

Somnath Bhattacharjee

✉ somnath.bhattacharjee@mail.utoronto.ca

in profile

🌐 <https://somnathbtcjee.github.io/>



Education

- 2024 – current **PhD Computer Science, University of Toronto**
Advisor: Dr. Shubhangi Saraf
- 2022 – 2024 **M.Sc. Computer Science, Chennai Mathematical Institute**
Thesis on *Rank Computation problem for Linear Matrices*
Thesis advisor: Dr. Partha Mukhopadhyay
Report: [PDF]
- 2019 – 2022 **B.Sc. Mathematics and Computer Science, Chennai Mathematical Institute**
- 2017 – 2019 **Higher Secondary Education, Ramakrishna Mission Vidyalaya, Narendrapur**
- 2011 – 2017 **Secondary Education, Ramakrishna Mission Vidyalaya, Narendrapur**

Research Interest

Algebraic Algorithms, Algebraic and Boolean Complexity Theory, Fine-grained Complexity, Pseudorandomness, Computational Algebra, Error-correcting codes, Algebraic Proof Complexity

Research Publications





Conference Proceedings

- 1 **S. Bhattacharjee**, M. Bläser, P. Dutta, and S. Mukherjee, “Exponential Lower Bounds via Exponential Sums,” in *51st International Colloquium on Automata, Languages, and Programming (ICALP 2024)*, K. Bringmann, M. Grohe, G. Puppis, and O. Svensson, Eds., ser. Leibniz International Proceedings in Informatics (LIPIcs), vol. 297, Dagstuhl, Germany: Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2024, 24:1–24:20, ISBN: 978-3-95977-322-5. [DOI: 10.4230/LIPIcs.ICALP.2024.24.](#)







Research Internships and Projects

- 2023 – current **Project on Witness for ABP-PIT via non-commutativity**
Guide Dr. Partha Mukhopadhyay (CMI) and Dr. Iddo Tzameret (Imperial college, London)
In this project, I’m studying upper bounds and lower bounds for the proof-size of non commutative ABPs (which are commutatively zero) using commutators as axioms.
- 2023 (summer) **Project on Black-box approximate algorithm for Edmond problem**
Guide Dr. Abhranil Chatterjee (ISI Cal) and Dr. Partha Mukhopadhyay (CMI)
In this project I tried to find black box subexponential approximate algorithm for edmonds’ problem using Bläser-Jindal-Pandey idea. I also read about algorithms for matroids using edmonds’ problem (commutative and non-commutative both) algorithms.

Research Internships and Projects (continued)

- 2022 – 2023  Worked on *The conditional optimality of Ryser formula: Algebraic version of Strong ETH*
with Dr. Markus Bläser (University of Saarland), Dr. Pranjal Dutta (NUS) and Saswata Mukherjee (CMI)
In this project I learned about parameterized complexity and fine grained complexity and their relation with algebraic complexity. We finally achieve exponential lower bound in parameterized valiant classes from tau-conjecture.
This project leads to the submitted work *Lower bounds in parameterized algebraic complexity via exponential sums*, [PDF]
- 2022 (summer)  Project on *Uniform Determinantal Complexity*
Guide: Dr. Markus Bläser (University of Saarland).
That internship was funded by MPI software system, Saarbrücken.
Here we have improved the upper bounds for specific Generic polynomials with/without approximation
- 2022 (6th semester)  Reading project on *Lower bounds and Border Complexity*
Guide: Dr. Partha Mukhopadhyay (CMI)
In this project I studied the determinant complexity and ABP-size lower bounds for power sum. Further more I studied the power of small width ABPs, separation between width-2 weak and general ABP, universality of approximated width-3 weak ABP and width-2 ABP.
- 2021 (summer)  Reading project on *PIT using ROABP and Diagonal Circuits*
Guide: prof. Nitin Saxena (IITK)
In this project I studied about progress in PIT in various models, mainly focusing on diagonal circuits.
Report of the internship: [PDF]

Talks and Presentations

- 2024  **MSc Thesis Presentation** (CMI):
"A study on Rank Computation problem for Linear Matrices"
Slides: [PDF]
- 2023  **Course-work Presentation** (Timed Automata):
"Decidability of Timed Communication Automata" by Lorenzo Clemente
Slides: [PDF]
-  **Course-work Presentation** (Parallel Algorithm and Complexity):
"Linear Matroid Intersection is in Quasi-NC" by Rohit Gurjar and Thomas Thierauf
Slides: [PDF]
- 2022  **Course-work Presentation** (Complexity Theory II):
" $BPSPACE(S) \subseteq DSPACE(S^{3/2})$ " by Michael Saks and Shiyu Zhou
Report: [PDF]
-  **Course-work Presentation** (Matching and Flow Algorithms):
"An $O(n \log^2 n)$ Algorithm for Maximum Flow in Undirected Planar Networks" by Refael Hassin and Donald B. Johnson
Report: [PDF], Slides: [PDF]
- 2021  **Course-work Presentation** (Structure vs Hardness in Cryptography):
"Lattice Basis Delegation in Fixed Dimension and Shorter-Ciphertext Hierarchical IBE" by Shweta Agrawal, Dan Boneh and Xavier Boyen.
Report:[PDF], Slides: [PDF]

Talks and Presentations (continued)

- **CMI Student Seminar:** "Progress in PIT"
Slides: [PDF]

Attended Workshops

- Jan-Apr 2024 ■ Quantum Computing Semester, CMI
- March 2023 ■ Workshop on Algebraic Complexity Theory (WACT'23)
- 2021-2022 ■ School and Conference on Geometric Complexity Theory (online)

Academic Achievements

- 2022 ■ Selected for Sriram and Infosys scholarship for Masters Degree
- Research Intern in Max Planck Institute for Software Systems.
- 2019 ■ Selected for INSPIRE scholarship (sponsored by central Government for research purpose, given to the top 1% student of India)
- Selected for Sriram scholarship (Based on the result of CMI admission test)
- 2018 ■ Attended JBNSTS junior science camp held at IISER Kolkata
- JBNSTS junior scholar (Government sponsored science scholarship test)
- 2017 ■ Swami Vivekananda Scholarship (State-Government scholarship based on Board-marks)
- 2015 ■ 3rd in Mathemazic (Intra-city mathematical quiz competition)

Relevant Courses

The following courses I have credited during my college educations:

1. Complexity Theory I and II
2. Quantum Computing
3. Structure vs Hardness in Cryptography (IITM)
4. Stochastic Process I
5. Algebraic Number Theory
6. Matching and Flow Algorithms
7. Communication Complexity
8. Geometric Complexity Theory
9. Algebra and Computation
10. Timed Automata (Ongoing)
11. Parallel Algorithms and Complexity
12. Algorithmic Coding Theory

I have followed the following courses:

1. Arithmetic Circuit Complexity (NPTEL)
2. Design and Analysis of Algorithms (MIT OCW)

Other than these, I have taken basic courses on Real Analysis, Complex Analysis, Metric Spaces, Topology, Linear Algebra, Group and Ring Theory, Algorithms, Automata Theory and Mathematical Logic in CMI.

Teaching Assistant

- Jan-Apr 2024 ■ Discrete Maths (CMI course)
Instructor: Dr. Samir Datta

Teaching Assistant (continued)

Jan-Mar 2024	■ Design and Analysis of Algorithms (NPTEL course) Instructor: Dr. Madhavan Mukund
Aug-Nov 2023	■ Design and Analysis of Algorithms (CMI course) Instructor: Dr. G. Philip
	■ Linear Algebra (Sai University course) Instructor: Dr. Neha Prabhu
Aug-Sep 2023	■ Design and Analysis of Algorithms (NPTEL course) Instructor: Dr. Madhavan Mukund
Jan-Apr 2023	■ Discrete Maths (CMI course) Instructor: Dr. V. Arvind and Dr. Amit Sinhababu
Jan-Apr 2022	■ Computational Complexity Theory (CMI course) Instructor: Dr. Prajakta Nimbhorkar
Aug-Nov 2021	■ Mathematical Methods of Analysis (CMI course) Instructor: Dr. Kavita Sutar
Apr-Jul 2021	■ Discrete Maths (CMI course) Instructor: Dr. K. V. Subrahmanyam

Extra Curricular Activities

Programming

Languages	■ Python, C, C++, JAVA, Haskell, Latex and HTML
Magazine	■ I was one of the co-editors of the science magazine Tiyaas. It is an online science magazine mainly contains lots of science articles, puzzles, quizzes and many more
STEMS	■ I was part of question setting committee for computer science in STEMS 2021, 2022, 2023 I was part of core organising committee of our college fest Tessellate 2020
Games	■ I mainly play and watch football. Other than that I used to play Table Tennis, Cricket, Basketball, Volleyball and Chess etc.
Others	■ In my spare time I used to perform drama, recitation and music. Also I love to read story books and watch movies.

References

Dr. Markus Bläser

Professor
University of Saarland,
mail: mblaeser@cs.uni-saarland.de

Dr. K. V. Subrahmanyam

Professor and Dean of Studies
Chennai Mathematical Institute,
mail: kv@cmi.ac.in

Dr. Partha Mukhopadhyay

Professor
Chennai Mathematical Institute,
mail: partham@cmi.ac.in

Dr. Amit Sinhababu

Asst. Professor
Chennai Mathematical Institute,
mail: amitks@cmi.ac.in