Soham Phade, Ph.D.

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Education

University of California, Berkeley. Ph.D. in Electrical Engineering and Computer Sciences 2021
Indian Institute of Technology, Bombay. B.Tech. in Electrical Engineering (minor: Comp. Sci.) 2015

Skills

Statistical Analysis and Optimization	Machine Learning and Data Analysis	Game Theory and Economics
Algorithms and Data Structures	Deep Reinforcement Learning	Generative AI
Coding and Visualization	Large-scale project management	Simulation & Experiment Design

SW Proficiency: C, C++, Python, PyTorch, SQL, CUDA, Matlab, Mathematica

Work Experience

Research Scientist, Salesforce **Sept 2021 - present**

- Developed simulation environments in PyTorch to train agents using deep reinforcement learning (RL) policies for two microeconomic settings: commodity trade networks and urban EV charging.
- Designed a scalable ($\approx 1000\times$) multi-agent RL algorithm to find Walrasian equilibria in these settings; applied it to simulations with 100K agents (previously limited to 100) – achieved by exploiting economic network sparsity, training agents in parallel, and sharing policy weights between similar agents.
- Extended the WarpDrive CUDA framework to support training using this algorithm.
- Collaborated with MILA in building the RICE-N simulator for supporting the implementation of general negotiation protocols to use in the AI for Global Climate Change Cooperation competition.
- Additional projects: Reinforcement Learning from Human Feedback, Model Agnostic Meta Learning.

Graduate Student Researcher, UC Berkeley **Aug 2015 - Aug 2021**

- Adopted a first principles approach to lay the mathematical foundations of game theory under cumulative prospect theory (CPT), a leading model for decision-making under uncertainty; proposed novel frameworks (e.g. mediated mechanism design) and proved fundamental theorems (e.g. CPT revelation principle).
- Invented a lottery-based analog of the TCP/IP mechanism to improve network resource allocations (e.g. allocating bandwidth, scheduling cloud computing servers, etc.) by better aligning them with the agents' risk preferences resulting in increased social welfare/customer satisfaction.
- Led a team of 4 students (doctoral and senior undergraduate) on a research project for interactive learning of agent preferences, pricing, and recommendations in matching markets (e.g. Airbnb, Amazon, Uber, eBay, etc.). Project highlights–novel algorithms, optimality guarantees, synthetic and real-world data simulations, baseline comparisons. Techniques used–collaborative filtering, explore and exploit, bidding protocols.
- Published papers in peer-reviewed conferences (e.g. AIStats, Allerton) and journals (e.g. DGAA, DA, SiOPT) and presented research at top conferences (e.g. INFORMS, GameNets).

Applied Scientist Intern, Amazon **Summer 2019**

- Implemented extreme multi-label classification (a tree-based machine learning) algorithm to generate session-aware search recommendations (e.g. a previous search for a camera increases the likelihood of Nikon over Nike for a prefix search with "Ni").
- Showcased performance improvement (e.g. mean reciprocal rank) for small-length prefix inputs (up to 6 characters) and improved safety in recommendations compared to generative AI-based methods (e.g. RNN).
- Trained models over a curated dataset with billions of session samples; tools used–SQL, PySpark, pandas.

Awards and Achievements

- Best Paper Award at GameNets, Paris, France, 2019
- IUSSTF Viterbi-India Program Scholarship, USC, Los Angeles, US, 2014
- National Board of Higher Education Nurture Scholarship, TIFR, Mumbai, India, 2012
- All India Rank 65 in IIT JEE, India, 2011
- Best Solution Award at International Mathematics Olympiad Training Camp, HBCSE, Mumbai, India, 2010

Professional Activities

- Teaching University Courses: Discrete Mathematics and Probability Theory (UC Berkeley CS 70), Random Processes in Systems (UC Berkeley EE 226A), Complex Analysis (IIT Bombay MA 205).
- Reviewing Papers: IEEE Transactions on Control of Network Systems, Dynamic Games and Applications
- Reviewing Applications for Graduate Admissions, EECS Department at UC Berkeley
- Mentoring: Michael Curry, Arundhati Banerjee (interns at Salesforce), Yigit Efe Eringbas, Landon Butler (doctoral students at UC Berkeley), International Mathematics Olympiad aspirants from India

Selected Publications

- Y. E. Eringbas, S. Phade, and K. Ramchandran (2022). "Interactive Learning with Pricing for Optimal and Stable Allocations in Markets." *Artificial Intelligence and Statistics Conference.*
- S. Phade and V. Anantharam (2021). "Learning in Games with Cumulative Prospect Theoretic Preferences." *Dynamic Games and Applications,* 1-42.
- S. Phade and V. Anantharam (2019). "Optimal Resource Allocation over Networks via Lottery-Based Mechanisms." *International Conference on Game Theory for Networks,* pp. 51–70. Springer, Cham. (**Best Paper Award**)
- S. Phade and V. Anantharam (2019). "On the Geometry of Nash and Correlated Equilibria with Cumulative Prospect Theoretic Preferences." *Decision Analysis* 16(2), 142-156.
- S. Phade and V. Borkar (2017). "A Distributed Boyle-Dykstra-Han Scheme." *SIAM journal on optimization* 27(3), pp.1880-1897.

Presentations

- 2022 INFORMS Annual Meeting, October 16-19, Indianapolis. "Interactive Recommendations for Optimal Allocations in Markets with Constraints."
- 9th EAI International Conference on Game Theory for Networks, GameNets 2019, April 25-26, Paris. "Optimal Resource Allocation over Networks via Lottery-Based Mechanisms."
- The 29th International Conference on Game Theory, Stony Brook University July 16 - 20, 2018. "Learning in Games with Cumulative Prospect Theoretic Preferences."
- 55th Annual Allerton Conference on Communication, Control, and Computing, Allerton Oct. 4 - 6, 2017. "On the Geometry of Nash and Correlated Equilibria with Cumulative Prospect Theoretic Preferences."

Selected Advanced Courses

Combinatorial Algorithms	Advanced Probability	Information Theory
Non-convex Optimization	Stochastic Processes	Queuing Theory
Dynamical Systems	Signals and Systems	Statistical Learning Theory
Finite Fields and Coding	Game Theory	Differential Manifolds and Gravitation
Error Control Coding	Graph Theory	Quantum Mechanics