

Aleksandar Nikolov

Curriculum Vitae

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Education

- 2008—2014 PhD, Computer Science **Rutgers, the State University of New Jersey**
Advisor: S. Muthukrishnan
2004—2008 BSc, Computer Science **Saint Peter's College, Jersey City, NJ**

Experience

- July 2015 — Present **University of Toronto**
Assistant Professor
- Oct 2014 — July 2015 **Microsoft Research, Redmond**
Postdoctoral Researcher
Supervisor: Christopher Meek
- Sept 2012 — Oct 2014 **Rutgers, the State University of New Jersey**
Simons Graduate Fellow
Supervisor: S. Muthukrishnan
- Aug 2008 — Sept 2012 *Graduate Assistant*
Supervisor: S. Muthukrishnan
- Apr 2013 — July 2013 **Microsoft Research, Silicon Valley**
Research Intern
Supervisor: Cynthia Dwork
- June 2013 — Sept 2013 *Research Intern*
Supervisor: Kunal Talwar
- May 2011 — Dec 2011 **Technicolor Labs, Palo Alto**
Research Intern
Supervisors: Nadia Fawaz and Nina Taft

Honors

- 2018 Ontario Early Researcher Award
2016 Canada Research Chair in Algorithms and Private Data Analysis
2015 SoCG 2015 Best paper award
2012—2014 Simons Graduate Fellow
2011 \$100 from Joel Spencer for resolving Beck's Three Permutations problem
(jointly with Alantha Newman)
2008 Valedictorian, St. Peter's College

Publications

PhD thesis

1. Nikolov, A. (2014). "New Computational Aspects of Discrepancy Theory". PhD thesis. Rutgers, The State University of New Jersey. <http://dx.doi.org/doi:10.7282/T3RN3749>.

Book chapters

1. Bhattacharyya, A., F. Grandoni, A. Nikolov, B. Saha, S. Saurabh, A. Vijayaraghavan, and Q. Zhang (2018). Editorial: ACM-SIAM Symposium on Discrete Algorithms (SODA) 2016 Special Issue. *ACM Trans. Algorithms* 14(3), 26:1–26:2. <http://doi.acm.org/10.1145/3230647>.
2. Nikolov, A. (2016). "Geometric Approaches to Answering Queries". In: *Encyclopedia of Algorithms*, pp.828–834. http://dx.doi.org/10.1007/978-1-4939-2864-4_553.

Submitted papers

1. Zadeh, S. A., N. Bansal, G. Guruganesh, A. Nikolov, R. Schwartz, and M. Singh (2018). "Sticky Brownian Rounding and its Applications to Constraint Satisfaction Problems". To appear in SODA 2020. [arxiv:1812.07769](https://arxiv.org/abs/1812.07769).

Refereed research papers

1. Blasiok, J., M. Bun, A. Nikolov, and T. Steinke (2019). Towards Instance-Optimal Private Query Release. In: *SODA 2019*. SIAM, pp.2480–2497.
2. Khesin, A. B., A. Nikolov, and D. Paramonov (2019). Preconditioning for the Geometric Transportation Problem. In: *SoCG 2019*. Vol. 129. LIPIcs. Schloss Dagstuhl - Leibniz-Zentrum fuer Informatik, pp.15:1–15:14. **Invited to the special issue.**
3. Li, J., A. Nikolov, I. P. Razenshteyn, and E. Waingarten (2019). On Mean Estimation for General Norms with Statistical Queries. In: *COLT*. Vol. 99. Proceedings of Machine Learning Research. PMLR, pp.2158–2172.
4. Nikolov, A., M. Singh, and U. T. Tantipongpipat (2019). Proportional Volume Sampling and Approximation Algorithms for A-Optimal Design. In: *SODA 2019*. SIAM, pp.1369–1386.
5. Andoni, A., A. Naor, A. Nikolov, I. P. Razenshteyn, and E. Waingarten (2018). Data-dependent hashing via nonlinear spectral gaps. In: *STOC 2018*. ACM, pp.787–800.
6. Andoni, A., A. Naor, A. Nikolov, I. P. Razenshteyn, and E. Waingarten (2018). Hölder Homeomorphisms and Approximate Nearest Neighbors. In: *FOCS 2018*. IEEE Computer Society, pp.159–169.
7. Dadush, D., A. Nikolov, K. Talwar, and N. Tomczak-Jaegermann (2018). Balancing Vectors in Any Norm. In: *FOCS 2018*. IEEE Computer Society, pp.1–10.
8. Matoušek, J., A. Nikolov, and K. Talwar (2018). Factorization Norms and Hereditary Discrepancy. *International Mathematics Research Notices*, rny033. <http://dx.doi.org/10.1093/imrn/rny033>. Originally in SODA 2015 and SoCG 2015.
9. Andoni, A., H. L. Nguyen, A. Nikolov, I. P. Razenshteyn, and E. Waingarten (2017). Approximate near neighbors for general symmetric norms. In: *STOC 2017*. ACM, pp.902–913.
10. Kattis, A. and A. Nikolov (2017). Lower Bounds for Differential Privacy from Gaussian Width. In: *SoCG 2017*. Vol. 77. LIPIcs. Schloss Dagstuhl - Leibniz-Zentrum fuer Informatik, pp.45:1–45:16.
11. Nikolov, A. (2017). Tighter bounds for the discrepancy of boxes and polytopes. *Mathematika* 63(3), 1091–1113. <https://doi.org/10.1112/S0025579317000250>.
12. Aistleitner, C., D. Bilyk, and A. Nikolov (2016). Tuszynski's Problem, the Transference Principle, and Non-uniform QMC Sampling. In: *Monte Carlo and Quasi-Monte Carlo Methods*. Ed. by A. B. Owen and P. W. Glynn. Springer International Publishing, pp.169–180.
13. Dadush, D., S. Garg, S. Lovett, and A. Nikolov (2016). Towards a Constructive Version of Banaszczyk's Vector Balancing Theorem. In: *APPROX-RANDOM 2016*. Vol. 60. LIPIcs. Schloss Dagstuhl - Leibniz-Zentrum fuer Informatik, pp.28:1–28:12. **Invited to the special issue.**
14. Nikolov, A. and M. Singh (2016). Maximizing determinants under partition constraints. In: *STOC 2016*. ACM, pp.192–201.
15. Nikolov, A., K. Talwar, and L. Zhang (2016). The Geometry of Differential Privacy: The Small Database and Approximate Cases. *SIAM J. Comput.* 45(2), 575–616. <http://dx.doi.org/10.1137/130938943>. Originally in STOC 2013.
16. Dwork, C., A. Nikolov, and K. Talwar (2015). Efficient algorithms for privately releasing marginals via convex relaxations. *Discrete Comput. Geom.* 53(3), 650–673. <http://dx.doi.org/10.1007/s00454-015-9678-x>. Originally in SoCG 2014.
17. Matoušek, J. and A. Nikolov (2015). Combinatorial Discrepancy for Boxes via the γ_2 Norm. In: *Symposium on Computational Geometry 2015*. Vol. 34. LIPIcs. Schloss Dagstuhl - Leibniz-Zentrum fuer Informatik, pp.1–15. **Best Paper Award.**
18. Nikolov, A. (2015). An Improved Private Mechanism for Small Databases. In: *ICALP 2015 (1)*. Vol. 9134. Lecture Notes in Computer Science. Springer, pp.1010–1021.
19. Nikolov, A. (2015). Randomized Rounding for the Largest Simplex Problem. In: *STOC 2015*. ACM, pp.861–870.
20. Nikolov, A. and K. Talwar (2015). Approximating Hereditary Discrepancy via Small Width Ellipsoids. In: *SODA 2015*. SIAM, pp.324–336. **Invited to the special issue.**
21. Nikolov, A. and K. Talwar (2015). On the hereditary discrepancy of homogeneous arithmetic progressions. *Proc. Amer. Math. Soc.* 143(7), 2857–2863. <http://dx.doi.org/10.1090/S0002-9939-2015-12545-2>.
22. Andoni, A., A. Nikolov, K. Onak, and G. Yaroslavtsev (2014). Parallel algorithms for geometric graph problems. In: *STOC 2014*. ACM, pp.574–583.
23. Bolot, J., N. Fawaz, S. Muthukrishnan, A. Nikolov, and N. Taft (2013). Private decayed predicate sums on streams. In: *ICDT 2013*. ACM, pp.284–295.

24. Fawaz, N., S. Muthukrishnan, and A. Nikolov (2013). “Nearly Optimal Private Convolution”. In: *Algorithms – ESA 2013*. Vol. 8125. Lecture Notes in Computer Science. Springer Berlin Heidelberg, pp. 445–456.
25. Muthukrishnan, S. and A. Nikolov (2012). Optimal private halfspace counting via discrepancy. In: *STOC 2012*. ACM, pp.1285–1292.
26. Newman, A., O. Neiman, and A. Nikolov (2012). Beck’s Three Permutations Conjecture: A Counterexample and Some Consequences. In: *FOCS 2012*. IEEE Computer Society, pp.253–262.
27. Charikar, M., A. Newman, and A. Nikolov (2011). Tight Hardness Results for Minimizing Discrepancy. In: *SODA 2011*. SIAM, pp.1607–1614.
28. Mir, D., S. Muthukrishnan, A. Nikolov, and R. N. Wright (2011). Pan-Private Algorithms via Statistics on Sketches. In: *PODS ’11: Proceedings of the thirtieth ACM SIGMOD-SIGACT-SIGART symposium on Principles of database systems*. Athens, Greece: ACM, pp.37–48. <http://dx.doi.org/doi:10.1145/1989284.1989290>.

Scientific Service

- Program Committee member for AAAI 2020
- Program Committee member for FOCS 2019
- Program Committee member for ICML 2019
- Program Chair for TPDP 2018 and TPDP 2019 (with Michael Hay)
- Participated in Simons Institute Program on Data Privacy
- Program Committee member for RANDOM 2018
- Participated in Simons Institute Program on Bridging Continuous and Discrete Optimization
- Program Committee member for WADS 2017
- Organized a special session on Combinatorial Discrepancy at MCQMC 2016 (August 2016) (with Kunal Talwar)
- Organized Workshop on Hereditary Discrepancy and Factorization Norms (February 2016) at the American Institute of Mathematics (with Kunal Talwar)
- Program Committee member for SODA 2016

Tutorials and Overview Talks

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| Spring 2019 | Simons Institute Data Privacy Program Boot Camp
<i>Algorithms for Answering Linear Queries</i>
(with Gerome Miklau) |
| Summer 2018 | Prague Summer School on Discrete Mathematics
<i>Course on Discrepancy Theory</i> |
| Spring 2018 | Endless Summer School 2018, Vector Institute
<i>Tutorial on Differential Privacy</i> |
| Fall 2016 | Monte Carlo and quasi-Monte Carlo Methods, Stanford
<i>Introduction to Combinatorial Discrepancy</i> |
| Spring 2014 | SIAM Conference on Data Mining
<i>Safer Data Mining: Tutorial on Differential Privacy</i>
(with Moritz Hardt) |
| Fall 2013 | Big Data Program, Simons Institute, Berkeley
<i>Privacy in Streaming Models: Overview Talk</i> |

Invited Talks

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| Fall 2019 | Georgia Tech ARC Seminar
<i>The Power of Factorization Mechanisms in Differential Privacy</i> |
| Fall 2019 | CWI Networks and Optimization Seminar
<i>Proportional Volume Sampling and Approximation Algorithms for Optimal Design</i> |
| Spring 2019 | UC Berkeley Theory Lunch
<i>Sticky Brownian Rounding and its Applications to Constraint Satisfaction Problems</i> |
| Spring 2019 | TCS+ Online Seminar
<i>Sticky Brownian Rounding and its Applications to Constraint Satisfaction Problems</i> |
| Fall 2018 | Avner Magen Memorial Lecture |

- Spring 2018 *Spectral Partitioning and Nearest Neighbor Search*
International Symposium on Mathematical Programming
Balancing Vectors in Any Norm
- Spring 2018 CWI Workshop on Integer Programming
Balancing Vectors in Any Norm
- Spring 2018 Annual Meeting, Simons Collaboration on Algorithms and Geometry
Balancing Vectors in Any Norm
- Spring 2018 Banff Mathematical Foundations of Data Privacy Workshop
Geometric Lower Bounds and Algorithms for Differential Privacy
- Fall 2017 Stanford
Proportional Volume Sampling and Approximation Algorithms for A-Optimal Design
- Fall 2017 Simons Institute
Discrepancy and Approximation Algorithms
- Spring 2017 Simons Institute Data Privacy Planning Workshop
Privacy and Geometry
- Spring 2017 Dagstuhl Computational Geometry Workshop
Maximizing Volume under Combinatorial Constraints
- Spring 2016 CWI Amsterdam
Maximizing Determinants under Partition Constraints
- Spring 2016 Google Research New York
On Differential Privacy and Gaussian Width
- Spring 2016 Courant Institute, Workshop in Honor of Joel Spencer
Factorization Norms and the Discrepancy of Boxes
- Spring 2016 Institut Henri Poincare, Secrecy and Privacy Theme
On Differential Privacy and Gaussian Width
- Spring 2016 American Institute of Mathematics, Workshop on Discrepancy
Hereditary Discrepancy and Factorization Norms
- Fall 2015 University of Waterloo Theory Seminar
Randomized Rounding for the Largest Simplex Problem
- Spring 2015 University of Toronto Theory Seminar
Randomized Rounding for the Largest Simplex Problem
- Spring 2015 Bellairs Workshop on Combinatorial Optimization
Hereditary Discrepancy and Factorization Norms
- Fall 2014 DIMACS Theory Seminar
Randomized Rounding for the Largest j -Simplex Problem
- Fall 2014 UW Theory Seminar
Randomized Rounding for the Largest j -Simplex Problem
- Fall 2014 UW Combinatorics Seminar
Factorization Norms and Tusnády's Problem
- Fall 2014 ICERM Discrepancy Theory Workshop
Factorization Norms and Tusnády's Problem
- Fall 2014 NYU Geometry Seminar
Factorization Norms and Tusnády's Problem
- Spring 2014 DIMACS Theory Seminar
Approximating Hereditary Discrepancy
- Fall 2013 NYU Theory Seminar
Approximating Hereditary Discrepancy
- Spring 2013 IBM TJ Watson Research Center
The Geometry of Differential Privacy
- Fall 2012 DIMACS Workshops on Differential Privacy
The Geometry of Differential Privacy
- Fall 2012 NYU Theory Seminar
The Geometry of Differential Privacy
- Spring 2012 Rutgers Discrete Math Seminar
Vector Discrepancy and the Komlos Problem
- Spring 2012 DIMACS Theory Seminar
Optimal Private Halfspace Counting via Discrepancy
- Fall 2011 Microsoft Research, Silicon Valley Campus
Optimal Private Halfspace Counting via Discrepancy

Grants

- (2018–2023) Ontario Early Researcher Award
- (2017–2019) Connaught Fund: Geometric Methods in Discrepancy and Privacy.
- (2016–2021) NSERC Discovery Grant: Computational Discrepancy Theory.

Patents

- Differentially Private Linear Queries on Histograms

Courses Taught

Fall 2019	CSC2412 Algorithms for Private Data Analysis
Fall 2019	CSC265 Enriched Data Structures and Analysis
Winter 2019	CSC473 Advanced Algorithms
Fall 2018	CSC2412 Algorithms for Private Data Analysis
Fall 2018	CSC265 Enriched Data Structures and Analysis
Winter 2018	CSC473 Advanced Algorithms
Winter 2018	CSC263 Data Structures and Analysis
Winter 2017	CSC2419 Algorithms and Complexity in Private Data Analysis
Winter 2017	CSC473 Advanced Algorithms
Fall 2016	CSC265 Enriched Data Structures and Analysis
Winter 2016	CSC263 Data Structures and Analysis
Fall 2015	CSC2414 Discrepancy Theory In Computer Science

Students

PhD: Sepehr Abbasi Zadeh, Alexander Edmonds, XinYuan Li

Masters: Assimakis Kattis (now in NYU),