Neha

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6th Year Ph.D. Candidate in Operations Management

Education

Aug 2019 - Present	**PhD in Operations Management, Tepper School of Business, Carnegie Mellon University, Pittsburgh**, *Pennsylvania*. ○ Minor in Operations Research, GPA: 3.77/4.0
August 2021	**Masters in Operations Management, Tepper School of Business** , *GPA: 3.77/4.0*.
July 2016	**Integrated Bachelors & Masters of Science, Mathematics & Computing, Indian Institute of Technology, Kharagpur, India**, *GPA: 8.7/10*.

PhD Research Projects

Summer 2020 - Spring 2021	**Resilient Solution to Delays in School Bus Transportation**, Heinz College of Information Systems and Public Policy, CMU. ○ Mentors: Prof. Peter Zhang, Prof. Holly Wiberg ○ Frequent school bus delays (due to heavy traffic, harsh weather conditions, driver shortage) and no-shows of school buses have posed societal and education burdens. ○ We propose a data-driven optimization approach to address the daily school bus routing problem in presence of uncertain delays triggered by bad weather and traffic conditions in the school bus network.
Spring 2023 - Present	**School Bus Sharing Across School Districts**. ○ Mentors: Prof. Peter Zhang, Prof. Hai Wang, Prof. John Hooker (external reviewer) ○ Redesign the school bus transportation system in order to minimize the total school bus operating costs while improving the overall student experience. ○ Studied the tactical design of *school bus collaboration* among schools across school districts as a cooperative game where multiple levels of players (i.e., schools, school districts) with different objectives are involved. ○ Derived closed-form approximations for metrics to evaluate school bus operation costs and student travel time under collaboration. ○ Found conditions under which collaboration among schools is most beneficial in terms of student welfare and school bus costs.
Summer 2021 - Present	**Conditional Promotion Offers to Encourage Loyalty**. ○ Mentors: Prof. Alan Montgomery, Prof. Fatma Kilinc-Karzan ○ With growing popularity of loyalty programs and the resulting collection of vast amount of customer purchase data, there is a potential of designing customized offers to target specific customer groups and increase their spending (thereby loyalty) at the firm. ○ Analyzed a conditional promotion that is earned only after a certain spending threshold is reached over multiple periods and studied conditions that improves the customer utility and firms revenue in presence of offer. ○ Analyzed conditions in which the stated conditional promotional offer is more beneficial to a firm than a regular offer (exercised without any spending threshold).

Patents and Papers

○ Resilient Solution to Delays in School Bus Transportation. In preparation for submission to *Transportation Research Part C*.
○ School Bus Sharing Across School Districts. *In preparation*.
○ Conditional Promotion Offers to Encourage Loyalty. *In preparation.*
○ **N. Singh**, T. Rambha: "Offline Optimization of Cab Supply for Ride-Sharing Applications using Hypergraph Matching". **Accepted for publication in World Conference on Transport Research (WCTR 2019)**.
○ U.S. Patent, 20180003US01: "Method and system for dynamic trust model for personalized recommendation system in shared and non-shared economy", Filed November, 2018.
○ Poster presentation: "Xhare-A-Ride (XAR): An efficient dynamic ride sharing service for Multi-modal trip planner" in **COMSNETS, 2017**.

Employment

May 2018 – June 2019	**Indian Institute of Science (IISc), Bangalore**, *India*. ○ Project Associate, Centre for infrastructure, Sustainable Transportation and Urban Planning (CiSTUP) ○ Mentor: Prof. Tarun Rambha, IISc bangalore
July 2016 – April 2018	**Xerox Research Centre, India (XRCI)**, *Bangalore*. ○ Research Engineer in Algorithms and Optimization Group ○ Mentor: Dr. Koyel Mukherjee, Research Scientist at Adobe Research

Technical Skills

Languages   **Advanced:** C++, Java, Python, C. **Intermediate:** R, MATLAB.

Packages   **Advanced:** Cplex, Gurobi, Gurobi-machinelearning, Pytorch, Pandas, Scikit-learn .

Relevant Coursework

Theory   Discrete Mathematics, Design & Analysis of Algorithms*, Operation Research*, Graph Theory and Algorithms, Optimization Techniques in Finance, Linear Algebra, Modern Algebra, Real & Functional Analysis, Measure Theory & Integration, Non-Linear Programming, Probability & Statistics, Regression and Time Series Model, Stochastic Processes, Markov Decision Processes, Statistical Inference, Computational Statistics, Discrete Choice Theory and Modelling Applications in Transportation, Advanced Graph Theory, Linear Programming, Integer Programming, Advanced Integer Programming, Dynamic Programming, Machine Learning, Probability and Mathematical Statistics (graduate level), Convex Optimization   (*had a laboratory component).

Academic Distinctions and Awards

- William Larimer Mellon Fellowship 2019-2024.
- Recipient of Mitacs GlobalInk Fellowship Grant 2015.
- INSPIRE scholarship and mentorship grants from Department of Science & Technology, Government of India for outstanding academic performance in 4 consecutive years.
- Consistently ranked among top three students throughout ten semesters in Math department.
- Offered a department change to Mathematics for outstanding performance at the end of freshman year, IIT Kharagpur (75 in the batch of 1300 students were offered this opportunity).

Internships and Research Experience (Before PhD)

April 2018 – August 2019
  Improved matching and routing algorithms for ride sharing, IISc, Bangalore, India.
- Mentor: Prof. Tarun Rambha
- Studied the problem of finding a robust lower bound to number of vehicles needed to serve known short-term demand that can be used for regulatory policies.
- Employed a divide-and-conquer framework to construct a non-uniform hypergraph representing trips that can be shared and formulated a matching problem to solve for optimal number of vehicles.
- Validated the proposed model against existing **Dial-a-ride problem algorithms** and achieved huge **reduction in computational time** on New York City yellow taxicab dataset.

January 2018 – April 2018
  Dynamic trust model for ride recommendation in shared environment, XRCI.
- Mentor: Saurabh Srivastava, Research Scientist, Google, India
- Built a **TrustCircle model** using ground truth data collected on user preferences for taking different rides.
- Designed ride recommendation as **contextual multi-arm bandit** and modified **LinUCB** algorithm to solve it.
- Trained the model to learn preferences through user feedback on previous recommended rides in online fashion.
- Validated the model using **cumulative regret (CR)** and **frobenius Norm** of estimated theta vs actual.

May 2017 – August 2017
  XTrack Fairness problem for group tracking, XRCI.
- Guide: Prof. Ragavendranan Gopalakrishnan, Operations Management, Queen's University
- Worked on designing a **fair strategy** that allocates tracking times to commuters within a group while satisfying the individual battery power constraints in each leg of the trip.
- Combined the information on available battery power and previous work done in group tracking to allocate tracking times that maximize the chances of group tracking being an **individually rational action**.

March 2017 – May 2017
  Influencing Ride Share, XRCI.
- Mentor: Prof. Ragavendranan Gopalakrishnan
- Worked on developing an improved **information diffusion** model in ride sharing context that accommodated opinions more extensively instead of binary models such as linear threshold and independent cascade models.
- Attempted to establish theoretical proofs to show parallelism with the existing state of the art.

October 2016 – March 2017
  XhareCost: Online strongly individual rational cost sharing scheme, XRCI.
- Mentors: Prof. Ragavendranan Gopalakrishnan, Dr. Koyel Mukherjee, Raja Subramaniam Thangaraj (InMobi)
- Implemented the **fair pricing model** that included a disutility cost to account for inconveniences in ride sharing.
- Estimated optimal values for parameters like degree of disutility, etc. through simulations on different datasets.
- Added the validated pricing module within the **GoCity trip planning apps**.

July 2016 – October 2016
  CommuteShare: Offline scheduling & routing of cabs for employee commute, XRCI.
- Mentors: Dr. Koyel Mukherjee, Raja Subramaniam Thangaraj
- Used employee travel information to design an ILP (integer linear program) with exhaustive constraints on detours, time windows etc. and added strongly individual rational constraints to find the **optimum supply** of cabs to serve the employees.
- Observed superior results on Denver City data when compared to routing algorithm of Lyft ridesharing service.

August 2015 – March 2016	**Triad Prediction in social network**, *Master's Thesis*, IIT Kharagpur.
	○ Mentor: Prof. Bibhas Adhikari, Department of Mathematics
	○ Proposed a new **similarity measure** using information in network structure to predict the formation of triads.
	○ Validated the proposed measure on Twitter dataset collected for a week and inferred logical conclusions.
May 2015 – July 2015	**Social network analysis with Latent Dirichlet Allocation**, *Internship*, Univ. of Manitoba, Canada.
	○ Mentor: Prof. Saman Muthukumarana, Department of Statistics
	○ Modified the topic modeling algorithm, **Latent Dirichlet Allocation (LDA)** to function on graph data and find the latent graph structure by grouping edges in a graph using their **topic similarity**.
	○ Verified the algorithm through simulations and observed significant improvements over existing methods.

Independent Projects

March 2018 – April 2018	**Women Hackathon**, Walmart Labs, Bangalore, India.
	○ Built a **routing and scheduling engine**, **"Aahaar"** which regulated the movement and distribution of surplus food from different corporate offices to those in need within Bangalore city.
Spring 2013	**Understand intra-group hierarchy of a team**, IIT Kharagpur.
	○ Developed a **crawler** to get information on authors' published papers, citation counts, h-indices and used it to propose a new class of **indices to rank** the authors in a research paper.
	○ Proposed indices estimate the actual involvement of authors while ensuring positive correlation with **h index**.

Extra-academic Activities

- ○ **Semi-Finalist** in Ultimate Frisbee Intramural CMU 2022.
- ○ Participated in Ultimate Frisbee Intramural CMU 2022, 2023.
- ○ Won **Bronze** in **Table Tennis**, Sports Tournament at **Xerox/Conduent Labs India**, 2017.
- ○ Won **Bronze** in **Social Innovation** event held at **Avaya Labs Research**, Bangalore, 2014.
- ○ Won **Gold** in fresher's **Badminton** tournament, IIT Kharagpur, 2011-2012.
- ○ Won **Silver** in Badminton Singles and **Gold** in Badminton Doubles at **District Level**, 2006.
- ○ Hold a Diploma in **Kathak dance**, 2004.