Vipul Arora

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Research Interests

Theoretical Computer Science, with focus on Complexity Theory, Combinatorics, & Property Testing.

Teaching Interests

Theoretical Computer Science, and Advanced Mathematics, especially Geometry, and Combinatorics.

Education

National University of Singapore (NUS) — **Jan 2019 - Dec 2023 (Expected)**
Doctor of Philosophy (PhD), Computer Science — *GPA: 4.1/5 (continued from IISc)*

Indian Institute of Science (IISc), Bangalore — **Jan 2018 - Dec 2018**
Doctor of Philosophy (PhD), Computer Science — *GPA: 8.2/10*

Chennai Mathematical Institute (CMI) — **Aug 2015 - July 2017**
Master of Science (M.Sc.), Computer Science — *GPA: 8.24/10*

Indian Institute of Technology (IIT), Kanpur — **Aug 2008 - June 2014**
Bachelor of Technology (B.Tech.), Computer Science and Engineering — *GPA: 6.5/10*

St. Kabir Convent School, Bathinda, Punjab, India — **June 2008**
CBSE Class XII AISSCE — *84%*

St. Xavier's High School, Bathinda, Punjab, India — **June 2006**
CBSE Class X AISSE — *92.8%*

M.Sc. Thesis

Arithmetic Circuits: A Study

Advisor: Prof. Meena Mahajan, Institute of Mathematical Sciences (IMSc)

This thesis was a literature survey on arithmetic circuits, focused on the point of view of proving lower bounds on the size required for circuits to compute certain polynomials. Starting from Valiant's definitions of complexity classes VP, and VNP, and the notions of projections, and complete problems, the techniques studied included homogenization, design of universal circuits, formal partial derivative computation, and depth reduction, ending with a concrete lower bound for circuits computing the permanent polynomial.

B.Tech. Project

Entropy Estimation in Data Streams using Stable Distributions

Advisor: Prof. Sumit Ganguly, CSE Department, IIT Kanpur

The project focused on trying to relate the well-behaved characteristic functions of stable distributions and the hard-to-compute entropy function of a data stream. It involved developing approximation arguments to show that the function we were computing, a manipulated form of the characteristic function, was multiplicatively close to the desired entropy function.

Publications/Preprints

1. Vipul Arora, Arnab Bhattacharyya, Noah Fleming, Esty Kelman, and Yuichi Yoshida. *Low Degree Testing over the Reals.* https://doi.org/10.48550/arXiv.2204.08404 (To appear in SODA 2023)

Relevant Computer Science & Mathematics Courses Done

- At NUS (Doctoral):
  - Randomized Algorithms
  - Theory and Algorithms for Machine Learning
  - Property Testing
  - Algorithmic Mechanism Design
  - Space Bounded Computations
  - Topics in Information Security (Probabilistic Proof Systems)
- At IISc (Doctoral):
  - Topics in Algebra and Computation
  - Topics in Discrete Probability
  - Spectral Algorithms
  - Cryptography
  - Graph Theory
- At CMI, and IMSc, Chennai (Masters):
  - Computational Complexity
  - Infinite Discrete Structures
  - Graduate Algorithms
  - Algebra and Computation
  - Concrete Lower Bounds
  - Mathematical Logic
  - Mathematical Foundations of Computer Science
  - Mathematical Optimization
  - Dynamic Data Structures Lower Bounds
  - Dynamic Graph Algorithms
- At IIT Kanpur (Undergraduate):
  - Data Streaming: Algorithms & Systems
  - Theory of Computation
  - Design and Analysis of Algorithms
  - Discrete Mathematics
  - Data Structures & Algorithms
  - Applied Game Theory
  - Probability and Statistics
  - Complex Analysis & Linear Algebra
  - Real Analysis
  - Differential Equations

Skill-Set

- </> Programming: Java, C/C++, Python, x86 Assembly, GNU Octave, Matlab
- Typesetting: LaTeX
- Operating Systems: Linux, Windows
- Miscellaneous: GApps, Microsoft Office

Advisor & References

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Dr. Divesh Aggarwal
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Dr. Yuichi Yoshida
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National Institute of Informatics
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