

Devansh Shringi

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Education

Indian Institute of Technology, Kanpur

Dual BT-MT in Computer Science and Engineering

- M. Tech CPI - 10.0/10.0 Supervisor- Prof. Nitin Saxena
- B. Tech CPI - 9.8/10.0

Kanpur, India

Jul 2017 - May 2022 (expected)

Research Interests

Computational Complexity Theory, Pseudorandomness, Computational Algebra, Algebraic Complexity, Graph Theory

Publications

Explicit Construction of Local Ramanujan Graphs of $q+1$ degree for almost all prime power q

[paper]

Rishabh Batra, Nitin Saxena, Devansh Shringi

Mar. 2022

Under review at STACS 2022

Research Experience

Construction of Local Ramanujan Graphs (Master Thesis)

[paper]

Advisor: Prof. Nitin Saxena, Indian Institute of Technology Kanpur

Jan. 2021 - Present

- Worked on localizing the known constructions of Ramanujan Graphs of degree prime power + 1
- Learnt about the constructions of Ramanujan graphs, Cayley graphs, local expanders and local Ramanujan graphs of degree 3
- Gave construction of infinite families of $O(\log q)$ locality $q + 1$ regular bipartite Ramanujan graphs for all $q = p^k$, $p \geq 5$, $q = 9^k$
- Working on giving construction for degrees which were left open, i.e. $3^{2k+1} + 1$ and $2^k + 1$ ($k > 1$)
- Led to submission: **Explicit Construction of Local Ramanujan Graphs of $q+1$ degree for almost all prime power q**

Sparse Polynomial Identity Testing using less Random bits

[report]

Advisor: Prof. Markus Bläser, Max-Planck-Institut für Informatik

Jan. 2021 - Jul. 2021

- Worked on decreasing the number of random bits required to do Blackbox Polynomial Identity Testing (PIT) for Sparse polynomial
- Learnt about concepts like testers, Sidon sets, Isolation lemma and their application in blackbox PIT
- Created a Hitting set for sparse polynomial of size $O(m^2)$ where m is number of monomials, if variables are given in increasing order of number of distinct degrees
- Using it created a randomized algorithm that can solve PIT for sparse polynomials using only $O(\log(\text{number of monomials}))$ random bits

Polynomial Identity Testing for Depth 4 Circuits Constant Top and Bottom Fan-in (UG project)

[report1][report2]

Advisor: Prof. Nitin Saxena, Indian Institute of Technology Kanpur

Jan. 2020 - Nov. 2020

- Studied about the work done on the problem of PIT for the case of constant top fan-in depth 3 and depth 4 (constant bottom fan-in) circuits using Sylvester Gallai approach. Also, studied various results on constant top fan-in problem for depth 3 circuits.
- Explored an approach to extend the ideal membership approach for depth 3 circuits to depth 4 using Gröbner's basis and F5 algorithm.
- Worked on extending the work of Shpilka and Peleg of Top fan-in 2 Bottom fan-in 2 from Top fan-in 2 Bottom fan-in 3
- Created structure theorem for cubics lying in radical generated by 2 cubics that is equivalent to structure theorem by Shpilka for quadratics.

Lower bounds for Graph Streaming Algorithms with constant passes

[report]

Advisor: Prof. Raghunath Tewari, Indian Institute of Technology Kanpur

Jan. 2021 - Apr. 2021

- Read the literature on lower bounds of streaming algorithm
- Learnt about reduction of problem to set Intersection lower bounds, and various tools for it like Unique reach problem and Ruzsa-Szemerédi Graphs, as well as finding lower bounds for set-intersection problem
- Worked on extending the near quadratic lower bound of 2 pass streaming algorithm to for 3 pass and beyond
- Created a 3 player communication game that worked for 3 pass algorithm. Also, attempted various designs to create worst case distribution.

Talks

Derandomizing PIT Means Proving Circuit Lower Bounds

Nov. 2020

Course: Computational Complexity Theory

[Slides]

Polynomial Identity Testing of Depth 4 Constant Top and Bottom Fanin

Nov. 2019

Special Interest Group on Theoretical Aspects of Computer Science, SIGTACS, IITK

[Abstract]

Introduction to Theoretical Computer Science

Sep. 2019

Computer Science Freshers (ACA), IITK

[Slides]

Teaching Experience

Teaching Assistant, CS345: Algorithms II

Instructor: Prof. Surender Baswana

- Graded Assignments and Quizzes of 150+ students.

Kanpur, India

Jul. 2021 - Nov. 2021

Tutor, ESC101: Fundamentals of Computing

Instructor: Prof. Debadatta Mishra and Prof. Swarnendu Biswas

- Conducted weekly tutorial lectures through zoom, graded students, designed questions for lab assignments and written exams.

Kanpur, India

Feb. 2021 - Jun. 2021

Tutor, ESC101: Fundamentals of Computing

Instructor: Prof. Biswabandan Panda

- Conducted weekly tutorial lectures through zoom, graded students, designed questions for lab assignments and written exams.

Kanpur, India

Oct. 2020 - Feb. 2021

Honors & Awards

2021	Research Fellow , Max Planck Institute for Informatics
2020	DAAD-WISE scholarship , for research in Summer 2020(Redacted due to COVID)
2018-21	4 consecutive Academic Excellence Awards , Indian Institute of Technology, Kanpur
2017-21	Exceptional Performances in 8 courses , Indian Institute of Technology, Kanpur
2017	AIR 179 JEE Advance , out of 200,000 candidates
2017	AIR 52 JEE Main , out of 1.2 million candidates
2017	Qualified INChO, INPhO, INAO , Top 35 in each field(Chemistry,Physics,Astronomy) in all of India
2016	Bronze Medal at IOAA 2016 , representing India
2016	AIR 88 KVPY Scholarship , out of 100,000 candidates
2016	Qualified INMO, INAO , Top 35 in all of India

Selected Projects

Relationship between Circuit Lower bounds and PIT

Course Project: Computational Complexity Theory

[report]

Dec 2020

Exploring Relation between Rényi entropy and Kolmogorov Complexity

Advisor: Prof. Satyadev Nandakumar

Kanpur, India

May 2019 - Jul. 2019

Finding Young Stellar Objects from GMRT data

Advisor: Prof Sarita Vig, Indian Institute of Space and Technology

Thiruvananthapuram, India

Dec. 2017

Other Professional Activities

Coordinator, Association of Computing Activities (ACA)

Indian Institute of Technology, Kanpur

Aug. 2019 - Dec. 2020

- Conducted various events like Happy hours, Freshers and Farewell of CS Department promoting interaction among Department members
- Also organized introductory projects in Computer Science for First year Undergraduate students

Project Mentor

ACA, CSE IITK

Jan. 2019 - May 2020

Mentored a group of First Year Students introducing them to various aspects of Theoretical Computer Science

Student Guide

Counselling Service, IITK

Jul. 2018 - Apr. 2019

Helped a group of 6 First year Students get familiar in campus and conducted their orientation as their guide.

Graduate Courses

Arithmetic Circuit Complexity,
Randomized Methods in Computational Complexity,
Computational Number Theory and Algebra,
Special Topics in Computer Science Engineering

Quantum Computing*,
Modern Cryptology,
Randomized Algorithms*,

Computational Complexity Theory*,
Algorithmic Information Theory,
Intro to ML*,

*-Exceptional Performance