Ishaq Hamza

PhD Student in Operations Research
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Research Interests

My research centers on reinforcement learning theory and data-driven decision-making under uncertainty. I design and analyze practical policy-space algorithms, such as actor-critic methods, and establish finite-sample guarantees for them under minimal and realistic assumptions, aiming for theory that gives practitioners real insight. More broadly, I am interested in stochastic approximation, stochastic games, and optimization theory, and in developing reinforcement learning into a tool that reaches beyond its classical applications, assumptions, and modeling choices.

Education

Purdue University 2026 – Present
Ph.D. in Operations Research, Edwardson School of Industrial Engineering
Advisor: Dr. Zaiwei Chen

Indian Institute of Science (IISc) 2022 – 2026
B.Tech in Math and Computing
CGPA: **3.96/4**, **Rank 4**

Relevant coursework:

- On-line and Reinforcement Learning
- Game Theory
- Measure Theoretic Probability
- Regression and Time-Series Analysis
- Stochastic Finance
- Applied DS&AI
- Renewal and Queuing Theory
- Computational Optimization
- Detection & Estimation Theory
- Numerical Methods
- Nonlinear Systems & Stability
- Advanced Real Analysis

Awards and Achievements

- **Dr. W. Dale and Mrs. Jeanne C. Compton Award, Purdue University** 2026 – 2030
  Four-year doctoral fellowship, awarded over and above standard PhD support.
- **PhD Admission Offers** 2026
  Georgia Tech (ISyE) and Columbia University (IEOR).
- **ITTIAM Fellowship, IISc** 2024–25, 2025–26
  Two-time awardee. [details]
- **Dr. Kolar & Mrs. Girija Kodandapani Scholarship, IISc**
  Awarded to one student per batch. [details]
- **Simon Marais Mathematics Competition** 2024
  Global rank 98 (5th within IISc). [results]
- **Indian Statistical Institute Entrance Test** 2022
  National rank 62.

Publications

[1] Achieving ϵ^{-2} Sample Complexity in Single-Loop Actor-Critic, NeurIPS MLxOR 2026, **Ishaq Hamza**, Zaiwei Chen. Undergrad publication, arXiv link.

Presentations

To be updated.

Positions

Summer Research Intern May – Aug 2025
Edwardson School of Industrial Engineering, Purdue University Advisor: Dr. Zaiwei Chen
Project: *Optimal Single-Timescale Actor-Critic Algorithm*

- Proposed two variants of the actor-critic algorithm with single-timescale updates, and showed through a tight analysis that they achieve the optimal sample complexity in the off-policy setting under provably minimal assumptions.
- The analysis combines Moreau envelopes, stochastic approximation, and Markov chain mixing. This work became publication [1].

Teaching Assistant, Advanced Convex Optimization Jan – Apr 2025
Department of Electrical Engineering, IISc Instructor: Dr. Kunal N. Chaudhury
A graduate course for PhD students, assisted during my third undergraduate year. [course webpage]

- Conducted tutorials, answered students' questions, and graded assignments.
- The course covered rigorous convex analysis in extended-real settings and the operator-theoretic treatment of optimization algorithms in both smooth and non-smooth settings, using set-valued analysis for proximal algorithms.

Pre-PhD Projects

Extending Soft Actor-Critic to Multi-Agent RL Spring 2025
RL course project [GitHub]

- Surveyed entropy-regularized RL and Soft Actor-Critic algorithms in several settings.
- Proposed and implemented a novel multi-agent extension of the algorithm, incorporating cross-entropy regularization.
- Extended the analysis to prove single-step policy evaluation and improvement theorems, and gave a counterexample to global optimal convergence.
- Proposed dynamic cross-entropy regularization to escape sub-optimal Nash equilibria and designed experiments to validate it; the rest of the team implemented them, with positive results.

Game-Theoretic Market-Making and Trading Spring 2025
Game Theory course project

- Surveyed 10+ papers on the modeling and equilibrium analysis of market makers and traders in financial markets, and 5+ papers on information asymmetry and its impact on market making.
- Formulated a novel generalized model of trading with priced information exchange.

Automated Equity Research Analyst Fall 2024

Applied DS&AI course project (team of 6) [GitHub]

- Conceived the rating-generation mechanism and the project structure for the team.
- Implemented a self-engineered variant of the multiplicative weights algorithm that rates stocks from aspect-based sentiment analysis scores computed on financial news.
- Tested it on both real and geometric-Brownian-motion-simulated prices, with high-noise expert ratings.

Financial Network Modeling Fall 2024

Data Analytics course project (led a team of 5) [GitHub]

- Studied generative models for analyzing community structure in graphs.
- Modeled relationships between stock price movements with a hierarchical weighted stochastic block model.
- Applied the same model to import–export data across 200+ countries to study trade relations, obtaining the expected community structure.

Last updated: October 2026