Aditya Bhaskara

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Research Interests

Approximation & Online Algorithms, Spectral Methods
Beyond-Worst-Case Analysis
Foundations of Machine Learning

Teaching Interests

Theoretical Computer Science, Foundations of Machine Learning and Data Science

Employment

(Jan 2023 - present) Visiting Faculty, Toyota Technological Institute (TTI) Chicago, IL

(Sep 2022 - Dec 2022) Eshbach Visiting Scholar, Northwestern University, Evanston, IL

(Aug 2022 - Sep 2022) Long Term Visitor, Simons Institute for Theory of Computing, Berkeley, CA

(Jul 2022 - present) Associate Professor, University of Utah, Salt Lake City, UT

(Jan 2016 - Jun 2022) Assistant Professor, University of Utah, Salt Lake City, UT

(Oct 2013 - Oct 2015) Post Doctoral Researcher, Google Research NYC, New York, NY

(Sep 2012 - Sep 2013) Post Doctoral Researcher, EPFL, Lausanne, Switzerland

Education

(2007 - 2012) Ph.D., Computer Science, Princeton University
Advisor: Moses Charikar
Dissertation: Finding Dense Sub-structures in Graphs and Matrices

(2003 - 2007) B.Tech., Computer Science and Engineering, Indian Institute of Technology, Bombay

Honors and Awards

2021 NSF CAREER Award

2017 Google Faculty Research Award

2007 Princeton University Graduate Fellowship

First place, ACM Inter-collegiate Programming Contest (ICPC) Regionals, Coimbatore, India 2005

Silver Medal, International Mathematical Olympiad 2002, Glasgow, UK

Funding

(2021-26) NSF Grant (PI): *CAREER: Models and Algorithms for Beyond Worst-case Analysis of Learning*, $540K

(2021-24) NSF Grant (Co-PI): *FMiTF: Correctness at Both Ends: Rigorous ML Meets Efficient Sparse Implementations*, $210K (my portion).

(2020-23) NSF Grant (PI): *Online Algorithms and Approximation Methods in Learning*, $350K.

(2020-23) NSF Grant (Co-PI): *Using the POWDER Platform to Explore the Feasibility of NRDZs*, $275K (my portion).

(2019) University of Utah SEED Grant (PI), $29K.

(2017) Google Faculty Research Award (PI): *Towards Practical and Large-Scale Feature Selection*, $80K.

Publications

As is the custom in theoretical research, author order is alphabetical in most publications.

Refereed Conference Publications:

1. A. Bhaskara, S. Gollapudi, S. Im, K. Kollias, K. Munagala, "Online Learning and Bandits with Queried Hints", 14th Innovations in Computer Science (ITCS), 2023.

2. A. Bhaskara, A. Cutkosky, R. Kumar, M. Purohit, "Logarithmic Regret with Sublinear Hints", 35th Conference on Neural Information Processing Systems (NeurIPS), 2021.

3. A. Bhaskara, K. Ruwanapathirana, M. Wijewardena, "Additive Error Guarantees for Weighted Low Rank Approximation", 38th International Conference on Machine Learning (ICML), 2021.
(**Long presentation**, 3% of submissions.)

4. A. Bhaskara, K. Ruwanapathirana, M. Wijewardena, "Principal Component Regression with Semirandom Observations via Matrix Completion", 24th International Conference on Artificial Intelligence and Statistics (AISTATS), 2021.

5. A. Bhaskara, A. Cutkosky, R. Kumar, M. Purohit, "Power of Hints for Online Learning with Movement Costs", 24th International Conference on Artificial Intelligence and Statistics (AISTATS), 2021.

6. M. Abbassi, A. Bhaskara, S. Venkatasubramanian, "Fair Clustering via Equitable Group Representations", 4th Annual Conference on Fairness, Accountability, and Transparency (ACM FAccT), 2021.

7. A. Bhaskara, A. Karbasi, S. Lattanzi, M. Zadimoghaddam, "Online MAP Inference of Determinantal Point Processes", 34th Conference on Neural Information Processing Systems (NeurIPS), 2020.

8. A. Bhaskara, A. Cutkosky, R. Kumar, M. Purohit, "Online Linear Optimization with Many Hints", 34th Conference on Neural Information Processing Systems (NeurIPS), 2020.

9. A. Bhaskara, K. Munagala, S. Gollapudi, K. Kollias, "Adaptive Probing Policies for Shortest Path Routing", 34th Conference on Neural Information Processing Systems (NeurIPS), 2020.

10. A. Bhaskara, K. Ruwanapathirana, "Robust Algorithms for Online k-means Clustering", 31st International Conference on Algorithmic Learning Theory (ALT), 2020.

11. M. Wijewardena, A. Bhaskara, S. K. Kasera, S. A. Mahmud, N. Patwari, "A Plug-n-Play Game Theoretic Framework For Defending Against Radio Window Attacks", 13th ACM Conference on Security and Privacy in Wireless and Mobile Networks, (ACM WiSec), 2020.

12. A. Bhaskara, A. Cutkosky, R. Kumar, M. Purohit, "Online Learning with Imperfect Hints", 37th International Conference on Machine Learning (ICML), 2020.

13. A. Bhaskara, M. Wijewardena, "On Distributed Averaging for Stochastic k-PCA", 33rd Conference on Neural Information Processing Systems (NeurIPS), 2019.

14. A. Bhaskara, S. Vadgama, H. Xu, "Greedy Sampling for Approximate Clustering in the Presence of Outliers", 33rd Conference on Neural Information Processing Systems (NeurIPS), 2019.

15. A. Bhaskara, S. Lattanzi, M. Zadimoghaddam, S. Vassilvitskii, "Residual Based Sampling for Online Low Rank Approximtion", 60th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2019.

16. A. Bhaskara, A. Chen, A. Perrault, A. Vijayaraghavan, "Smoothed Analysis in Unsupervised Learning via Decoupling", 60th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2019.

17. A. Bhaskara, W. Tai, "Approximate Guarantees for Dictionary Learning", 32nd Annual Conference on Learning Theory (COLT), 2019.

18. A. Baset, C. Becker, K. Derr, S. Ramirez, S. K. Kasera, A. Bhaskara, "Towards Wireless Environment Cognizance by Incremental Learning", IEEE Intl. Conference on Mobile Ad Hoc and Sensor Systems (IEEE MASS), 2019.

19. A. Bhaskara, M. Wijewardena, "Distributed Clustering via LSH Based Data Partitioning", 35th International Conference on Machine Learning (ICML), 2018.

20. A. Bhaskara, S. Kumar, "Low Rank Approximation in the Presence of Outliers", 21st International Conference on Approximation Algorithms for Combinatorial Optimization Problems (APPROX), 2018.

21. A. Bhaskara, S. Daruki, S. Venkatasubramanian, "Sublinear Algorithms for MAXCUT and Correlation Clustering", 45th International Colloquium on Automata, Languages, and Programming (ICALP), 2018.

22. A. Bhaskara, S. Lattanzi, "Non-negative Sparse Regression and Column Selection with ℓ_1 Error", 9th Conference on Innovations in Theoretical Computer Science (ITCS), 2018.

23. H. Singh, S. Sarkar, A. Dimri, A. Bhaskara, N. Patwari, S. K. Kasera, S. Ramirez, K. Derr, "Privacy Enabled Crowdsourced Transmitter Localization Using Adjusted Measurements", 2nd IEEE Symposium on Privacy-Aware Computing (IEEE PAC), 2018.

24. A. Dimri, H. Singh, S. Sarkar, S. K. Kasera, N. Patwari, A. Bhaskara, S. Ramirez, K. Derr, "Privacy Enabled Noise Free Data Collection in Vehicular Networks", 15th IEEE Intl. Conference on Mobile Ad Hoc and Sensor Systems (IEEE MASS), 2018.

25. Z. Allen-Zhu, A. Bhaskara, S. Lattanzi, V. Mirrokni, L. Orecchia, "Expanders via Local Edge Flips", 27th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2016. (Also featured in Highlights of Algorithms Conference (HALG), 2017.)

26. A. Bhaskara, M. Ghadiri, V. Mirrokni, O. Svensson, "Linear Relaxations for Finding Diverse Elements in Metric Spaces", 30th Conference on Advances in Neural Information Processing Systems (NIPS), 2016.

27. J. Altschuler, A. Bhaskara, G. Fu, V. Mirrokni, A. Rostamizadeh, M. Zadimoghaddam, "Greedy Column Subset Selection: New Bounds and Distributed Algorithms", 33rd International Conference on Machine Machine Learning (ICML), 2016.

28. A. Bhaskara, A. T. Suresh, M. Zadimoghaddam, "Sparse Solutions to Nonnegative Linear Systems and Applications", 18th International Conference on Artificial Intelligence and Statistics (AISTATS), 2015.

29. Z. Abbassi, A. Bhaskara, V. Misra, "Optimizing Display Advertising in Online Social Networks", 24th International World Wide Web Conference (WWW), 2015.

30. A. Bhaskara, M. Charikar, A. Moitra, A. Vijayaraghavan, "Smoothed Analysis of Tensor Decompositions", 46th Annual ACM Symposium on Theory of Computing (STOC), 2014.

31. S. Arora, A. Bhaskara, R. Ge, T. Ma, "Provable Bounds for Learning Some Deep Representations", 31st International Conference on Machine Learning (ICML), 2014.

32. A. Bhaskara, M. Charikar, A. Vijayaraghavan, "Uniqueness of Tensor Decompositions and Identifiability in Latent Variable Models", 27th Annual Conference on Learning Theory (COLT), 2014.

33. H-C. An, A. Bhaskara, C. Chekuri, S. Gupta, V. Madan, O. Svensson, "Centrality of Trees for Capacitated k-Center", 17th Conference on Integer Programming and Combinatorial Optimization (IPCO), 2014.

34. M. Bateni, A. Bhaskara, S. Lattanzi, V. Mirrokni, "Distributed Balanced Clustering via Mapping Coresets", 28th Conference on Advances in Neural Information Processing Systems (NIPS), 2014.

35. A. Bhaskara, R. Krishnaswamy, K. Talwar, U. Wieder, "Minimum Makespan Scheduling with Low-rank Processing Times", 24th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2013.

36. A. Bhaskara, M. Charikar, V. Guruswami, A. Vijayaraghavan, Y. Zhou, "Polynomial Integrality gaps for Strong relaxations of Densest k-subgraph", 23rd Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2012.

37. A. Bhaskara, D. Dadush, R. Krishnaswamy, K. Talwar, "Unconditional Differentially Private Mechanisms for Linear Queries", 44th ACM Symposium on Theory of Computing (STOC), 2012.

38. A. Bhaskara, M. Charikar, R. Manokaran, A. Vijayaraghavan, "On Quadratic Programming with a Ratio Objective", 39th International Colloquium on Automata, Languages and Programming (ICALP), 2012.

39. A. Bhaskara, D. Desai, S. Srinivasan, "Optimal Hitting Sets for Combinatorial Shapes", 16th International Workshop on Randomization and Computation (RANDOM), 2012.

40. A. Bhaskara, A. Vijayaraghavan, "Approximating Matrix p-norms", 22nd Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2011.

41. A. Bhaskara, M. Charikar, E. Chlamtac, U. Feige, A. Vijayaraghavan, "Detecting High Log-densities: An $O(n^{1/4})$-approximation for Densest k-subgraph", 42nd ACM Symposium on Theory of Computing (STOC), 2010.

Refereed Journal/Magazine Publications:

1. A. Bhaskara, A. Chen, A. Perrault, A. Vijayaraghavan, "Smoothed analysis for tensor methods in unsupervised learning", Mathematical Programming, 2020.

2. A. Bhaskara, A. Vigneron, "Approximating a planar convex set using a sparse grid", Information Processing Letters, Vol. 149, 2019.

3. F. Yu, A. Bhaskara, S. Kumar, Y. Gong, S-F. Chang, "On Binary Embedding using Circulant Matrices", Journal of Machine Learning Research (JMLR), 2018.

4. H-C. An, A. Bhaskara, C. Chekuri, S. Gupta, V. Madan, O. Svensson, "Centrality of trees for capacitated k-center", Mathematical Programming, Vol. 154, 2015.

5. A. Bhaskara, D. Desai, S. Srinivasan, "Optimal Hitting Sets for Combinatorial Shapes", Theory of Computing, Vol. 9, 2013.

Manuscripts

1. V. Joseph, S. A. Siddiqui, A. Bhaskara, G. Gopalakrishnan, S. Muralidharan, M. Garland, S. Ahmed, A. Dengel, "Going Beyond Classification Accuracy Metrics in Model Compression", Manuscript, 2021.

2. S. Arora, A. Bhaskara, R. Ge, T. Ma, "More Algorithms for Provable Dictionary Learning", Manuscript, 2014.

3. S. Arora, A. Bhaskara, "Eigenvectors of Random Graphs: Delocalization and Nodal Domains", Manuscript, 2011.

Invited Talks (recent)

1. McCormick Colloquium, Northwestern University (January 2023)

2. Indian Institute of Science - Microsoft Research Seminar Series (March 2022)

3. Northwestern University Theory Seminar (June 2021)

4. Google Algorithms Workshop Series on Markets, Mobility, and the Mind (May 2021)

5. NIT Calicut, India (October 2020)

6. Information Theory and Applications (ITA), UCSD (February 2020)

7. Google Research Mountain View (June 2019)

8. Simons Institute, UC Berkeley (November 2018)

Teaching:

CS 497 Learning Augmented Online Algorithms. (Fall 2022, Northwestern University). Graduate level course that covers some of the recent research on augmenting online algorithms with "advice" from a machine learning oracle.
URL: `https://sites.google.com/view/ml-augmented-algos/home`.

CS 5966 / 6966 Theory of Machine Learning. (Spring 2022, 2017). A graduate level course on the theoretical foundations of machine learning. URL: `https://utah.instructure.com/courses/755183`.

CS 5150 / 6150 Graduate Algorithms. (Fall 2016-21). An introductory graduate course, aimed to cover the basics of algorithm design, randomized algorithms, formulating problems as optimization, and intractability. Lecture notes and videos are available via the course webpage `https://utah.instructure.com/courses/643359`.

CS 3130 / ECE 3530 Probability and Statistics for Engineers. (Spring 2020-21). A required undergraduate course that introduces probability and statistics to CS and ECE majors. The course also introduces students to programming in R.

CS 5968 / 6968 Techniques in Algorithms and Approximation. (Spring 2016). An advanced graduate course on advanced topics in algorithm design. Lecture notes were written for this course are available at: `http://www.cs.utah.edu/~bhaskara/courses/x968/`.

Machine Learning Seminar: Large Scale ML. (Fall 2016). The goal of the seminar is to introduce students to different techniques in distributed machine learning, including topics like lock-free algorithms, ADMM, communication complexity, and so on. URL: `https://mlseminar.wordpress.com/syllabus/`

Advising:

Current Students:

1. Kanchana Ruwanpathirana, expected Ph.D. defense: August 2023, Thesis topic: Online Algorithms and Beyond Worst Case Models for Learning.

2. Frost Mitchell, expected Ph.D. defense: August 2024, Thesis topic: Learning-based algorithms for transmitter localization and channel monitoring.

3. Christopher Harker, expected Ph.D. defense: August 2024, Thesis topic: Graph Neural Networks.

4. Prasanth Yalamanchili, expected Ph.D. defense: August 2026, Thesis topic: TBD.

Graduated Students:

1. Graduated PhD student: Maheshakya Wijewardena, Ph.D., 2021. Thesis: Practical Algorithms with Provable Guarantees for Large Scale Data Analysis.

2. Graduated MS (project) student: Sharvaree Vadgama, M.S., 2020. Project: Greedy Sampling for Clustering with Outliers.

3. Graduated MS (project) student: Srivatsan Kumar, M.S., 2018. Project: Low Rank Approximation in the Presence of Outliers.

External Service (Professional/Outreach):

- (Senior) program committee [1]:
  - Symposium on Theory of Computing (STOC) 2023.
  - International Colloquium on Automata, Languages, and Programming (ICALP) 2023.
  - Innovations in Theoretical Computer Science (ITCS) 2022.
  - Symposium on Discrete Algorithms (SODA) 2019.
  - European Symposium on Algorithms (ESA) 2019.
  - The Web Conference (WWW) 2018.
  - IEEE Conference on Foundations of Computer Science (FOCS) 2017.
- Review/program committee [2]:
  - International Conference on Machine Learning (ICML) 2016-2020.
  - Conference on Neural Information Processing Systems (NeurIPS) 2016-2021.
  - Conference on Learning Theory (COLT) 2019-2021.
  - IEEE International Conference on Data Mining (ICDM) 2018.
  - ACM Knowledge Discovery and Data Mining (KDD) 2017.
  - Artificial Intelligence and Statistics (AISTATS) 2018-2019.
  - AAAI Conference on Artificial Intelligence (AAAI) 2018-2020.
- NSF service:
  - Served on NSF CISE panels (2017, 2019, 2020, 2021, 2022).
  - One of 20-40 invited participants at NSF-sponsored Workshop on Smart Cyberinfrastructure 2020.

University Service:

- SoC Student Fellowships Committee Chair, 2018-2022: Involves soliciting nominations, writing letters, gathering material and coordinating submission for 8-10 fellowships/awards each year.
- Track Director, Data Management and Analysis, 2018-2022.

[1] In these conferences, the PC is composed of about 30 experts, by invitation. Each member is in charge of about 20-40 papers, seeks external reviews, engages in online discussions of papers, and in some cases, attends a program committee meeting to select papers for the conference.

[2] The size of the PC in these conferences is quite large, and each member is assigned 5-10 papers. It involves providing reviews for all the assigned papers, participating in discussions and rebuttals.

- Associate Director of Research, Utah Center for Data Science, Jan 2021 - Jul 2022.
- Faculty Search Committee (Machine Learning), Spring 2017.
- Graduate Admissions Committee, 2016-2018, 2021-2022.