


# Soham Phade, PhD

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## EDUCATION

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**University of California, Berkeley** 2015 - 2021

Ph.D. in Electrical Engineering and Computer Sciences

**Indian Institute of Technology, Bombay** 2011 - 2015

B.Tech in Electrical Engineering (with Honors) and Minor in Computer Science

## WORK EXPERIENCE

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**Research Scientist | Salesforce | AI Economist** 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.
- Invented 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 | BLISS Lab** 2015 - 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 (eg mediated mechanism design) and proved fundamental theorems (eg CPT revelation principle).
- Invented a lottery-based analog of the TCP/IP mechanism for improved network resource allocations (eg allocating bandwidth, scheduling cloud computing servers, etc.); outputs are better aligned 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, SIOP) and presented research at top conferences (eg INFORMS, GameNets).
- Graduate student instructor: random processes and systems, discrete mathematics and probability.

**Applied Scientist Intern | Amazon | Search Science** 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 (upto 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

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

**Selected Advanced Courses:** Combinatorial Algorithms and Data Structures, Optimization, Graphs and Networks, Game Theory, Advanced Probability, Stochastic Processes, Dynamical Systems, Queuing Theory, Statistical Learning Theory, Coding Theory, Information Theory

## PROFESSIONAL ACTIVITIES

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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 student at UC Berkeley), International Mathematics Olympiad aspirants from India.

## AWARDS AND ACHIEVEMENTS

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**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

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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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**Thomas Courtade**

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