Arpon Basu

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arponbasu
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Education

2020 – Present — **Indian Institute of Technology Bombay, India** — 9.65 CPI
B.Tech. with Honors in Computer Science and Minor in Mathematics

2018 – 2020 — **Atomic Energy Central School No. 4, Mumbai, India** — 98%
Intermediate/+2

2008 – 2018 — **Atomic Energy Central School No. 4, Mumbai, India** — 96.4%
Matriculation

Workshops

2023 — Max Planck Institute for Software Systems, Saarbrücken: Was selected for the **Cornell, Maryland and Max Planck pre-doctoral research school**, and attended it in Fall 2023

Publication(s)

Presented paper "Ablation Study of Indian Automatic Vehicle Number-Plate Recognition Model Trained Over Synthetic Dataset" in FICTA 2022, (proceedings, pg 95) and won the **Best Paper Award** for it

Research Experience

2022-Ongoing — **Stochastic Particle Models Project** *Guide: Prof. Amitava Bhattacharya | TIFR, Mumbai*

- Rigorously proved phase transitions in Manna-type models, and also derived very precise estimates for the critical probability. Also proved results outlining the time of stabilization of the stochastic process. ***Publication expected soon***.
- Picked up multiple tools in Advanced Probability theory for the same, from Bernoulli percolation through Hugo Copin's notes and Geoffrey Grimmett's book, and Interacting Particle Systems through Holly and Ligett's paper.

2023 — **Cryptography Summer Internship** *Guide: Prof. Prashant Vasudevan | NUS, Singapore*

- Read Liu, Tessaro, and Vaikuntanathan's paper [LTV21] on provable independence bounds of AES. Tried to apply their techniques to ciphers like MiMC, and rediscovered some key insights of Angelos Pelecanos's Master's Thesis, which proved independence bounds on the block cipher MiMC [AGRRT16]
- Surveyed literature (Alon and Lovett, Rubinfield and Xie, Alon et. al.) regarding derandomization of algorithms involving the use of random permutations in an effort to derandomize LTV21's construction of independent block ciphers
- Also explored fine-grained complexity (through Williams-Vassilevska's survey), and connections with average case hardness, through Ball, Rosen, Sabin, and Vasudevan's paper.

Research Experience (continued)

2022-Ongoing **B.Tech. Thesis** *Guide: Prof. Sundar Vishwanathan | IIT Bombay*

- Worked to use structural constraints to prove optimality of Alon's biclique 2-cover bounds
- Studied Fomin and Kratsch's book on Exponential Algorithms and read Zamir's work on breaking the 2^n-barrier for 5-coloring, in the process picking up tools such as Yates' fast zeta transform, and inclusion-exclusion methods for improving exponential algorithms
- Investigating how improvements in Beigel-Eppstein's list-coloring algorithms would have ramifications on Zamir's 5-coloring algorithm

2023-Ongoing **Computational Geometry Research Project** *Guide: Prof. Sujoy Bhore | IIT Bombay*

- Working on dynamic approximation algorithms for maximum independent sets in axis-parallel rectangular systems.
- Looking into improving lower bounds for the ratio between the chromatic number and clique number of intersection graphs of axis-parallel rectangles, en route to applying it for designing algorithms to find independent sets.
- A constant ratio between the chromatic number and clique number would imply a constant integrality gap for the LP for calculating the maximum independent set

Expository Writings and Reading Projects

2023 **Sum-of-Squares Hierarchy** *Self-Project*

Prepared an report of the Sum-of-Squares Hierarchy from Pravesh Kothari's lecture series on the same, and covered Goemans-Williamson's Max-Cut algorithm, Nesterov's $\frac{\pi}{2}$-theorem, Arora-Rao-Vazirani's conductance algorithm, Grigoriev's lower bounds on the k-XOR problem through SoS, and SoS vs. spectral refutation algorithms.

Log-Concave Polynomials *Self Project*

Prepared an expository report on the technique of log-concave polynomials, especially as pioneered by Shayan Oveis Gharan and others. Covered deterministic matroid base counting algorithms, proof of Mason's conjecture, and an introduction to spectral independence

Coding Theory *Self Project*

Prepared a report of coding theory from Guruswami, Rudra, and Sudan's book on the same, and covered Derivative, Folded Reed-Solomon codes, Algebraic-Geometric Codes, and BCH codes, and also covered List Decoding of Reed-Solomon codes, Elias-Bassalygo and Johnson bounds

Stochastic Processes *Prof. Ayan Bhattacharya, IIT Bombay*

Studied the use of *Dirichlet Forms* on reversible ergodic Markov chains to derive bounds regarding their relaxation time from this monograph by Aldous and Fill, and prepared a report on the same

2022 **Percolation Theory** *Prof. Amitava Bhattacharya, TIFR*

Prepared an expository writing on the calculation of the critical probability for bond percolation on $\mathbb{Z}^2$, one of the most fundamental results of percolation theory

Service

2021–2023 **Teaching Assistantship** *IIT Bombay*

2023 **CS 215 (Data Analysis & Interpretation)** *Instructors: Prof. Ajit Rajwade, Pushpak B.*
2023 **CS 228 (Logic for CS)** *Instructors: Prof. Ashutosh Gupta, Krishna S.*
2022 **MA 106 (Linear Algebra)** *Instructor: Prof. Gopal Krishna Srinivasan*
2021 **MA 109 (Calculus I)** *Instructor: Prof. Sourav Pal*

Responsible for conducting tutorial sessions for a batch of students throughout the semester, helping them clear conceptual doubts through personal interaction, and correcting answer sheets. Created LaTeXed solutions which were referred to by hundreds of students in the batch

2023 **Mentor, Summer of Science**

Guided students interested in group theory by creating an action plan, recommending resources, clearing doubts, having discussions, and reviewing their reports

Company Internship(s)

2022 **Software Development** *Company Internship at Franklin Templeton*

- Built Django-based **toolbox** for handling data concerning **Australian Fixed Income Securities**
- Wrote scripts for **scraping** data from financial websites and uploading time-series into **Macrobond**
- Implemented **Optimizer** for choosing which bonds to buy based on maximum **CTD utilization**

Scholastic Achievements

2022 Listed in the top quartile in the Simon-Marais Mathematics Competition
2020 Secured an All India Rank of 59 in JEE Advanced among more than 0.15 million aspirants
Received 100 percentile in Physics in both attempts of JEE Mains, among 0.88 million aspirants
Conferred an AP grade in Calculus among the 1371 students registered for the course
Received 100/100 in both Mathematics and Biology in CBSE Board examinations, NCERT
Among 46 students invited to IChO (International Chemistry Olympiad) training camp
Among 100 students declared Times Scholar by Times of India among 0.3 million aspirants
2019 Secured All India Rank 6 in NMTC (National Mathematics Talent Contest) conducted by AMTI
In top 1% students across Maharashtra in NSEB (National Standard Examination in Biology)
Received the prestigious KVPY fellowship with All India Rank 58 awarded by DST, Govt. of India
2018 Among 46 students invited to IJSO (International Junior Science Olympiad) training camp
2016-2018 Qualified the Regional Mathematics Olympiad (RMO) thrice from the state of Maharashtra

Select Courses Undertaken

Computer Science — Advanced Image Processing (Compressed Sensing), Cryptography and Network Security, Geometric Algorithms, Spectral Graph Theory, Game Theory

Mathematics — Extremal Combinatorics, Stochastic Processes, Basic Algebra, Real Analysis

Extra-Curriculars

2021 Performed Inaugural Song at the IIT Bombay Convocation Ceremony twice
Successfully completed the year-long NSO program in Hindustani Classical Music at IIT Bombay
2020 Declared winner of the Freshiezza Writing Competition organized by the Literati Club of IIT Bombay