SAGNIK BHATTACHARYA

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Research Interests

Information and coding theory, data compression, random field models, quantum information theory

Education

University of Maryland, College Park, MD — **2019 – present**
Ph.D. in Electrical and Computer Engineering — *GPA: 3.94/4.0*

Indian Institute of Technology, Kanpur, India — **2015 – 2019**
Bachelor of Technology in Electrical Engineering, Minors in Physics & Computer Science — *GPA: 8.9/10*

Research Experience

University of Maryland, College Park *Graduate Research Assistant* — **2019 – present**
↪ Advisor: Prof. Prakash Narayan

- Working on learning, lossy compression, and the shared information function in a Markov random field.
- Developed single-shot bounds on the universal sampling rate distortion for randomized sampling mechanisms.

Dept. of Electrical Engineering, IIT Kanpur *Undergraduate researcher* — **2018 – 2019**
↪ Advisor: Prof. Adrish Banerjee

- Studied sphere packing bounds in classical coding theory, extending them to more general discrete metrics from the known Hamming metric case.
- Generalized the linear programming bound to linear codes in the Lee metric via discrete Fourier analysis.

Institute of Network Coding, Chinese University of Hong Kong *Research intern* — **Summer 2018**
↪ Advisor: Prof. Sidharth Jaggi

- Studied arbitrarily varying channels (AVCs), their capacity characterizations, generalizations of classical coding theory bounds to AVC settings, and the role of common randomness.
- Developed tight bounds on the amount of common randomness required to reliably communicate over AVCs.

Dept. of Computer Science and Engineering, IIT Kanpur *Undergraduate researcher* — **2017 – 2018**
↪ Advisor: Prof. Rajat Mittal

- Worked on polynomial methods in quantum query complexity, explored classes of function compositions for which the dual block composition technique does not give good lower bounds.

Awards

Dean's Fellowship by the Department of Electrical and Computer Engineering, UMD. — **2019-20**

Best Undergraduate Project in the Department of Electrical Engineering, IIT Kanpur. — **2019**

Academic Excellence Award by IIT Kanpur. — **2016**

National Top 1% in the National Standard Examination in Physics — **2015**
Qualified for both the Indian National Physics Olympiad and the Indian National Chemistry Olympiad.

KVPY National Fellowship by the Department of Science and Technology of the Govt. of India. — **2014**

Publications

Universal Single-Shot Sampling Rate Distortion — **2021**
S. Bhattacharya and P. Narayan
Proceedings of the IEEE International Symposium on Information Theory (ISIT) 2021. [link]

Shared Randomness in Arbitrarily Varying Channels — **2019**
S. Bhattacharya, A. J. Budkuley and S. Jaggi
Proceedings of the IEEE International Symposium on Information Theory (ISIT) 2019. [link]

A Method to Find the Volume of a Sphere in the Lee Metric, and its Applications — **2019**
S. Bhattacharya and A, Banerjee
Proceedings of the IEEE International Symposium on Information Theory (ISIT) 2019. [link]

Research Talks and Poster Presentations

A Method to Find the Volume of a Sphere in the Lee Metric, and its Applications (poster) **2020**
Information Theory and Applications Workshop (ITA) 2020.

Shared Randomness in Arbitrarily Varying Channels (talk) **2020**
Communication, Control and Signal Processing Seminar, UMD.

Research Seminar Organization and Teaching Experience

Communication, Control and Signal Processing Seminar *UMD* **2020 – present**

- Co-organizer of research seminar with Zoom whiteboard talks oriented towards teaching.
- Redesigned and currently maintain the seminar website, http://ccsp.ece.umd.edu/

Graduate Teaching Fellow *Dept. of Electrical and Computer Engineering, UMD*

- ENEE420: Communication Systems (upcoming) **Fall 2021**
- ENEE324: Engineering Probability **Fall 2020**

Academic Mentor *Counselling Service, IIT Kanpur* **2016 – 2017**

- Took remedial classes for academically weak students on various topics in first-year electrodynamics.
- One-to-one mentoring to help academically weak students understand the course content better.

Selected Course Projects

Bandit Algorithms for Most Informative Arms *Information Theoretic Methods in Learning* **Spring 2021**
Proposed a new bandit algorithm to identify the arm that has the highest mutual information with all other arms. Further extensions in progress.

Classical Shadows for Quantum Property Testing *Quantum Algorithms* **Spring 2021**
Proposed a method for quantum property testing using the method of classical shadows, and several directions for further research, which are in progress.

Quantum Blahut-Arimoto Algorithms *Convex Optimization* **Fall 2020**
Wrote Python implementations of the algorithms proposed in *Quantum Blahut-Arimoto Algorithms* [github]

Selected Coursework

Electrical Engineering	**Computer Science**	**Mathematics**
Information Theory	Quantum Algorithms	Real Analysis
Convex Optimization	Coding Theory	Probability Theory ($\star$)
Random Processes	Algorithmic Information Theory	Topics in Combinatorics
Information Theoretic Methods in Learning	Machine Learning ($\star$)	

($\star$) - Fall 2021

Technical Skills

Languages Python (Numpy, Matplotlib, CVXPY), C, Octave | **Tools** LaTeX, Git, Vim | **Web** HTML, CSS, Jekyll

Service

Co-Organizer and Webmaster Science Coffeehouse, IIT Kanpur (2017-2018)

Volunteer Student Guide, Counselling Service, IIT Kanpur