

ALI VAKILIAN

Address: Toyota Technological Institute at Chicago
6045 South Kenwood Ave
Chicago, IL 60637
E-mail: vakilian@ttic.edu
Home Page: <http://www.ttic.edu/vakilian>

Research Interests

- Fairness of Algorithms and Machine Learning
- Learning-Augmented Algorithms, Algorithms with Predictions
- Algorithms for Massive Data
- Learning in the Presence of Strategic Agents
- Approximation Algorithms and Combinatorial Optimization

Academic Positions

- **Toyota Technological Institute at Chicago.** 9/2022 – present
Research Assistant Professor.
- **Toyota Technological Institute at Chicago, IDEAL Institute** 9/2020 – 9/2022
Postdoctoral Researcher hosted by Yury Makarychev and Nathan Srebro.
- **University of Wisconsin–Madison** 9/2019 – 9/2020
Postdoctoral Researcher hosted by Ilias Diakonikolas.

Education

- **Massachusetts Institute of Technology (MIT)** 9/2013 – 9/2019
Ph.D. in Computer Science, CSAIL
Thesis Title: *New Directions in Streaming Algorithms*
Advisors: Erik Demaine and Piotr Indyk
- **University of Illinois at Urbana-Champaign (UIUC)** 9/2011 – 9/2013
M.S. in Computer Science
Thesis Title: *Prize-Collecting Survivable Network Design Problem in Node-Weighted Graphs*
Advisor: Chandra Chekuri
- **Sharif University of Technology** 9/2007 – 6/2011
B.S. in Computer Engineering

Working Papers

- 44. **Bayesian Strategic Classification**
with Lee Cohen, Saeed Sharifi-Malvajerdi, Kevin Stangl and Juba Ziani. *February 2024*
- 43. **On Socially Fair Regression and Low-Rank Approximation**
with Zhao Song, David Woodruff and Samson Zhou. *February 2024*

Conference Publications

- 42. **Streaming Algorithms for Connectivity Augmentation**ICALP 2024
with Ce Jin, Michael Kapralov and Sepideh Mahabadi.
Proceedings of 39th International Colloquium on Automata, Languages, and Programming.
- 41. **Learning-Based Algorithms for Graph Searching Problems**AISTATS 2024
with Adela DePavia and Erasmo Tani.
Proceedings of International Conference on Artificial Intelligence and Statistics. PMLR.
Selected as an oral paper.
- 40. **Scalable Algorithms for Individual Preference Stable Clustering**AISTATS 2024
with Ron Mosenzon.
Proceedings of International Conference on Artificial Intelligence and Statistics. PMLR.
- 39. **Improved Frequency Estimation Algorithms with and without Predictions**NeurIPS 2023
with Anders Aamand, Justin Chen, Huy Nguyen and Sandeep Silwal.
Proceedings of Advances in Neural Information Processing Systems.
Selected as a spotlight paper.
- 38. **A Constant-Factor Approximation for Individual Preference Stable Clustering**NeurIPS 2023
with Anders Aamand, Justin Chen, Allen Liu, Sandeep Silwal, Pattara Sukprasert and Fred Zhang.
Proceedings of Advances in Neural Information Processing Systems.
Selected as a spotlight paper.
- 37. **Tight Bounds for Volumetric Spanners and Applications**NeurIPS 2023
with Aditya Bhaskara and Sepideh Mahabadi.
Proceedings of Advances in Neural Information Processing Systems.
- 36. **Approximating Red-Blue Set Cover**APPROX 2023
with Eden Chlamtáč and Yury Makarychev.
Proceedings of Approximation, Randomization, and Combinatorial Optimization.
- 35. **Sequential Strategic Screening**ICML 2023
with Lee Cohen, Saeed Sharifi-Malvajerdi, Kevin Stangl and Juba Ziani.
Proceedings of International Conference on Machine Learning (pp. 6279-6295). PMLR.
- 34. **Approximation Algorithms for Fair Range Clustering**ICML 2023
with Sedjro S. Hotegni and Sepideh Mahabadi.
Proceedings of International Conference on Machine Learning (pp. 13270-13284). PMLR.
- 33. **Learning the Positions in CountSketch**ICLR 2023
with Yi Li, Honghao Lin, Simin Liu and David Woodruff.

Proceedings of the Eleventh International Conference on Learning Representations.

Selected as a Notable-top-25% paper.

32. **Faster Fundamental Graph Algorithms via Learned Predictions** ICML 2022
with Justin Chen, Sandeep Silwal and Fred Zhang.
Proceedings of *International Conference on Machine Learning* (pp. 3583-3602). PMLR.
31. **Individual Preference Stability for Clustering** ICML 2022
with Saba Ahmadi, Pranjal Awasthi, Samir Khuller, Matthäus Kleindessner, Jamie Morgenstern and Pat-
tara Sukprasert.
Proceedings of *International Conference on Machine Learning* (pp. 197-246). PMLR.
Selected for a long presentation (118 out of 5630 submitted papers).
30. **Multi Stage Screening: Enforcing Fairness and Maximizing Efficiency in a Pre-Existing Pipeline**
FAcCT 2022
with Avrim Blum and Kevin Stangl.
Proceedings of the *2022 ACM Conference on Fairness, Accountability, and Transparency* (pp. 1178-1193)
29. **Fair Representation Clustering with Several Protected Classes** FAcCT 2022
with Zhen Dai and Yury Makarychev.
Proceedings of the *2022 ACM Conference on Fairness, Accountability, and Transparency* (pp. 814-823)
28. **Improved Approximation Algorithms for Individually Fair Clustering** AISTATS 2022
with Mustafa Yalçınır.
Proceedings of *International Conference on Artificial Intelligence and Statistics* (pp. 8758-8779). PMLR.
27. **Approximating Fair Clustering with Cascaded Norm Objectives** SODA 2022
with Eden Chlamtáč and Yury Makarychev.
Proceedings of the *ACM-SIAM Symposium on Discrete Algorithms* (pp. 2664-2683).
26. **Approximation Algorithms for Socially Fair Clustering** COLT 2021
with Yury Makarychev.
Proceedings of *Conference on Learning Theory* (pp. 3246-3264). PMLR.
25. **Learning Online Algorithms with Distributional Advice** ICML 2021
with Ilias Diakonikolas, Vasilis Kontonis, Christos Tzamos and Nikos Zarifis.
Proceedings of *International Conference on Machine Learning* (pp. 2687-2696). PMLR.
24. **Individual Fairness for k -Clustering** ICML 2020
with Sepideh Mahabadi.
Proceedings of *International Conference on Machine Learning* (pp. 6586-6596). PMLR.
23. **Improved Local Computation Algorithm for Set Cover via Sparsification** SODA 2020
with Christoph Grunau, Slobodan Mitrović and Ronitt Rubinfeld.
Proceedings of the *ACM-SIAM Symposium on Discrete Algorithms* (pp. 2993-3011).
22. **Learning-Based Low-Rank Approximations** NeurIPS 2019
with Piotr Indyk and Yang Yuan.
Proceedings of *Advances in Neural Information Processing Systems* (pp. 7402-7412).
21. **Structural Rounding: Approximation Algorithms for Graphs Near an Algorithmically Tractable**

- Class** ESA 2019
with Erik Demaine, Timothy Goodrich, Kyle Kloster, Brian Lavallee, Quanquan Liu, Blair Sullivan and Andrew van der Poel.
Proceedings of European Symposium on Algorithms.
20. **Tight Tradeoffs for Maximum k -Coverage Problem in the General Streaming Model** PODS 2019
with Piotr Indyk.
Proceedings of the ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems (pp. 200-217).
19. **Sample-Optimal Low-Rank Approximation of Distance Matrices** COLT 2019
with Piotr Indyk, Tal Wagner and David Woodruff.
Proceedings of Conference on Learning Theory (pp. 1723-1751). PMLR.
18. **Scalable Fair Clustering** ICML 2019
with Arturs Backurs, Piotr Indyk, Krzysztof Onak, Baruch Schieber and Tal Wagner.
Proceedings of International Conference on Machine Learning (pp. 405-413). PMLR.
17. **Learning-Based Frequency Estimation Algorithms** ICLR 2019
with Chen-Yu Hsu, Piotr Indyk and Dina Katabi.
Proceedings of the Seventh International Conference on Learning Representations.
16. **Local Computation Algorithms for Spanners** ITCS 2019
with Merav Parter, Ronitt Rubinfeld and Anak Yodpinyanee.
Proceedings of 10th Innovations in Theoretical Computer Science Conference.
15. **Set Cover in Sub-linear Time** SODA 2018
with Piotr Indyk, Sepideh Mahabadi, Ronitt Rubinfeld and Anak Yodpinyanee.
Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (pp. 2467-2486).
14. **Fractional Set Cover in the Streaming Model** APPROX 2017
with Piotr Indyk, Sepideh Mahabadi, Ronitt Rubinfeld, Jonathan Ullman and Anak Yodpinyanee.
Proceedings of Approximation, Randomization, and Combinatorial Optimization.
13. **Cost-Effective Conceptual Design Over Taxonomies** WebDB 2017
with Yodsawalai Chodpathumwan, Arash Termehchy and Amir Nayyeri.
Proceedings of the 20th International Workshop on the Web and Databases (pp. 35-40).
12. **Towards Tight Bounds for the Streaming Set Cover Problem** PODS 2016
with Sarel Har-Peled, Piotr Indyk and Sepideh Mahabadi.
Proceedings of the 35th ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems (pp. 371-383).
11. **On Streaming and Communication Complexity of the Set Cover Problem** DISC 2014
with Erik Demaine, Piotr Indyk and Sepideh Mahabadi.
Proceedings of 28th International Symposium on Distributed Computing (pp. 484-498). Springer Berlin Heidelberg.
10. **Which Concepts Are Worth Extracting?** SIGMOD 2014
with Arash Termehchy, Yodsawalai Chodpathumwan and Marianne Winslett.
Proceedings of the ACM SIGMOD International Conference on Management of Data (pp. 779-790).
9. **Improved Approximation Algorithms for Degree-Bounded Network Design Problems with Node Connectivity Requirements** STOC 2014

with Alina Ene.

Proceedings of the 46th ACM Symposium on Theory of Computing (pp. 754-763).

8. **Prize-Collecting Survivable Network Design in Node-Weighted Graphs** APPROX 2012
with Chandra Chekuri and Alina Ene.
Proceedings of *International Workshop on Approximation Algorithms for Combinatorial Optimization* (pp. 98-109). Springer Berlin Heidelberg.
7. **Node-Weighted Network Design in Planar and Minor-Closed Families of Graphs**ICALP 2012
with Chandra Chekuri and Alina Ene.
Proceedings of *39th International Colloquium on Automata, Languages, and Programming* (pp. 206-217).

Manuscripts

6. **(Learned) Frequency Estimation Algorithms under Zipfian Distribution**
with Anders Aamand and Piotr Indyk. February 2020.
5. **Approximation Algorithms for Nearly H -Minor-Free Graphs**
with Erik Demaine and Quanquan Liu. November 2018.
4. **Connected Domatic Packing Node-Capacitated Graphs**
with Alina Ene and Nitish Korula. July 2013.

Journal Publications

3. **Node-Weighted Network Design in Planar and Minor-Closed Families of Graphs**TALG 2021
with Chandra Chekuri and Alina Ene.
ACM Transactions on Algorithms (TALG), 17(2), 1-25.
2. **Cost-Effective Conceptual Design Using Taxonomies**VLDB 2018
with Yodsawalai Chodpathumwan, Arash Termehchy and Amir Nayyeri.
The VLDB Journal, 27(3), 369-394.
1. **Cost-Effective Database Design For Information Extraction Applications**TODS 2015
with Arash Termehchy, Yodsawalai Chodpathumwan and Marianne Winslett.
ACM Transactions on Database Systems (TODS), 40(2), 1-39.

Mentoring

- **Interns at TTIC**

- Madhusudhan Pittu Summer 2023
PhD student at CMU
- Erasmo Tani Summer 2023
PhD student at University of Chicago

- **Fatima Fellows**

The Fatima Fellow program (fatimafellowship.com) is an initiative aimed at increasing representation of students from marginalized communities in graduate schools throughout North America and Europe.

- Sedjro Hotegni5/2022 – 2/2023
MS student at African Institute for Mathematical Sciences-Rwanda

• **PhD Thesis Committee Members**

- Thy Nguyen Spring 2024
PhD student at Northeastern University
- Erasmo Tani Spring 2024
PhD student at University of Chicago
- Kevin Stangl Spring 2024
PhD student at TTIC
- Zhen Dai Spring 2023
PhD student at University of Chicago

Teaching _____

• **Instructor at TTIC/University of Chicago:**

Mathematical Toolkit (TTIC 31150/CMSC 31150) Spring 2023

• **Teaching Assistant at MIT:**

Introduction to Algorithms (6.006) Spring 2017

Introduction to Algorithms (6.006) Fall 2016

Advanced Algorithms (6.854) Spring 2016

Awards and Honors _____

- Recipient of **ETH Zurich Fellowship** 2019
- **Siebel Scholar** 2013
Awarded annually to 85 top students from the world's leading graduate schools.
Siebel Scholar is the largest award offered by the College of Engineering at UIUC.
- **3rd highest** GPA among all computer engineering students of class 2011 (+150 students)
- **Outstanding Student Award** 2008
Sharif University of Technology
- Ranked **38th** in the annual nationwide universities entrance exam in Iran 2007
Among 300,000+ participants

Professional Service

- **Program Committees**

Program Committee Member	ICALP 2024
Program Committee Member	PODS 2022
Area Chair	AISTATS 2024 & 2023
Junior Program Committee Member	COLT 2024
Junior Program Committee Member	ALT 2023 & 2022

- **Workshop Organization**

Summer Workshop on “ Learning-Augmented Algorithms ” at TTIC	August 2024
SoCG’23 Workshop on “ Recent Developments in Geometric Clustering ”	June 2023
Chicago Junior Theorists Workshop at Northwestern University and TTIC	January 2023
STOC Workshop on “ Algorithms with Predictions ”, Virtual	June 2020
Summer Workshop on “ Learning-Based Algorithms ” at TTIC	August 2019

- **Reviewer**

- STOC, FOCS, SODA, ITCS, ICALP, APPROX, RANDOM, PODS, DISC, ESA, STACS, KDD and WG
- ICML, NeurIPS, ICLR, AISTATS and COLT
- JACM, TALG, SICOMP, Algorithmica, JCSS and IJCAI

Research Internships and Visits

Simons Institute, Berkeley	Fall 2023
<i>Data Structures and Optimization for Fast Algorithms Program.</i>	
TTI, Chicago	Summer 2017
<i>Mentored by Julia Chuzhoy.</i>	
Google Research, NYC	Summer 2015
<i>Mentored by Silvio Lattanzi and Morteza Zadimoghaddam.</i>	

Recent Invited Talks

- **Algorithms for Socially Fair Clustering: Min-Max Fairness to Cascaded Norms**

MIT, A&C Seminar	12/6/2023
UW Seattle, Theory Seminar	11/14/2023
INFORMS Annual Meeting	10/15/2023
UT Austin, Theory Seminar	10/6/2023
Stanford University, Algorithmic Fairness Seminar	10/2/2023

- **Learning-Augmented Algorithms for Massive Data**
 INFORMS Annual Meeting 10/18/2023
- **Tight Bounds for Volumetric Spanners in All Norms**
 Simons Institute at Berkeley, Sketching and Algorithm Design Workshop 10/11/2023
- **Individual Preference Stability for Clustering**
 TRIPODS Postdoc Workshop 8/22/2023
 Research at TTIC 2/24/2023
- **Graph Algorithms with Learned Duals**
 “Scheduling” Seminar at Schloss Dagstuhl 2/9/2023
- **Learning Online Algorithms with Distributional Advice**
 Algorithms Under Uncertainty Workshop at FSTTCS’22, IIT Madras 12/6/2022
- **Algorithm Design in the Machine Learning Era**
 Research at TTIC 5/13/2022
- **Individually Fair Clustering**
 IDEAL Workshop on Clustering 4/23/2022
- **Approximation Algorithms for Fair Clustering**
 University of Wisconsin—Madison, IFDS 6/10/2021
 UC San Diego, Department of Computer Science & Engineering 5/17/2021
 UWaterloo, Combinatorics & Optimization Department 5/17/2021
 MIT A&C Seminar 5/10/2021
 TOC4Fairness Seminar 4/28/2021
 Joint Purdue University and University of Michigan Theory Seminar 4/23/2021
 University of Washington, Department of Computer Science 4/20/2021
 UIUC, Department of Computer Science 4/19/2021
 Google Research 4/15/2021
- **Learning-based Algorithms For Massive Data**
 INFORMS Annual Meeting 11/10/2020