

Soham Phade

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United States

EDUCATION

University of California, Berkeley 2015 - present

Ph.D. candidate in Electrical Engineering and Computer Sciences

Advisor: Prof. Venkat Anantharam

Committee Members: Prof. Jean Walrand, Prof. Anant Sahai, Prof. David Aldous

Indian Institute of Technology, Bombay 2011 - 2015

B.Tech in Electrical Engineering (with Honors)

Minor in Computer Science

Advisor: Prof. Vivek Borkar

RESEARCH INTERESTS

I am interested in the incentive-centered design of market-based mechanisms and algorithms in social and economic networks for the purpose of increasing human welfare and building efficient commercial systems that interact with humans.

Network Economics
Prospect Theory

Game Theory
No-regret Dynamics

Behavioral Economics
Mechanism Design

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

RESEARCH EXPERIENCE

Ph.D. Thesis, UC Berkeley 2015 - present

Title: Behavioral Network Economics

Advisor: Prof. Venkat Anantharam

Goal: Study problems in network economics and game theory using sophisticated behavioral models from psychology, decision theory, and learning theory to design mechanisms and algorithms better aligned with human interaction and welfare.

Designed optimal resource allocation and pricing algorithms for networks and scheduling problems via *lottery-based mechanisms*. Showed applications to improving the design of communication networks and cloud computing services.

Studied game-theoretic models with agents having *cumulative prospect theory* (CPT) preferences. Defined relevant notions of equilibrium - extensions of the traditional notions and new notions. Established properties of theoretical, methodological, and practical interest. Studying implications for mechanism design, such as auctions and matching markets.

Proposed a *novel solution concept* for n -player balanced cooperative games that satisfies *stability* properties - always lies inside the core of the game - and has *fairness* properties similar to the Shapley value. It has applications to distributing reward, revenue, or budget allocations in collaborative environments, such as academic collaborations, joint ventures, etc.

Studied convergence properties of the action play in repeated games when players adopt no-regret learning based strategies. It provides alternative explanations for equilibrium concepts from a behavioral and evolutionary perspective.

Applied Scientist Intern, Amazon AI and Search, Berkeley

Summer 2019

Team: Machine Intelligence and Decision Analytics (MIDAS)

Project: Session-Aware Search Recommendations

Mentors: Prof. Inderjit Dhillon, Daniel N. Hill, Kedarnath Kolluri

Designed and implemented an algorithm to improve Amazon's search recommendations based on customer's past queries, clicks, and purchases. Resulted in improving the relevance of search recommendations. Methods used: extreme multi-label classification, reinforcement learning (Q-learning).

Bachelor's Thesis, IIT Bombay

2014 - 2015

Title: A Distributed Boyle-Dykstra-Han Scheme

Advisor: Prof. Vivek Borkar

Proposed a provably convergent distributed variant of the Boyle-Dykstra-Han scheme for projecting on the intersection of a finite family of convex sets.

Viterbi Internship, USC

Summer 2014

Project: A Queuing model for Freeway Traffic

Advisor: Prof. Rahul Jain

Modeled freeway traffic as a queueing process and analyzed its Nash equilibrium.

TEACHING EXPERIENCE

Graduate Student Instructor, UC Berkeley

CS70: Discrete Mathematics and Probability Theory

Fall 2019

Duties: Content creation, weekly discussions, office hours, homework parties, review sessions, Piazza, grading

EE226A: Random Processes in Systems

Fall 2017

Duties: Content creation, weekly discussions, office hours, review sessions, grading, class lecture (~90 mins on non-causal Weiner filter and hypothesis testing)

Teaching Assistant, IIT Bombay

Math205: Complex Analysis

Fall 2013

Duties: Weekly discussions, grading

PUBLICATIONS

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

ARTICLES IN PROGRESS

V. Gupta, S. Phade, T. Courtade, K. Ramchandran. "Utility-Based Resource Allocation and Pricing for Serverless Computing." *Under review*. arXiv:2008.07793

S. Phade and V. Anantharam. "Learning in Games with Cumulative Prospect Theoretic Preferences." *Under review*. arXiv:1804.08005

S. Phade and V. Anantharam. "Black-Box strategies and Equilibrium in Games with Cumulative Prospect Theory Preferences." *Under review*. arXiv:2004.09592

V. Muthukumar, S. Phade, A. Sahai. "On the Impossibility of Convergence of Mixed Strategies with No-Regret Learning."

S. Phade and V. Anantharam. "A Fair and Stable Solution Concept for Balanced Cooperative Games."

PRESENTATIONS

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."

SERVICE ACTIVITIES

Reviewer: IEEE Transactions on Control of Network Systems

Student Reviewer for Graduate Admissions: EECS Department at UC Berkeley, Fall 2018, Fall 2019, and Fall 2020.

Mentoring: International Mathematics Olympiad aspirants from India.

GRADUATE LEVEL COURSES

Communication: Stochastic Processes, Coding Theory, Information Theory

Math: Functional Analysis**, Dynamical Systems, Topology

Computer Science: Combinatorial Algorithms and Data Structures, Sum of Squares**, Optimization*, Image Processing*, Computer Vision*, Game Theory*, Graph Theory*

Statistics: Advanced Probability, Statistical Learning Theory

(*completed as part of undergraduate curriculum, **audited)

SKILLS

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

REFERENCES

Venkat Anantharam

Professor, EECS, UC Berkeley
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Thomas Courtade

Professor, EECS, UC Berkeley
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Inderjit Dhillon

Vice President and Distinguished Scientist
at Amazon
Professor at UT Austin
inderjit@cs.utexas.edu

Kannan Ramchandran

Professor, EECS, UC Berkeley
kannanr@eecs.berkeley.edu

Vivek Borkar

Professor, EE, IIT Bombay
borkar.vs@gmail.com

Daniel Hill

Senior Scientist at Amazon Search
daniehil@amazon.com