Amit Rajaraman

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amitrajaraman
http://amitrajaraman.github.io/

Research Interests

Theoretical computer science, random algorithms, Markov chains, combinatorics, boolean function analysis

Research Experience

2022 **Summer Internship** *Guides: Piyush Srivastava and Hariharan Narayanan | TIFR, Mumbai*
- Analyzed a novel multiscale Markov chain on convex bodies that mixes rapidly from a cold start
- Proved that the coordinate hit-and-run Markov chain mixes rapidly from a cold start

2022 **B.Tech. Project** *Guides: Prof. Niranjan Balachandran and Prof. Rohit Gurjar | IIT Bombay*
- Working towards proving Bagchi's conjecture, a problem in combinatorial geometry
- Studied various results in the analysis of boolean functions, including the KKL Theorem and a result on independent sets in graph products due to Dinur, Friedgut, and Regev
- Covered various general methods to solve combinatorial problems, also preparing a report on all the topics and papers studied, which can be found here.

2021 **Summer Internship** *Guide: Navin Goyal | Microsoft Research, Bengaluru*
- Worked towards proving the KLS Conjecture and Hyperplane Slicing Conjecture, elusive problems in high-dimensional geometry, using the localization and stochastic localization methods
- Prepared a report on the topics studied, covering several topics in asymptotic convex geometry from scratch, which can be found here

Publication(s)

1 H. Narayanan, **A. Rajaraman**, and P. Srivastava, *Sampling from convex sets with a cold start using multiscale decompositions*, 2022. DOI: 10.48550/ARXIV.2211.04439.

Reading Projects

2022 **Representation Theory of Finite Groups** *Summer of Science under Math Club, IIT Bombay*
Studied representation theory from *Representation Theory of Finite Groups* by Benjamin Steinberg
Prepared a report on the topics studied, which can be found here.

2022 **Derandomization and Pseudorandomness Course Project**
Presented a paper on pseudorandom generators for space-bounded computation by Nisan

2020 **Topics in Algebra II Course Project**
Prepared a presentation on the quiver of the Tits algebra and the Saliola lemma

2020 **Coding Theory** *Summer of Science under Math Club, IIT Bombay*
Studied Coding Theory from *Essential Coding Theory* by Guruswami, Rudra, and Sudan and *A First Course in Coding Theory* by Raymond Hill
Prepared a report on the topics studied, which can be found here

Education

2019 – Present **Indian Institute of Technology Bombay, India** 9.73 CPI
B.Tech. with Honors in *Computer Science and Engineering* (top 10% of department)
Minor in Mathematics

2017 – 2019 **Sri Chaitanya Junior College, India** 97.80%
Intermediate/+2

2010 – 2017 **Delhi Public School, Hyderabad, India** 10.0 GPA
Matriculation

Other Projects

2022 **Compiler for C-like language** *Guide: Prof. Uday Khedker | IIT Bombay*
- Developed a compiler for a subset of C, supporting functions, scope levels, and control sequences
- Used lex for tokenizing and yacc for parsing to construct the Abstract Syntax Tree and Three Address Code

2020 **Red Plag: Plagiarism Checker** *Guide: Prof. Amitabha Sanyal | IIT Bombay*
- Implemented a modified version of latent semantic analysis which calculates the cosine similarity between different vectors in the covariance matrix corresponding to the data
- Added further functionality for reliable detection if the program is written in C++, Python, or Java for ignoring language-specific syntax
- Built a user interface using Angular with a Django backend where registered users can upload and process files and view the similarities between the different pairs, visualised as a heat map

2021 **IITB Proc** *Guide : Prof. Virendra Singh | IIT Bombay*
- Developed a 16-bit processor using VHDL to execute operations based on instruction format
- Implemented a finite state machine for the execution of 15 instructions in a 6-stage pipeline

Scholastic Achievements

2019 Secured All India Rank 12 in JEE Advanced among 245,000 aspirants

2019 Secured All India Rank 102 in JEE Main among 1.2 million aspirants

Conferred an AP grade in

- 2022 MA214 (Numerical Analysis), awarded to 7 out of 739 students
- 2020 MA106 (Linear Algebra), awarded to 8 out of 1108 students
- 2019 CS101 (Computer Programming and Utilization), awarded to 1 out of 1212 students
- 2019 MA105 (Calculus), awarded to 35 out of 1137 students
- 2019 PH107 (Quantum Physics and Application), awarded to 12 out of 1115 students

2019 Secured All India Rank 2 in the admission test to Indian Statistical Institute, Kolkata

2019 Secured Rank 17 in the Telangana State EAMCET among 142,000 candidates

2019 Scored 415/450 in BITSAT (Birla Institute of Technology and Science Admission Test)

Scholarships and Recognition

2017 Recipient of the prestigious Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship

2019 Amongst the top 300 students across the nation in NSEC and appeared for the INChO

2019 Amongst the top 300 students across the nation in NSEA and appeared for the INAO

2015 Attended a camp in Delhi for securing All India Rank 33 in the DPS Talent Examination

Technical Skills

Software LaTeX, MATLAB, Git, LEAN

Programming C++, C, Python, Bash, Java, Julia

Select Courses Undertaken

Computer Science Derandomization and Pseudorandomness, Game Theory and Algorithmic Mechanism Design, Artificial Intelligence and Machine Learning, Special Topics in Automata and Logics

Mathematics Weak Convergence and Martingale Theory, Graph Theory, Combinatorics I, Topics in Algebra II, Real Analysis, Complex Analysis, General Topology, Linear Algebra

Miscellaneous

2020 **Teaching Assistant, MA 109 (Calculus I)** *Instructor: Prof. Ravi Raghunathan | IIT Bombay*
Responsible for conducting tutorial sessions for a batch of 45 students throughout the semester, helping them clear conceptual doubts through personal interaction, and correcting answer sheets

2021–2022 **Mentor, Summer of Science**
Guided students interested in topology and graph theory by creating an action plan, recommending resources, clearing doubts, having discussions, and reviewing their reports

2020–2022 **Notes**
Prepared notes for various undertaken courses and other topics, referred to by hundreds of peers, which can be found at amitrajaraman.github.io/notes

2019 Successfully completed an intermediate course in Table Tennis under the National Sports Organization at IIT Bombay

2016 Appointed as the Deputy Vice Head Boy at Delhi Public School, Hyderabad