# Sagnik Bhattacharya

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## Education

**University of Maryland, College Park** **MD, USA**
*Ph.D., Electrical and Computer Engineering, 3.9 GPA* *2019 – 2025 (expected)*

- **Thesis:** Markov Random Fields — Spatial Sampling, Learning and Compression (Advisor: Prakash Narayan)
- **Selected Coursework:** Information (A+) & Coding Theory, Convex Optimization (A+), Digital Signal Processing, Computational Imaging (A+), Estimation Theory, Probability Theory, Randomized Algorithms, Deep Learning
- **Awards:** Dean's Fellowship ('19), A. G. Wylie Dissertation Fellowship, ECE Outstanding Teaching Assistant Award ('25)

**Indian Institute of Technology (IIT), Kanpur** **Kanpur, India**
*B.Tech., Electrical Engineering, Minors in Physics & Computer Science, 8.9/10 GPA* *2015 – 2019*

- **Thesis:** Adversarial channels and fundamental bounds in coding theory (Advisor: Adrish Banerjee)
- **Awards:** Best Undergraduate Project, Dept. of EE (2019), IITK Academic Excellence Award (2016)

## Skills

**Languages:** Python, C, Matlab · **Libraries:** PyTorch, TensorFlow, NumPy, Scikit-learn, Pandas · **Tools**: Git, Linux Shell

## Experience

**University of Maryland, College Park** **College Park, MD**
*Graduate Research Assistant* *2019 – present*

- Developed novel information-theoretic bounds for optimizing compression and inference in interdependent systems using *shared information* to quantify cross-source correlation and applied it to graphical models
- Derived the first explicit formula for *shared information* in non-tree undirected graphical models that reduced the corresponding optimization problem from an exponential to a linear search space for sparse graphs
- Proposed a sequential bandit algorithm to estimate mutual information in tree graphical models, handling estimator bias
- Developed finite blocklength upper bounds on the lossy compression rate under randomized spatial sampling

**Kaleidoscope Blockchain, Inc.** **Princeton, NJ**
*Research Engineer Intern* *Summer 2023*

- Designed a protocol to verify internet node locations using ping delay measurements, robust against adversarial attack
- Implemented the protocol using RIPE Atlas and cloud data, reaching $\leq 500$ km accuracy for $> 90\%$ of nodes

**Institute of Network Coding, CUHK** **Hong Kong**
*Research intern* *Summer 2018*

- Proved that exactly $\log(n)$ shared random bits suffice to communicate $n$ bits even under adversarial corruption
- Extended the linear programming bound in coding theory to more general discrete metrics via discrete Fourier analysis

## Selected Publications

- M. Pathegama and **S. B.**, "Shared Information under Simple Markov Interdependencies," ISIT 2024 [link]
- **S. B.** and P. Narayan, "Shared Information for a Markov Chain on a Tree," IEEE Trans. on Information Theory, 2024 [link]
- **S. B.** and P. Narayan, "Universal Single-Shot Sampling Rate Distortion," ISIT 2021 [link]
- **S. B.**, A. J. Budkuley and S. Jaggi, "Shared Randomness in Arbitrarily Varying Channels," ISIT 2019 [link]

## Selected Projects

**Signal processing for sound detection using millimeter wave radar** **Spring 2025**

- Implemented a custom convolutional neural network in PyTorch to denoise the radar signal and applied Short-Time Fourier Transform (STFT) for feature extraction

**Lightweight Neural Networks for Turbulence Correction on Mobile Devices** **Spring 2024**

- Developed a lightweight model for on-device turbulence mitigation using mobile RGB-D data. Created the ARKitScene-Turbulent dataset & demonstrated that depth input improves reconstruction accuracy using smaller models.

**Voronoi tessellation-assisted classification - LINK** **Fall 2022**

- Used Voronoi tessellation-based MNIST classification from partial sampling of each image using deep CNNs for planar and spherical MNIST datasets. Showed that spherical MNIST loses less performance when number of sampled points decreases