# Keerthana Gurushankar

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## CURRENT RESEARCH INTERESTS

- Scheduling and Online Resource Allocation
- Restless Bandits

## EDUCATION

**Carnegie Mellon University**, Pittsburgh, PA
**PhD Student, Computer Science** Aug 2022 – Present
**Master of Science, Mathematical Sciences** Aug 2017 – May 2021
Thesis: Sharp Moment Comparisons for Sums of Independent Uniform Random Variables
**Bachelor of Science, Discrete Math and Logic** Aug 2017 – May 2021
Cumulative GPA: 3.80, College and University Honors

## PUBLICATIONS

[1] **Improving Upon the Generalized cμ rule: A Whittle Approach**
*Zhouzi Li, Keerthana Gurushankar, Mor Harchol-Balter, Alan Scheller-Wolf*
Operations Research (74(5):2577-2591, 2026). [PDF]

[2] **LookAhead: The Optimal Non-decreasing Index Policy for a Time-Varying Holding Cost Problem**
*Keerthana Gurushankar*, Zhouzi Li*, Mor Harchol-Balter, Alan Scheller-Wolf*
Queueing Systems, Volume 110, article number 7, (2026). [PDF]

[3] **Latency Guarantees for Caching with Delayed Hits**
*Keerthana Gurushankar*, Noah G. Singer*, Bernardo Subercaseaux**
IEEE International Conference on Computer Communications (INFOCOM 2025) [PDF]

[4] **A Minimal Intervention Definition of Reverse Engineering a Neural Circuit**
*Keerthana Gurushankar, Pulkit Grover*
NeurIT Workshop at IEEE ISIT 2024 [PDF]

[5] **What's in a Name? Linear Temporal Logic Literally Represents Time Lines**
*Runming Li*, Keerthana Gurushankar*, Marijn J.H. Heule, Kristin Y. Rozier*
IEEE Working Conference on Software Visualization (VISSOFT 2023) [PDF]

[6] **Capturing and Interpreting Unique Information**
*Praveen Venkatesh, Keerthana Gurushankar, Gabriel Schamberg*
IEEE International Symposium on Information Theory (ISIT 2023). [PDF]

[7] **Extracting Unique Information through Markov Relations**
*Keerthana Gurushankar, Praveen Venkatesh, Pulkit Grover*
Allerton Conference on Communication, Control and Computing 2022. [PDF]

[8] **Sharp bounds on p-norms for sums of independent uniform random variables, 0<p<1**
*Giorgos Chasapis, Keerthana Gurushankar, Tomasz Tkocz*
Journal d'Analyse Mathématique (149 (2), 529-553, 2023). [PDF]

## MANUSCRIPTS UNDER REVIEW

[A] **Lag: A Mean-Field Optimal Policy for Online Assignment with Reusable Resources**
*Keerthana Gurushankar* [PDF]

[B] **Assigning Reviewers under Rising Load: A Whittle Index for Online Reviewer Assignment**
*Keerthana Gurushankar* [PDF]

## INDUSTRY EXPERIENCE

- **Quantitative Research Intern, Two Sigma** May 2026 – Aug 2026
  I developed large scale machine learning models for financial return forecasting.

- **ML Performance Engineering Intern, AMD** May 2025 – Aug 2025
  I profiled and optimized quantization algorithms for LLM inference, improving runtime & memory usage. I also parallelized and sped up a key algorithm 5-fold by redistributing its GPU workload with Python multithreading. In addition, I uncovered performance bugs and contributed to PyTorch and KTransformers to enhance compatibility and performance for AMD GPUs.

- **Machine Learning Intern, CapSen Robotics** May 2023 – Aug 2023
  I built segmentation-based ML models for object detection and pose estimation from 3D point cloud data for pick-and-place robots. I decreased the failure rate and cycle time of robot arms (3x baseline) deployed in factories. I also contributed a novel calibration method, which reduced calibration time 6-fold and simplified a tedious and error-prone part of the company's prototyping work.

## RESEARCH PROJECTS

- **Restless Bandit Policies for Online Skill-Based Routing** [A, B] Jan 2026 – Aug 2026
  *Advised by Professor Alan Scheller-Wolf*
  I developed mean-field optimal policies for routing a stream of tasks to different servers, where the reward of an assignment depends on the quality of match between the task-server pair. I developed new contextual restless bandit methods for this. I evaluated my methods on online reviewer assignment for peer-review journals, benchmarking on TMLR submission traces scraped from OpenReview.

- **Optimal Scheduling for Delay-Based Holding Costs** [1, 2] Apr 2024 – Dec 2025
  *Advised by Professors Mor Harchol-Balter and Alan Scheller-Wolf*
  We examined optimal scheduling for a stream of jobs, where jobs incur a cost for every day they are not complete (a.k.a. holding costs). The goal is to minimize the total time-avg holding cost. We formulate the problem as a restless multiarmed bandit and derive Whittle/Gittins index based policies for scheduling.

- **Performance Analysis of Caching with Delayed Hits** [3] Feb 2024 – Aug 2024
  *Course project in Computer Networks, taught by Prof. Justine Sherry and Nirav Atre*
  Many high-throughput caches experience fetch times up to 1000x slower than inter-request times, leading to the problem of "delayed hits." This phenomenon violates classical hit-ratio caching analysis where LRU is known to be optimal. We analyzed caching with delayed hits, proved that LRU remains competitive-ratio optimal here. We also compare theoretical bounds to benchmark workload latencies.

- **Software Visualization for Linear Temporal Logic (LTL)** [5] Oct 2022 – May 2022
  *Course project, advised by Professors Kristin Yvonne Rozier and Marijn Heule*
  Software specifications for safety-critical systems (e.g. air traffic) are often encoded using formal languages like LTL. These are easy for computers to verify, but hard for humans to validate the correctness of. We developed a timeline graphic synthesizer, that takes LTL specifications and visualizes their behavior using automata theory, to validate that specification encoding is bug-free.

- **Partial Information Decomposition (PID)** [4, 6, 7] May 2019 – Aug 2022
  *Advised by Professor Pulkit Grover*
  In many data-inference applications, we want to understand not just how much information one signal contains about another, but whether that information is unique, redundant, or synergistic. I developed Markov chain models to formalize these PIDs and created efficient algorithms for the Gaussian case by solving eigenvalue problems on covariance matrices.

- **Moment Maximization Inequalities** [8] Sep 2020 – May 2021
  *Advised by Professor Tomasz Tkocz*
  I solved the last open problem in a long-standing research program of finding moment bounds for sums of uniform random variables. I studied the *p*th moment of linear combinations of uniform random variables, and established sharp bounds on the variability of the *p*th moment relative to variance, extending the famous Khintchine's inequality to the case of uniform random variables and $0<p<1$.

## TEACHING EXPERIENCE

- **Teaching Assistant, Graduate Performance Modeling** Aug 2025 – Dec 2025
  *Course instructed by Professor Mor Harchol-Balter*
  I taught one lecture every 2 weeks, graded homeworks & exams and conducted office hours, teaching Queueing, probability, Markov chains and operational laws. I received a 5/5 TA rating with 50%+ response rate.

- **Research Mentor, Lumiere Education** May 2023 – Aug 2023
  I mentored ambitious high-school/early college students through research projects in Computer Science/Artificial Intelligence. I guided students through working out their own research questions, providing support through accessible background material and guiding research directions. One project was accepted for publication in the International Highschool Journal of Science.

- **Teaching Assistant, Undergraduate Quantum Computation** Sep 2020 – Dec 2020
  *Course instructed by Professor Ryan O'Donnell*
  I led recitations, graded exams & typeset homework solutions, teaching the linear algebra of quantum computation. I also interacted with students via weekly check-in videos to mitigate social isolation during a fully remote semester (discussing doubts, catching up etc). Many students felt they had never connected with course staff as much as in our class. I received an overall TA rating of 4.9/5.

- **Instructor, Computational Linguistics Problem Solving Seminar** Dec 2017 – Jan 2018
  I organized & taught a linguistics seminar for advanced 8th-10th grade students at my high-school. For eight 3-hr sessions, we group-solved linguistics olympiad problems and learned theory as needed. The course received high attendance on a voluntary basis and was video-recorded for future viewing.

- **Mentor/Curriculum Developer, Teknowledge** Sep 2017 – Jan 2018
  I volunteered with an outreach program teaching underserved middle-school students programming with Python. I guided students in groups of 1-3 through weekly programming labs and helped them design and build their own projects. I also designed new lab activities for use in later semesters.

## ACADEMIC ACHIEVEMENTS & FELLOWSHIPS

- 2024 Citadel Global PhD Datathon 2024 - 3rd place winner among 1k+ applicants worldwide
- 2022 Irwin Mark Jacobs & Joan Klein Jacobs Presidential Fellowship - presented prestigious fellowship/funding at MIT
- 2019 CMU Quantathon - member of winning team solving quantitative finance problem in university-wide competition
- 2018 Putnam Competition - ranked in top 500 nationally
- 2017 International Physics Olympiad Selection Camp - top 35 students in Physics nationally
- 2017 NIOS Senior Secondary Board Examination - Highest score among 300,000 candidates
- 2016 KVPY Fellowship - instituted by Govt. of India, for pursuit of research careers in science

## COMMUNITY SERVICE & LEADERSHIP

- 2025-Present, Reviewer for Queueing Systems, Information Theory Workshop (ITW)
- 2023-Present, Department Tea Organizer & Volunteer Queue Manager
- 2023-25, Department PhD Student Council Member
- 2023-24, PhD Admissions Committee Member
- 2023-24, Graduate Application Support Program Mentor
- 2021-22, CMU Pantry Volunteer