Soham Phade, PhD

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Education

University of California, Berkeley August 2021
Ph.D. in Electrical Engineering and Computer Sciences

Indian Institute of Technology, Bombay May 2015
B.Tech in Electrical Engineering (with Honors) and Minor in Computer Science

Work Experience

Research Scientist | Salesforce Sept 2021 - present

- Developed simulation environments in PyTorch to train agents using **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 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 WarpDrive CUDA framework to support training using this algorithm.
- Collaborated with MILA in building the **RICE-N simulator** to support implementation of general negotiation protocols to be used in the AI for Global Climate Change Cooperation competition.

Graduate Student Researcher | UC Berkeley Aug 2015 - Aug 2021

- Adopted 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 (eg mediated mechanism design) and proved fundamental theorems (eg CPT revelation principle).
- Invented a lottery-based analog of the TCP/IP mechanism to improve network resource allocations (eg 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** (eg AirBnB, Amazon, Uber, eBay, etc.). Project highlights–novel algorithms, optimality guarantees, synthetic and real-world data simulations, baseline comparisons. Techniques used–collaborative filtering, explore/exploit, and bidding.
- Published papers in peer-reviewed conferences (eg AIStats, Allerton) and journals (eg DGAA, DA, SiOPT) and presented research at top conferences (eg 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 (eg previous search of camera increases the likelihood of Nikon over Nike for a prefix search with "Ni").
- Showcased performance improvement (eg mean reciprocal rank) for small length prefix inputs (up to 6 characters) and improved safety in recommendations compared to generative AI based methods (eg RNN).
- Trained models over a curated dataset with billions of session samples; tools used–SQL, PySpark, pandas.

Skills

Programming languages & Software: Python, C, C++, PyTorch, Matlab, Mathematica

Selected Advanced Courses: Combinatorial Algorithms and Data Structures, Machine Learning and Artificial Intelligence, Reinforcement Learning, Optimization, Graphs and Networks, Game Theory and Economics, Advanced Probability, Stochastic Processes, Statistical Learning Theory, Information Theory

Professional Activities

Reviewing Journal 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 (PhD students at UC Berkeley), International Mathematics Olympiad aspirants from India.

Awards and Achievements

Best Paper Award at GameNets, 2019

Undergraduate Research Award, IITB, 2015

IUSSTF Viterbi-India Program Scholarship, USC, 2014

National Board of Higher Education Nurture Scholarship, TIFR, 2012

All India Rank 65 in IIT JEE, 2011

Best Solution Award at International Mathematics Olympiad Training Camp, HBCSE, 2010

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

References

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