamic Programming and Stochastic Control, Network Optimization, Logistics and Supply Chain Management, Microeconomics, Finance Theory, and Optimization and the Internet.
- *Harvard University, Cambridge*: Computational Mechanism Design, Market Design, and Probability Theory and Mathematical Statistics.

SKILLS

- Programming and scripting: Java, Matlab, SQL, XML, Eclipse.
- Optimization packages: CPLEX, OPL Studio, Ampl.
- Experience in handling large data sets.

LEADERSHIP EXPERIENCES

- Organizer, Operations Research Center(ORC) Spring Seminar Series, Spring 2006
- Plants Officer, Sidney Pacific - Graduate Students House, MIT, 2005–06
- Head Officer, Guidance and Counseling Unit(GCU) for women, IIT Madras, 2002–03
- Branch Representative, Department of Mechanical Engineering, IIT Madras, 2000–03

REFERENCES

- Prof. Cynthia Barnhart
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- Prof. Munther Dahleh
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- Prof. David C. Parkes
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SEAS, Harvard University
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- Prof. Hamsa Balakrishnan
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