Sahasrajit Sarmasarkar

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Research Interests: Learning theory, Social Choice, Optimization, and Differential Privacy

EDUCATION

Stanford University   *(Sept '21 -)*
PhD student in the Department of Electrical Engineering GPA 4.0/4.0

Indian Institute of Technology Bombay   *(Jul '16 - Jun '21)*
Bachelors and Masters in Electrical Engineering GPA 9.74/10 (**Second** among 74 students)
Minor in Computer Science and Engineering

SELECT PUBLICATIONS

* denotes co-first authors/alphabetical order

1. Mohak Goyal*, Sukolsak Sakshuwong*, Sahasrajit Sarmasarkar*, Ashish Goel, *'Low Sample Complexity Participatory Budgeting,'* International Colloquium on Automata, Languages and Programming(ICALP), 2023 (paper)

2. Mohak Goyal*, Sahasrajit Sarmasarkar*, Ashish Goel, *'A Mechanism for Participatory Budgeting With Funding Constraints and Project Interactions',* Web And InterNet Economics, 2023 (paper)

3. Sahasrajit Sarmasarkar, V.S. Lalitha, Nikhil Karamchandani, *'On Gradient Coding with Partial Recovery,'* International Symposium on Information Theory, 2021 (paper) [Extended version accepted at IEEE-TCOM].

4. Sahasrajit Sarmasarkar, Kota Srinivas Reddy, and Nikhil Karamchandani, *'Query Complexity of Heavy Hitter Estimation,'* International Symposium on Information Theory, 2021. (paper)

 Papers under review

5. Ashish Goel*, Zhihao Jiang*, Aleksandra Korolova*, Kamesh Munagala*, Sahasrajit Sarmasarkar*, *'On Differential Privacy with Multiple Selections,'* [submitted to ITCS '25] (paper)

6. Sahasrajit Sarmasarkar, Zhihao Jiang, Ashish Goel, Aleksandra Korolova and Kamesh Munagala , *'Multi-Selection for Private Recommendation Systems'* [submitted to WSDM '25] (paper)

7. Sahasrajit Sarmasarkar*, Mohak Goyal*, *'Metric Distortion under Probabilistic voting'* [submitted to Neurips 2024] (paper)

8. Sahasrajit Sarmasarkar, Harish Pillai*, *'Optimal Moments on Redundancies in Noisy Parallel Computing Setup'* (paper)

INDUSTRY EXPERIENCE

Quantitative Finance Intern —*Morgan Stanley, New York*   *(June '23 - Aug '23)*

Studied and implemented adaptive band based hedging strategies for a portfolio of FX options with different expiries by peeking into the past and empirically showed its improvement over non-adaptive strategies.

Digital Engineering Intern — *Texas Instruments, Bengaluru*   *(May '19 - Jun '19)*

Devised algorithms for connections of cells and buffer insertion problems in a carry-save adder network to minimize the overall delay and wave pipeline the whole network to run at higher speeds.

TECHNICAL SKILLS

Courses taken: Convex optimization, Randomized algorithms, Optimization and Algorithmic Paradigm, Machine learning theory, Algorithms in Decentralized Finance, Information Theory and Stats, Number Theory and Cryptography, Theory of Statistics, Statistical Signal Processing, Markov chains and Queueing Systems, Random graphs, Games and Information, Optimal Controls, Nonlinear Dynamical Systems, Matrix Computations, Information Theory, Error Correcting Codes and Advanced Concentration Inequalities

Courses taught as a CA: Optimization and Algorithmic Paradigm(CS 261), Market Design for Engineers(MS&E 230), Introduction to Probability (MS&E 120) & Advanced Applied Optimization (MS & E 214)

Programming Languages: Python, R, C/C++, MATLAB

RESEARCH PROJECTS

On Targeted Advertising with Differential Privacy [5, 6]
Advisors: Prof. Ashish Goel , Prof. Kamesh Munagala and Prof. Aleksandra Korolova

Working on the design of a mechanism that takes noisy input from the user (preserving the privacy of the user) and returns multiple selections and a local model to return a single item from multiple selections.

- Proved the optimality of laplace noise addition amongst a class of differentially private mechanisms.
- Evaluated our results empirically on an existing trained deep neural network on movie-lens dataset and constructed a local PCA based model to demonstrate the advantage of multi-selection.

List PAC learning for agnostic and realizable regression

We study the problem of list regression where the aim of the learner is to predict a set of labels for every input point x and the loss is measured with respect to the "best" label.

- We identify two dimensions of the hypothesis class—referred to as the k fat-shattering dimension and the k OIG dimension—whose finiteness is both necessary and sufficient for agnostic and realizable regression respectively.
- These are extensions of the fat-shattering and OIG (One Inclusion Graph) dimension that characterise learnability for PAC learning under agnostic and realizable regression.

Metric Distortion in Probabilistic Voting [7]

We extend the study of metric distortion in social choice for aggregation of ranked votes to probabilistic voting that includes popularly studies models like Plackett-Luce.

- In this model we show that Copeland's distortion is at most 2, whereas that of Random Dictator (RD) scales with the square root of the number of candidates.
- This contrasts with classical model where RD beats Copeland with a distortion of 3 versus 5.

Menu-based participatory budgeting [2]
Advisor: Prof Ashish Goel (Stanford University)

- Proposed a ballot design for participatory budgeting where projects are partitioned into multiple groups presenting a model for different project interactions such as substitutes, complementary and contradictions.
- We present an efficient algorithm for preference aggregation maximizing social welfare and also show that truth-telling is a Nash Equilibrium for an interesting class of vote profiles.

Batched Thompson Sampling in MABs
Advisor: Prof. Ayfer Ozgur (Stanford University)

Studied regret minimization in an adaptive batch Sampling in Multi-Armed Bandit(MAB) Problems.

- Generalized the batch Thomson sampling algorithm for the case of multiple optimal arms reducing the batch complexity.
- Performed simulations on several MAB instances to demonstrate our algorithms.

On Gradient Coding with Partial Recovery [3]
Advisors: Prof. Nikhil Karamchandani (IIT Bombay) and Prof. V. Lalitha (IIIT Hyderabad)

- Designed coding schemes for the assignment of training data to child servers with the master computing an approximate gradient based on one or more coded gradients from child servers.
- Tested our schemes on real MNIST data of handwritten digits and showed improvement over previous schemes.

Scholastic Achievements

- Scored a Semester Performance Index **10/10** in the seventh and eighth semesters at IIT-Bombay and awarded an institute academic prize for the same.

- Achieved **All India Rank 1** in **Kishore Vaigyanik Protsahan Yojana (KVPY) 2016** conducted by **Indian Institute of Science,Bangalore** out of nearly **100,000** candidates.

- Secured **All India Rank 98 and 49** in **Joint Entrance Examination (Advanced) 2016** and **Joint Entrance Examination (Mains) 2016** respectively among 1.4 million students.

- Was among the top **35** students in **Indian National Physics Olympiad** out of nearly 40,000 students and selected to attend the **OCSC (Orientation-Cum Selection Camp)** for **International Physics Olympiad, 2016**.

Other Course Projects

Model Selection in Linear Contextual Bandits [Slides]
Course: Stochastic Control

- Studied this problem in the pure exploratory set-up where the aim is to identify the optimal model class.

- Proposed a variant of the existing algorithm and validated it through simulations over different arm instances.

A survey of combinatorial auctions [Report]
Course: Games and Information

- Surveyed designs of single-round combinatorial auctions under different objective functions of social welfare.

- Studied iterative auctions in price and quantity settings, their duality relation, and VCG auction scheme.

Miscellaneous

- I oversaw **maintenance tasks** for the Stanford PB website, including the implementation of a novel **token voting** system, along with various bug fixes and minor updates.

- Teaching Assistant for **Probability and Random Processes, Markov Chains and Queueing Systems, Optimization and Algorithmic Paradigm.**

- Led a team of 4 students of the **System Integration** and **Controlled Area Network** (CAN) subsystem in IIT Bombay Racing team as the design engineer.

- Achieved third place in the **Logic GC-2018** competition hosted by the Maths and Physics Club at IITB, and secured third position in the **Electric Jhatka GC-2017** organized by the ERC club, IITB.

- Received the **top** prize for the course project titled "**Universal Sensor Signal Conditioning**" in Analog Circuits Lab (EE 230) at IIT-B.