

Prayaag Venkat

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RESEARCH INTERESTS

Theoretical computer science, average-case complexity, and discrete probability

EDUCATION

Harvard University

Aug. 2018 - Present

- Ph.D. Computer Science.
- Advisor: Boaz Barak.

University of Maryland, College Park

Aug. 2014 - Dec. 2017

- B.S. Computer Science, B.S. Mathematics.
- Advisors: Andrew Childs, Samir Khuller, David Mount, Penghui Yao.

AWARDS

- NSF Graduate Fellowship (2018 - Present)
- Banneker Key Scholarship (2014-2018): Full ride offered to top 200 incoming students at UMD.
- 2017 Goldwater Scholarship.
- 2016 CRA Undergraduate Research Award, Honorable Mention.
- 2016 Abramowitz Award: Awarded by the UMD Department of Mathematics for superior competence and promise in the field of mathematics and its applications.

PUBLICATIONS

- *Optimal Regularization Can Mitigate Double Descent*. P. Nakkiran, P. Venkat, S. Kakade, T. Ma. ICLR 2021. Preprint available at: <https://arxiv.org/abs/2003.01897>.
- *A Fast Spectral Algorithm for Mean Estimation with Sub-Gaussian Rates*. Z. Lei, K. Luh, P. Venkat, F. Zhang. COLT 2020. Preprint available at: <https://arxiv.org/abs/1908.04468>
- *Select and Permute: An Improved Online Framework for Scheduling to Minimize Weighted Completion Time*. S. Khuller, J. Li, P. Sturmfels, K. Sun, P. Venkat. LATIN 2018. Preprint available at: <https://arxiv.org/abs/1704.06677>.
- *A Succinct, Dynamic Data Structure for Proximity Queries on Point Sets*. P. Venkat, D.M. Mount. CCCG 2014.

EXPERIENCE

Visiting Graduate Student

Spring 2021

The Statistical and Applied Mathematical Sciences Institute

- Participated in the Program on Combinatorial Probability.

Visiting Graduate Student

Fall 2020

Simons Institute, University of California, Berkeley

- Hosted by Professor Prasad Raghavendra.
- Participated in the “Probability, Geometry, and Computation in High Dimensions” program.

Undergraduate Researcher

Summer 2017

CAAR REU, University of Maryland, College Park

- Mentored by Dr. Penghui Yao and Professor Andrew Childs on a project in classical and quantum communication complexity.

- Studied the relationship between various communication complexity and information complexity lower bound methods through the lens of linear programming.
- Gave new, simplified proofs of previously known relationships with the aim of establishing new relationships.

Undergraduate Researcher

Summer 2016 - Fall 2016

CAAR REU, University of Maryland, College Park

- Mentored by Professor Samir Khuller on a project in approximation algorithms for scheduling problems.
- Designed a general algorithmic framework which gives improved approximation guarantees for several scheduling problems.
- Implemented numerous scheduling heuristics and ran numerical experiments on real-world data (Matlab).
- Summarized theoretical and practical improvements in a manuscript (submitted).

Undergraduate Researcher

Summer 2014, Spring 2017

University of Maryland, College Park

- Mentored by Professor David Mount on a project in computational geometry.
- Created space-efficient data structure for solving geometric proximity search problems (range searching, nearest neighbor searching) by transforming tree-based structures into compact linear bit strings.
- Studied new techniques like locality sensitive hashing for geometric data structure problems.
- Delivered oral presentation of results at CCCG 2014 in Halifax, Nova Scotia.

Software Engineering Intern

Summer 2015

Johns Hopkins University Applied Physics Lab, Laurel, MD

- Mentored by Dr. Anurag Dwivedi.
- Developed graph analytics and visualization tool to analyze critical infrastructure (Matlab).
- Researched and implemented efficient heuristic algorithms for NP-Hard optimization problems (Matlab).
- Developed a custom REST web service to provide integration with large-scale, distributed graph database (Java, MySQL, Apache TinkerPop, Apache Tomcat, GraphML).
- Improved mission visualization software to translate graph analytics into mission dependency models (Java, Matlab, XML).

PRESENTATIONS

- “A Fast Spectral Algorithm for Mean Estimation with Sub-Gaussian Rates,” P. Venkat. COLT 2020 (virtual). July 2020.
- “A 1D Area Law for Gapped Local Hamiltonians,” B. Gjura and P. Venkat. Physics and Computation Seminar. Harvard University. November 2018.
- “Mean Estimation in High Dimensions,” P. Venkat. Harvard TGINF. October 2018.
- “On Characterizing the Relationship between Lower Bound Methods in Communication Complexity,” J. Liu and P. Venkat.
 - Joint Center for Quantum Information and Computer Science (QuICS) Special Seminar. University of Maryland, College Park. August 2017.
 - Joint CAAR REU and Salisbury REU Poster Session. University of Maryland, College Park. July 2017.
- “Online Concurrent Open Shop Scheduling.” J. Li, P. Sturmfels, K. Sun, and P. Venkat. Joint CAAR REU and Salisbury REU Poster Session. University of Maryland, College Park. August 2016.

- “On Parameter-free LSH for Spherical Range Reporting by Ahle, Aumüller, and Pagh.” P. Venkat. Computational geometry reading group seminar. University of Maryland, College Park. April 2017.
- “On the polynomial partitioning method by Guth and Katz.” P. Venkat. Computational geometry reading group seminar. University of Maryland, College Park. November 2014.
- “On the Szemerédi-Trotter Theorem.” P. Venkat. Computational geometry reading group seminar. University of Maryland, College Park. September 2014.
- ‘A Succinct, Dynamic Data Structure for Proximity Queries on Point Sets.’ P. Venkat. Canadian Conference on Computational Geometry (CCCG) 2014. Dalhousie University, Halifax, Nova Scotia, Canada. August 2014.

COURSES

- Computer Science: Object Oriented Programming, Introduction to Computer Systems, Organization of Programming Languages, Machine Learning, Design and Analysis of Algorithms, Computational Methods, Cryptography, Introduction to Quantum Information Processing, Computer Vision, Computational Cancer Biology, Physics and Computation, Information Processing and Statistical Physics, Information Theory in Computer Science, Optimization for Machine Learning, Bayesian Modeling and Inference, Partition Functions: Algorithms and Complexity.
- Mathematics: Linear Algebra, Differential Equations, Discrete Math, Combinatorics and Graph Theory, Analysis, Abstract Algebra, Field Theory, Topology, Probability Theory, High-dimensional Probability, Discrete Probability and Stochastic Processes.

SERVICE AND TEACHING

Teaching assistant

- CS231 (Quantum Computation and Quantum Complexity), taught by Anurag Anshu in Spring 2022.
- CS121 (Introduction to Theoretical Computer Science), taught by Boaz Barak in Fall 2019

External reviewer for STOC

2020

Banneker-Key Peer Mentor

2016-Present

University of Maryland, College Park

- Mentored three computer science freshman Banneker-Key Scholarship recipients on selecting courses, pursuing research and internship opportunities, and preparing for future career endeavors.

Computer Science Department Tutor

2016-Present

University of Maryland, College Park

- Tutored several undergraduate students in algorithms and discrete math courses every week for entire semester.

External reviewer for DCC

2015