Contact Information

Department of Statistics and Data Science
The Wharton School
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Research Interests

Nonparametric Statistics, Inference on Networks, Statistical Learning, Combinatorial Probability, Discrete and Computational Geometry.

Employment

- **Associate Professor**, Department of Statistics and Data Science, The Wharton School, University of Pennsylvania, July 2022-present.

- **Associate Professor** (Secondary Appointment), Department of Mathematics, University of Pennsylvania, July 2022-present.

- **Assistant Professor**, Department of Statistics and Data Science, The Wharton School, University of Pennsylvania, July 2016-June 2022.

- **Research Intern, Microsoft Research, Redmond**, June 2014-September 2014.

Education

- **Doctor of Philosophy (Ph.D.), Department of Statistics, Stanford University**, September 2011-June 2016.

  Thesis Title: Power of Graph-Based Two-Sample Tests
  Advisor: Prof. Persi Diaconis

- **Master of Statistics (M. Stat.), Indian Statistical Institute**, July 2009-May 2011.

- **Bachelor of Statistics (B. Stat.), Indian Statistical Institute**, July 2006-May 2009.

Awards and Honors

1. Alfred P. Sloan Fellowship in Mathematics, 2021.

2. NSF CAREER Award, 2021.

3. *Probability Dissertation Award* from the Department of Statistics, Stanford University in 2016.

4. *Sabyasachi Roy Memorial Gold Medal* for the best Master's thesis in the 2009-2011 M. Stat. program of the Indian Statistical Institute, Kolkata, India.

5. Fellow of the *Kishore Vaiganik Protsahan Yojana* (KVPY), 2008.

Editorial Boards

- Associate Editor, Journal of the American Statistical Association (January 2023–)

- Associate Editor, Annals of Applied Probability (January 2022–)

- Associate Editor, Bernoulli (January 2022–)

- Associate Editor, Sankhya, Series B (January 2022–)

Preprints

1. Anirban Chatterjee and **Bhaswar B. Bhattacharya**, Boosting the power of kernel two-sample tests, `arXiv:2302.10687`, 2023.

2. Nabarun Deb, **Bhaswar B. Bhattacharya**, and Bodhisattva Sen, Efficiency lower bounds for distribution-free Hotelling-type two-sample tests based on optimal transport, `arXiv:2104.01986`, 2022.

3. Ziang Niu and **Bhaswar B. Bhattacharya**, Distribution-free joint independence testing and robust independent component analysis using optimal transport, `arXiv:2211.15639`, 2022.

4. **Bhaswar B. Bhattacharya**, Sayan Das, Somabha Mukherjee, and Sumit Mukherjee, Asymptotic distribution of random quadratic forms, `arXiv:2203.02850`, 2022.

5. **Bhaswar B. Bhattacharya** and Rajarshi Mukherjee, Sparse uniformity testing, `arXiv:2109.10481`, 2022.

6. Somabha Mukherjee, Ziang Niu, Sagnik Halder, **Bhaswar B. Bhattacharya**, and George Michailidis, High dimensional logistic regression under network dependence, `arXiv:2110.03200`, 2021.

7. Somabha Mukherjee, Jaesung Son, and **Bhaswar B. Bhattacharya**, Phase transitions of the maximum likelihood estimates in the p-spin Curie-Weiss model, `arXiv:2005.03631`, 2020.

8. Kwonsang Lee, **Bhaswar B. Bhattacharya**, Jing Qin, and Dylan S. Small, A nonparametric likelihood approach for inference in instrumental variable models, `arXiv:1605.03868v2`, 2019.

Publications

9. **Bhaswar B. Bhattacharya**, Anirban Chatterjee, and Svante Janson, Fluctuations of subgraph counts in graphon based random graphs, *Combinatorics, Probability, and Computing*, to appear, 2023.

10. Sayak Chatterjee, Dibyendu Saha, Soham Dan, and **Bhaswar B. Bhattacharya**, Two-sample tests for inhomogeneous random graphs in L_r norm: Optimality and asymptotics, *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2023, to appear.

11. Somabha Mukherjee, Jaesung Son, and **Bhaswar B. Bhattacharya**, Estimation in tensor Ising models, *Information and Inference: A Journal of the IMA*, A Journal of the IMA, Volume 11 (4), 1457–1500, 2022.

12. **Bhaswar B. Bhattacharya**, Sayan Das, and Sumit Mukherjee, Motif estimation via subgraph sampling: the fourth moment phenomenon, *Annals of Statistics*, Vol. 50 (2), 987–1011, 2022.

13. Somabha Mukherjee, Divyansh Agarwal, Nancy R. Zhang, and **Bhaswar B. Bhattacharya**, Distribution-free multisample test based on optimal matching with applications to single cell genomics, *Journal of the American Statistical Association*, Vol. 117 (538), 627–638, 2022.

14. **Bhaswar B. Bhattacharya**, Xiao Fang, and Han Yan, Normal approximation and fourth Moment theorems for monochromatic triangles, *Random Structures and Algorithms*, Vol. 60 (1), 25–53, 2022.

15. Aritra Banik, **Bhaswar B. Bhattacharya**, Sujoy Bhore, and Leonardo Martínez-Sandoval, Geometric systems of unbiased representatives, *Information Processing Letters*, Vol. 176, 106232, 2022.

16. Somabha Mukherjee, Jaesung Son, and **Bhaswar B. Bhattacharya**, Fluctuations of the magnetization in the p-spin Curie-Weiss model, *Communications in Mathematical Physics*, Vol. 387, 681–728, 2021.

17. **Bhaswar B. Bhattacharya** and Kavita Ramanan, Parameter estimation in undirected graphical models with hard constraints, *IEEE Transactions on Information Theory*, Vol. 67 (10), 6790–6809, 2021.

18. **Bhaswar B. Bhattacharya**, Somabha Mukherjee, and Sumit Mukherjee, Asymptotic distribution of Bernoulli quadratic forms, *Annals of Applied Probability*, Vol. 31 (4), 1548–1597, 2021.

19. **Bhaswar B. Bhattacharya**, Sohom Bhattacharya, and Shirshendu Ganguly, Spectral edge in sparse random graphs: Upper and lower tail large deviations, *Annals of Probability*, Vol. 49 (4), 1847–1885, 2021.

20. Trambak Banerjee, **Bhaswar B. Bhattacharya**, and Gourab Mukherjee, A nearest-neighbor based nonparametric test for viral remodeling in heterogeneous single-cell proteomic data, *Annals of Applied Statistics*, Vol. 14 (4), 1777–1805, 2020.

21. **Bhaswar B. Bhattacharya**, Asymptotic distribution and detection thresholds for two-sample tests based on geometric graphs, *Annals of Statistics*, Vol. 48 (5), 2879–2903, 2020.

22. Soham Dan and **Bhaswar B. Bhattacharya**, Goodness-of-fit tests for inhomogeneous random graphs, *International Conference on Machine Learning (ICML)*, PMLR 119, 2335–2344, 2020.

23. Somabha Mukherjee and **Bhaswar B. Bhattacharya**, Replica symmetry in upper tails of mean-field hypergraphs, *Advances in Applied Mathematics*, Vol. 119, 102047, 2020.

24. **Bhaswar B. Bhattacharya** and Shirshendu Ganguly, Upper tails for edge eigenvalues of random graphs, *SIAM Journal on Discrete Mathematics*, Vol. 34 (2), 1069–1083, 2020.

25. **Bhaswar B. Bhattacharya**, Somabha Mukherjee, and Sumit Mukherjee, The second moment phenomenon for monochromatic subgraphs, *SIAM Journal on Discrete Mathematics*, Vol. 34 (1), 794–824, 2020.

26. **Bhaswar B. Bhattacharya**, Shirshendu Ganguly, Xuancheng Shao, and Yufei Zhao, Upper tail large deviations for arithmetic progressions in a random set, *International Mathematics Research Notices*, Vol. 2020 (1), 167–213, 2020.

27. **Bhaswar B. Bhattacharya** and Sumit Mukherjee, Limit theorems for monochromatic stars, *Random Structures and Algorithms*, Vol. 55 (4), 831–853, 2019.

28. Manjari Pradhan, **Bhaswar B. Bhattacharya**, Krishnendu Chakrabarty, and Bhargab B. Bhattacharya, Predicting X-sensitivity of circuit-inputs on test-coverage: A machine-learning approach, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* (TCAD), Vol. 38 (12), 2343–2356, 2019.

29. Qingyuan Zhao, Dylan S. Small, and **Bhaswar B. Bhattacharya**, Sensitivity analysis for inverse probability weighting estimators via the percentile bootstrap, *Journal of the Royal Statistical Society, Series B*, Vol. 81 (4), 735–761, 2019.

30. **Bhaswar B. Bhattacharya**, A general asymptotic framework for distribution-free graph-based two-sample tests, *Journal of the Royal Statistical Society, Series B*, Vol. 81 (3), 575–602, 2019.

31. **Bhaswar B. Bhattacharya** and Sumit Mukherjee, Monochromatic subgraphs in randomly colored graphons, *European Journal of Combinatorics*, Vol. 81, 328–353, 2019.

32. Aritra Banik, **Bhaswar B. Bhattacharya**, Sandip Das, and Sreeja Das, The 1-dimensional discrete Voronoi game, *Operations Research Letters*, Vol. 47, 115–121, 2019.

33. **Bhaswar B. Bhattacharya** and Sumit Mukherjee, Inference in Ising models, *Bernoulli*, Vol. 24 (1), 493–525, 2018.

34. **Bhaswar B. Bhattacharya**, Shirshendu Ganguly, Eyal Lubetzky, and Yufei Zhao, Upper tails and independence polynomials in random graphs, *Advances in Mathematics*, Vol. 319, 313–347, 2017.

35. Aritra Banik, **Bhaswar B. Bhattacharya**, Sandip Das, and Satyaki Mukherjee, The discrete Voronoi game in $\mathbb{R}^2$, *Computational Geometry: Theory and Applications*, Vol. 63, 53–62, 2017.

36. **Bhaswar B. Bhattacharya** and Sumit Mukherjee, Degree sequence of random permutation graphs, *Annals of Applied Probability*, Vol. 27 (1), 439–484, 2017.

37. **Bhaswar B. Bhattacharya**, Persi Diaconis, and Sumit Mukherjee, Universal poisson and normal limit theorems in graph coloring problems with connections to extremal combinatorics, *Annals of Applied Probability*, Vol. 27 (1), 337–394, 2017.

38. **Bhaswar B. Bhattacharya**, Collision times in multicolor urn models and sequential graph coloring with applications to discrete logarithms, *Annals of Applied Probability*, Vol. 26 (6), 3286–3318, 2016.

39. **Bhaswar B. Bhattacharya** and Subhabrata Sen, High temperature asymptotics of orthogonal mean-field spin glasses, *Journal of Statistical Physics*, Vol. 162 (1), 63–80, 2016.

40. Deepan Basu, Kinjal Basu, **Bhaswar B. Bhattacharya**, and Sandip Das, Almost empty monochromatic triangles in planar point sets, *Discrete Applied Mathematics*, Vol. 210, 207–213, 2016.

41. **Bhaswar B. Bhattacharya** and Gregory Valiant, Testing closeness with unequal sized samples, *Neural Information Processing System (NIPS)*, 2611–2619, 2015.

42. **Bhaswar B. Bhattacharya** and Sumit Mukherjee, Exact and asymptotic results on coarse Ricci curvature of graphs, *Discrete Mathematics*, Vol. 338, 23–42, 2015.

43. **Bhaswar B. Bhattacharya**, Sayantan Das, and Shirshendu Ganguly, Minimum-weight edge discriminator in hypergraphs, *Electronic Journal of Combinatorics*, Vol. 21 (3), #P3.18, 2014.

44. Aritra Banik, **Bhaswar B. Bhattacharya**, and Sandip Das, The minimum enclosing circle of a set of fixed points and a mobile point, *Computational Geometry: Theory and Applications*, Vol. 47 (9), 891–898, 2014.

45. Aritra Banik, **Bhaswar B. Bhattacharya**, and Sandip Das, Optimal strategies for the one-round discrete Voronoi game on a line, *Journal of Combinatorial Optimization*, Vol. 26, 655–669, 2013.

46. **Bhaswar B. Bhattacharya** and Sandip Das, On pseudo-convex partitions of a planar point set, *Discrete Mathematics*, Vol. 313 (21), 2401–2408, 2013.

47. **Bhaswar B. Bhattacharya** and Subhas C. Nandy, New variations of the maximum coverage facility location problem, *European Journal of Operational Research*, Vol. 224, 477–485, 2013.

48. **Bhaswar B. Bhattacharya** and Sandip Das, Disjoint empty convex pentagons in planar point sets, *Periodica Mathematica Hungarica*, Vol. 66 (1), 73–86, 2013.

49. Riddhipratim Basu, **Bhaswar B. Bhattacharya**, and Tanmoy Talukdar, The projection median of a set of points in $\mathbb{R}^d$, *Discrete and Computational Geometry*, Vol. 47 (2), 329–346, 2012.

50. **Bhaswar B. Bhattacharya** and Sandip Das, Holes or empty-pseudo-triangles in planar point sets, *Moscow Journal of Combinatorics and Number Theory*, Vol. 2 (1), 16–46, 2012.

51. **Bhaswar B. Bhattacharya** and Sandip Das, On the minimum size of a point set containing a 4-Hole and a disjoint 5-Hole, *Studia Scientiarum Mathematicarum Hungarica*, Vol. 48 (4), 445–457, 2011.

52. **Bhaswar B. Bhattacharya**, On the Fermat-Weber point of a polygonal chain and its generalizations, *Fundamenta Informaticae*, Vol. 107 (4), 331–343, 2011.

53. **Bhaswar B. Bhattacharya**, Maximizing Voronoi regions of a set of points enclosed in a circle with applications to facility location, *Journal of Mathematical Modelling and Algorithms*, Vol. 9 (4), 375–392, 2010.

54. **Bhaswar B. Bhattacharya** and Sandip Das, Geometric proof of a Ramsey-type result for disjoint empty convex polygons I and II, *Geombinatorics*, Vol. XX (1), 5–16, and Vol. XIX (4), 146–155, 2010.

Teaching

- Spring 2022 (Wharton): Mathematical Statistics (STAT 432)

- Fall 2021 (Wharton): Mathematical Statistics (STAT 970)

- Spring 2021 (Wharton): Seminar in Advanced Applications in Statistics (STAT 991)

- Fall 2020 (Wharton): Mathematical Statistics (STAT 970)

- Fall 2019 (Wharton): Mathematical Statistics (STAT 970)

- Fall 2018 (Wharton): Statistical Inference (STAT 431/511), Mathematical Statistics (STAT 970)

- Fall 2017 (Wharton): Statistical Inference (STAT 431/511), Mathematical Statistics (STAT 970)

- Spring 2017 (Wharton): Seminar in Advanced Applications in Statistics (STAT 991)

- Fall 2016 (Wharton): Statistical Inference (STAT 431/511)

- Summer 2013 (Stanford): Qualifying Exams Workshop (STATS 302)

Software

- Invited contribution to the **Wolfram Demonstration Project**: *Fermat-Weber Point of a Polygonal Chain.*

Advising

- Ph.D. Dissertation Advisor:

  - Anirban Chatterjee, Department of Statistics and Data Science, The Wharton School, University of Pennsylvania, expected to graduate in 2025.
  - Somabha Mukherjee, Department of Statistics and Data Science, The Wharton School, University of Pennsylvania, Ph.D. 2021. (Current Position: Assistant Professor, Department of Statistics and Applied Probability, National University of Singapore).

- Ph.D. Dissertation Committee: Kwonsang Lee (Applied Mathematics), Raiden Hasegawa, (Statistics), Cecilia Balocchi, (Statistics), Seth Neel, (Statistics), Mateo Wirth (Statistics), Siyu Heng (Applied Mathematics), Kaitian Jin (Mathematics), Da Wu (Mathematics), Jorge Barreras Cortes (Applied Mathematics), Brinkley Raynor (Epidemiology and Biostatistics).

- M. Phil. Dissertation Committee: Weichen Zhou (Mathematics).

Grant Support

- Alfred P. Sloan Fellowship in Mathematics, 2021–2023.

- Wharton Dean's Research Fund, 2021–2023.

- NSF CAREER DMS 2046393 (Principal Investigator): *Geometric and combinatorial methods for distribution-free inference and dependent network data*, 07/01/2021–06/30/2026.

- NSF DMS 2113771 (Co-Principal Investigator with Debashis Mondal): *Distance based analysis for complex high-dimensional data*, 07/01/2021–06/30/2024.

- NIH/NIAID R01-AI168291 (Co-Investigator): *Spatially responsive mass vaccination strategies for urban rabies*, 04/08/22–03/31/27 (Principal Investigator: Ricardo Castillo-Neyra).

- NIH-R01AI146129 (Co-Investigator): *An immune system for the city: a new paradigm for control of urban disease vectors*, 07/01/2019–06/30/2024 (Principal Investigators: Micheal Z. Levy and Valerie A. Paz-Soldan).