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

Areas of Expertise

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.

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).
- Graduate student instructor: Random Processes and Systems, Discrete Mathematics and Probability.

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

- 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	Game Theory	Differential Manifolds and Gravitation
Non-convex Optimization	Stochastic Processes	Information Theory	Statistical Learning Theory
Dynamical Systems	Signals and Systems	Queuing Theory	Quantum Mechanics