Makrand Sinha

Contact Information

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Research Interests

- Computational Complexity (Foundations of Classical and Quantum Computation)
- Optimization (Discrepancy Theory, Extended Formulations) and Stochastic Processes

Employment

Nov 2018-present **Centrum Wiskunde & Informatica (CWI)**, Amsterdam
Postdoctoral Researcher in the *Networks & Optimization* group
Advisors: Nikhil Bansal, Ronald de Wolf, Monique Laurent

Education

Aug 2018 **University of Washington**, Seattle
Ph.D. in *Computer Science and Engineering*
Advisor: Anup Rao
Dissertation: Lower Bounds for Interactive Compression and Linear Programs

May 2011 **ETH Zürich**, Switzerland
M. Sc. in *Computer Science*
Advisor: Thomas Holenstein

May 2009 **Indian Institute of Technology Kanpur**, India
Bachelor of Technology in *Computer Science and Engineering*

Publications

1. k-**Forrelation Optimally Separates Quantum and Classical Query Complexity** [arXiv]
   Nikhil Bansal and Makrand Sinha
   To appear in the 53rd Symposium on Theory of Computing (**STOC '21**).
   Contibuted talk at Quantum Information Processing (**QIP '21**).

2. **Majorizing Measures for the Optimizer** [arXiv]
   Sander Borst, Daniel Dadush, Neil Olver and Makrand Sinha
   Appeared in the 12th Innovations in Theoretical Computer Science (**ITCS '21**)

3. **Online Discrepancy Minimization for Stochastic Arrivals** [arXiv]
   Nikhil Bansal, Haotian Jiang, Raghu Meka, Sahil Singla and Makrand Sinha
   To appear in the 32nd Symposium on Discrete Algorithms (**SODA '21**).

4. **Online Vector Balancing and Geometric Discrepancy** [arXiv]
   Nikhil Bansal, Haotian Jiang, Sahil Singla and Makrand Sinha
   Appeared in the 52nd Symposium on Theory of Computing (**STOC '20**). Invited talk at **TCS+**.

5. **Exponential Separation between Quantum Communication and Logarithm of Approximate Rank** [arXiv]
Makrand Sinha and Ronald de Wolf
Appeared in IEEE 60th Annual Symposium on Foundations of Computer Science, (**FOCS** '19).
Contibuted talk at Quantum Information Processing (**QIP '20**) as part of a joint submission.

6. **Simplified Separation of Information and Communication** [ECCC]
Anup Rao and Makrand Sinha
Appeared in **Theory of Computing**, December 2018.

7. **Edge Estimation with Independent Set Oracles** [arXiv]
Paul Beame, Sariel Har-Peled, Sivaramakrishnan Natarajan Ramamoorthy, Cyrus Rashtchian and Makrand Sinha
Appeared in the 9th Innovations in Theoretical Computer Science (**ITCS '18**).
Full version in ACM **Transactions on Algorithms**.

8. **Lower Bounds for Approximating the Matching Polytope** [arXiv][ECCC]
Makrand Sinha
Appeared in the 29th Annual ACM-SIAM Symposium on Discrete Algorithms (**SODA '18**).
Invited talk at the International Symposium on Mathematical Programming (**ISMP '18**).

9. **A Direct-sum Theorem for Read-Once Branching Programs** [pdf]
Anup Rao and Makrand Sinha
Appeared in the 20th International Workshop on Randomization and Computation (**RANDOM '16**)

10. **Fooling Pairs in Randomized Communication Complexity** [ECCC]
Shay Moran, Makrand Sinha and Amir Yehudayoff
Appeared in the 23rd International Colloquium on Structural Information and Communication Complexity (**SIROCCO '16**)

11. **On the Communication Complexity of Greater-Than** [pdf]
Sivaramakrishnan Natarajan Ramamoorthy and Makrand Sinha
Appeared in the 53rd Annual Allerton Conference on Communication, Control and Computing (**Allerton '15**)

12. **Constructing a Pseudorandom Generator Requires an Almost Linear Number of Calls** [arXiv]
Thomas Holenstein and Makrand Sinha
Appeared in the 53rd Annual Symposium on Foundations of Computer Science (**FOCS' 12**)

13. **Vertices of Degree k in Random Unlabeled Trees** [pdf]
Konstantinos Panagiotou and Makrand Sinha
Appeared in the proceedings of **EuroComb '09**. Full version appeared in **Journal of Graph Theory**, 2012

Research Visits

Aug 18-Sep 18	**Simons Institute**, *Lower Bounds in Computational Complexity* program Visiting Researcher
Sep 14-Oct 14	**Technion-Israel Institute of Technology** Visiting Researcher
Jul 13-Oct 13	**Microsoft Research India**, *Theory Group* Research Internship
Jun 13-Jul 13	**Technion-Israel Institute of Technology** Visiting Researcher
May 08-Jul 08	**ETH Zürich** Research Internship

Organized Workshops

· Organized the post-conference workshop *'Extension Complexity and Lifting Theorems'* at **FSTTCS '19**.

Talks

k-Forrelation Optimally Separates Quantum and Classical Query Complexity
Sep 2020 QuSoft Seminar, *CWI (Virtual)*
Sep 2020 Quantum Information Seminar, *UT Austin (Virtual)*

Online Vector Balancing and Geometric Discrepancy
Sep 2020 HALG '20, *Virtual*
Jun 2020 STOC '20, *Virtual*
May 2020 N&O Seminar, *CWI*

Tutorial: Lower Bounds for Extension Complexity
Dec 2019 FSTTCS '19 Workshop, *IIT Bombay*

Exponential Separation between Quantum Communication and Logarithm of Approximate Rank
Nov 2019 FOCS '19, *Baltimore*
Oct 2018 Seminar, *ENS Lyon*
Jun 2019 Seminar, *Institute of Mathematics, Czech Academy of Sciences*
Sep 2019 QuantAlgo Workshop, *CWI*
Sep 2019 Seminar, *Université de Libre Bruxelles*
Apr 2019 QuSoft Seminar, *CWI*

Lower Bounds for Approximating the Matching Polytope
Sep 2018 Simons Institute, *Berkeley*
Jul 2018 ISMP 2018, *Bordeaux*
Mar 2018 Seminar, *CWI Amsterdam*
Jan 2018 SODA 2018, *New Orleans*
Nov 2017 UW Theory Seminar, *University of Washington*

A Direct-sum Theorem for Read-Once Branching Programs
Sep 2016 APPROX-RANDOM 2016, *IHP Paris*

Simplified Separation of Information and Communication
Mar 2018 Theory Seminar, *KTH Stockholm*
Dec 2015 UW Theory Seminar, *University of Washington*

On Parallelizing Streaming Computation
Apr 2015 Workshop on Information Theory in Complexity Theory and Combinatorics, *Simons Institute*

Direct Sums and Compression for Parallel Streaming Computation
Feb 2014 UW Theory Seminar, *University of Washington*

Constructing a Pseudorandom Generator Requires an Almost Linear Number of Calls
Oct 2012 FOCS 2012, *New Brunswick*
Apr 2012 UW Theory Seminar, *University of Washington*

Teaching Experience

CWI

· Organized a reading group on *Random Matrices, Matrix Concentration and connections to Quantum Information Theory* (Fall 2019)

University of Washington

- Guest lecturer for several lectures in a graduate course on *Communication Complexity* (Autumn 2015).
- Teaching Assistant for graduate *Randomized Algorithms* (Winter 2015), undergraduate *Algorithms* (Summer 2014, Spring 2014), undergraduate *Complexity Theory* (Spring 2013).
- Organized and lectured in student reading groups: *Fourier Analysis* (Summer 2012, Organizer), *Recent developments in Theory* (Spring 2013, Organizer), *Incidence Geometry* (Winter 2014), *Recent developments in Theory* (Winter 2015), *Additive Combinatorics* (Spring 2016).
- Gave a popular science talk at Town Hall Seattle:

  P vs NP: The Limits of Computers (May 2013), UW Science Now, *Town Hall Seattle*.

Academic Awards

- *Computer Science and Engineering Research Fellowship* at University of Washington for the year 2011-2012
- *Excellence Scholarship* at ETH Zürich from 2009-2011
- *Academic Excellence Award* for the year 2005-06 at IIT Kanpur
- *All India Rank 82* (among top 0.05% candidates) in IIT-Joint Entrance Examination 2005

Other Professional Activities

1. Conference Reviewer for RANDOM, STOC, FOCS, CCC, ITCS, ICALP, QIP, SODA
2. Journal Reviewer for Random Structures & Algorithms, Theoretical Computer Science, JACM, SICOMP, Information and Computation