Siddhartha **Jain**

Computer Science @ EPFL · Algorithms · Complexity Theory

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Education

EPFL

École Polytechnique Fédérale de Lausanne — *Lausanne, Switzerland*

M.S. in Computer Science — *Sep 2020 - Present*

- MSc Research Scholar
- **Relevant Courses**: Advanced Algorithms, Learning Theory, Probabilistic Methods in Combinatorics, Spectral Graph Algorithms, Computational Complexity, Information Theory & Coding

IIIT-Delhi

Indraprastha Institute of Information Technology, Delhi — *New Delhi, India*

B.Tech in Computer Science & Applied Mathematics — *Aug 2016 - Aug 2020*

- Cumulative GPA 9.1/10, Major GPA 9.3/10

Publications

Unambiguous DNFs and Alon-Saks-Seymour — *Boolean Functions*

FOCS 2021 [Invited to SICOMP Special Issue] — *2021*

- Coauthors: Mika Göös (EPFL), Kaspars Balodis (ULatvia), Shalev Ben-David (UWaterloo), Robin Kothari (Microsoft Research)
- We exhibit an unambiguous k-DNF formula that requires CNF width $\widetilde{\Omega}(k^2)$, which is optimal up to logarithmic factors. As a consequence, we get a near-optimal solution to the Alon–Saks–Seymour problem in graph theory (posed in 1991), which asks: How large a gap can there be between the chromatic number of a graph and its biclique partition number? Our result is also known to imply several other improved separations in query and communication complexity.
- [ECCC] [arXiv]

Projects

Communication Complexity of Collision — *Boolean Functions*

Communication complexity — *2021*

- Advisor: Mika Göös (EPFL)
- We show that a natural version of Collision in the communication setting has $\Omega(poly(n))$ randomised communication complexity. As an application, we prove that the size of any tree-like Res($\oplus$) refutation of the Weak Pigeonhole Principle (WPHP) has size $2^{\Omega(poly(n))}$. This is equivalent to the statement that parity decision trees require $\Omega(poly(n))$ queries to find a violated clause in WPHP.

Query Complexity of Search Problems — *Boolean Functions*

Query and proof complexity — *2021*

- Collaborators: Mika Göös, Gilbert Maystre (EPFL), Alexandros Hollender (Oxford), Robert Robere, Ran Tao, William Pires (McGill)
- We exhibit oracle seperation(s) between subclasses of **TFNP** by consideing the Query analogues, which have characterisations/relations to Proof systems.

Unsupervised Preprocessing for Clustering — *Clustering*

Clustering — *2020 - 2021*

- Collaborators: Shay Ben-Elazar (Microsoft Research), Vincent Cohen-Addad (Google Research), Karthik CS (Rutgers)
- We propose a completely new paradigm for preprocessing data in an unsupervised manner to improve the performance of clustering algorithms, inspired by **Error-Correcting Codes** and **Locality Sensitive Hashing**.

Probabilistic & Interactive Proofs — *Interactive Proofs*

Reading Project — *2021*

- Advisor: Alessandro Chiesa (UC Berkeley, EPFL)
- Reading about recent advances in interactive proofs and their applications to Cryptography.

Maximum Independent Set for Rectangles & Pattern Avoidance in Permutations — *Combinatorics*

Combinatorial Geometry | Bachelor Thesis at IIIT-Delhi — *2018 - 2019*

- Advisors: Rajiv Raman, Samrith Ram
- Worked on a combinatorial conjecture on Guillotine Cuts for Axis Parallel Rectangles, which would imply a polytime $O(1)$ approximation algorithm for MISR, as presented in On Guillotine Cutting Sequences [Abed, Chalermsook et al].
- We found an interesting connection to Pattern Avoidance in Permutations, and posed our own conjecture along with a few results.

Experience

MSc Research Scholar — *Lausanne, Switzerland*
EPFL — *Feb 2021 - Jan 2022*
- Working with Mika Göös.

Research Intern — *Shanghai, China*
ITCS @ Shanghai University of Finance & Economics — *May 2019 - Jul 2019*
- Hosted by Bundit Laekhanukit.
- Showed a result about the inapproximability of a **graph compression** problem. The paper can be found on ArXiv.

Teaching Assistant — *New Delhi, India*
IIIT-Delhi — *Aug 2018 - Nov 2018*
- Course: Discrete Structures.

Skills

Presentation	LaTeX, Illustrator
Programming	Python, Mathematica, Julia, C++, Java
Languages	English, Hindi, French (beginner)

Honors & Awards

2021	**MSc Research Scholar**, EPFL	*Lausanne, Switzerland*
2020	**Graduation with Honors**, IIIT-Delhi	*New Delhi, India*
2019	**Dean's List**, IIIT-Delhi	*New Delhi, India*

Workshops & Schools

Mathematics of Quantum Computation — *Jerusalem, Israel*
Israel Institute for Advanced Studies — *Dec 2019*

Mathematics for Data Science — *Bangalore, India*
Indian Institute of Science — *Jul 2019*

Graph Theory & Graph Algorithms — *Gandhinagar, India*
Indian Institute of Technology, Gandhinagar — *Jun 2017*

Extracurricular Activity

Évariste (Math Club of IIIT-Delhi) — *New Delhi, India*
Founder — *Aug 2017*
- 40+ active members, 8 innovative events per semester.
- Organised Convergence along with Math dept of IIIT-Delhi.

Student Senate of IIIT-Delhi — *New Delhi, India*
Representative — *Apr 2018 - Aug 2019*
- Represented CSAM Batch of 2016 in the Senate.
- Represented entire student body in the Disciplinary Action Committee.