

## Bodhisattva Sen

September 24, 2024

Department of Statistics  
Columbia University  
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### Research Interests

- Nonparametric empirical Bayes methods
- Theory of optimal transport and applications to statistics
- Nonparametric function estimation (especially with shape constraints)
- Kernel (RKHS) methods in statistics and machine learning
- Statistical methods in astronomy and High Energy physics
- Bootstrap and resampling techniques
- Non-standard asymptotics and empirical process theory
- Threshold/change-point estimation

### Academic Positions

- Vice Chair for Research, Dept. of Stat., Columbia University Aug 2022 – present
- Professor, Dept. of Stat., Columbia University Jul 2020 – present
- Associate Professor with tenure, Dept. of Stat., Columbia U. Jul 2015 – Jun 2020
- Visiting Associate Professor of Statistics, Stanford U. Apr 2017 – Jun 2017
- Visiting Scholar, University of California, Berkeley Jul 2016 – Jun 2017
- Associate Professor, Dept. of Stat., Columbia University Jul 2013 – Jun 2015
- Assistant Professor, Dept. of Stat., Columbia University Jul 2008 – May 2013
- University Lecturer, DPMMS, Univ. of Cambridge, UK Jul 2011 – Aug 2012
- Teaching Fellow at St. John's College, Cambridge, UK Sep 2011 – Aug 2012

### Education

1. University of Michigan: Ph.D. in Statistics 2004 – 2008  
**Title:** *A study of bootstrap and likelihood based methods in non-standard problems* Co-advisors: Moulinath Banerjee and Michael Woodroffe
2. Indian Statistical Institute: M.Stat. (graduated with Distinction) 2002 – 2004
3. Indian Statistical Institute: B.Stat. (graduated with Distinction) 1999 – 2002

## Honors and Awards

- *IMS Medallion Lecture* at IMS Annual Meeting, Salzburg, Austria July, 2026
- *Lunteren Lecturer* at Stochastics Meeting Lunteren, Netherlands November, 2024
- *Robert Wijsman Lecture* at University of Illinois at Urbana-Champaign April, 2024
- *Data Science Distinguished Lecture Series* (sponsored by the Center for Data Science for Enterprise & Society) at Cornell University April, 2024
- *Special invited talk* at IISA Meeting, Bangalore 2022
- Fellow of the Institute of Mathematical Statistics (IMS) 2022
- *Young Statistical Scientist Award* (YSSA) in the *Theory and Methods* category, International Indian Statistical Association (IISA), Mumbai, India 2019
- Keynote speaker at Workshop “Advanced Statistics for Physics Discovery”, Padova, Italy September, 2018
- National Science Foundation (NSF) CAREER award 2012 – 2017
- Outstanding First Year Ph.D. Student (U. of Michigan, Ann Arbor) 2005
- Gold medal for outstanding performance in M.Stat. (Mahalanobis International Symposium on Statistics Prize), Indian Statistical Institute, Kolkata 2004

## Grants

1. NSF grant, DMS-2311062 (\$300,000) 2023 – 2026  
**Title:** *Nonparametric Testing: Efficiency and Distribution-freeness via Optimal Transportation*
2. NSF grant, DMS-2015376 (\$300,000) 2020 – 2023  
**Title:** *Multivariate Distribution-Free Nonparametric Testing Using Optimal Transportation*
3. NSF grant, DMS-1712822 (\$239,994) 2017 – 2020  
**Title:** *Estimation, Computation, and Uncertainty Quantification in Structured Regression Models*
4. NSF grant, AST-1614743 (\$347,193; Co-PI) 2016 – 2018  
(PI: Kathryn Johnston, Columbia U., Astronomy)  
**Title:** *A Study of the Faint Debris Remnant of Large Galaxy, Small Galaxy Interactions*
5. NSF CAREER award, DMS-1150435 (\$400,088) 2012 – 2017  
**Title:** *CAREER: Nonparametric methods in multiple dimensions: shape restrictions, bootstrap and beyond*
6. EPSRC<sup>1</sup> Strategic Fund (U. of Cambridge, UK, £49,843) 2011 – 2012
7. NSF grant, AST-1107373 (\$324,207; Co-PI) 2011 – 2014  
(PI: Kathryn Johnston, Columbia U., Astronomy)  
**Title:** *Mapping the Past in the Future: Science Enabled by High-Resolution Spectroscopic Stellar Surveys*
8. NSF grant, DMS-0906597 (\$100,077) 2009 – 2012  
**Title:** *Bootstrap and Threshold Models in Non-standard Problems*

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<sup>1</sup>Engineering and Physical Sciences Research Council

## Students

- Ph.D. thesis advisor to:
  - Zhen Huang (Columbia U., 2019 – 2024); title of Dissertation: *Nonparametric Methods for Measuring Conditional Dependence, Multi-Sample Dissimilarity, and Testing for Symmetry*; Quantitative Researcher at Two Sigma (from August 2024).
  - Ashley Dutta (Columbia U., 2016 – 2023); title of Dissertation: *Optimal Inference with a Multidimensional Multiscale Statistic*; Visiting Lecturer at Columbia University (from September 2023).
  - Nabarun Deb (Columbia U., 2017 – 2022); title of Dissertation: *Blessing of dependence and distribution-freeness in statistical hypothesis testing*; Assistant Professor of Econometrics and Statistics at the University of Chicago Booth School of Business (from July 2023).
  - Bridget Ratcliffe (Columbia U., 2016 – 2022); title of Dissertation: *Statistical approach to tagging stellar birth groups in the Milky Way*; now a postdoc at Leibniz Institute for Astrophysics Potsdam (AIP), Germany.
  - Rohit Patra (Columbia U., 2010 – 2016); title of Dissertation: *Semiparametric Inference with shape constraints*; now Assistant Professor of Statistics at University of Florida, Gainesville.
  - Emilio Seiyo (Columbia U., 2007 – 2012; title of Dissertation: *Statistical inference in two non-standard regression problems*); now Data Scientist at Morgan Stanley.
- Post-doctorate advisor to:
  - Adam Jaffe (Columbia U., 2024 – )
  - Nikos Ignatiadis (Columbia U., 2022 – 2023): Assistant Professor in Statistics at the University of Chicago (from July 2023).
  - Georg Hahn (Columbia U., 2015 – 2016): Research Scientist at Harvard Biostatistics.
  - Subhra Sankar Dhar (U. of Cambridge, 2011 – 2012): Associate Professor in Statistics at the Indian Institute of Technology, Kanpur, India.
- Dissertation committee member of: Harald Besdzick (ETH Zurich, May 2024), Zhenyuan Liu (IEOR, Apr. 2023), Gan Yuan (Apr. 2023), Nicholas Galbraith (Nov. 2023), Alexander Henzi (U Bern, May 2022) Tong Li (Dec. 2020), Xiaoqi Li (Biostatistics, Aug. 2020), Wenda Zhou (Aug. 2020), Junlong Feng (Economics, Apr. 2020), Promit Ghosal (Mar. 2020), David Hendel (Astronomy, Jul. 2018), Phyllis Wan (May 2018), Lisha Qiu (Jul. 2017), Jing Zhang (Jun. 2017), Gabor Balazs (U. of Alberta, Canada, Aug. 2016), Pierre Bellec (June 2016), Gongjun Xu (May 2013), Duane Lee (Astronomy, Sep. 2013).
- Ph.D. prelim committee member of: Nicholas Galbraith (Mar. 2021), Tong Li (Dec. 2018), Jing Zhang (Apr. 2016), Lisha Qiu (Feb. 2016), Tzu-Jung Huang (Biostatistics, Nov. 2013), Atul Mallik (U. of Michigan, Apr. 2011).
- Graduate summer interns: Anagh Chattopadhyay, Anvit Garg, Tathagata Sadhukhan (May – July 2022; remote); Aditya Ghosh, Souhardya Sengupta (May – July 2021; remote); Abhinav Chakraborty, Anirban Chatterjee (May – July 2019); Sagnik Nandy, Saptarshi Roy (May – July 2018); Rahul Biswas, Somabha Mukherjee (June – July 2015); Arun Kumar Kuchibhotla, Promit Ghosal (June – July 2014); Rupak Banerjee, Arkopal Choudhury, Aritra Guha (June – July 2013).
- Masters Dissertation Advisor: Soham Mallick (ISI, 2023-24), Aditya Ghosh (ISI, 2022-23).

- Undergraduate summer intern(s): Clemente Antuna (May – June 2021).
- High school interns: Amanda Ng (Bronx HS; 2020 – 2021), Susan Tan (Brooklyn Technical HS; NYU GSTEM, 2014).

### Editorial Work

- (Co)-Editor, *Statistics Surveys* Sep 2022 – present
- Associate Editor, *J. Amer. Statist. Assoc. (Theory & Methods)* Jan 2023 – present
- Associate Editor, *Ann. Statist.* Jan 2019 – present
- Associate Editor, *Statist. Sci.* Jan 2017 – present
- Guest co-Editor for special Issue on “Nonparametric Inference Under Shape Constraints” for *Statist. Sci.* Nov 2018
- Associate Editor, *Electron. J. Stat.* Jan 2019 – Dec 2021
- Member of the Editorial Board, *J. Statist. Plann. Inference* Jan 2012 – Dec 2018
- Member of the Editorial Board, *Sankhyā, Series A* Jan 2012 – Dec 2018
- Associate Editor, *Statist. Sinica* Aug 2014 – Dec 2017
- Associate Editor, *STAT* Aug 2012 – Feb 2018

### Preprints and submitted papers

1. Datta, A., Mukherjee, S., and **Sen, B.** (2024+). Optimal Confidence Bands for Shape-restricted Regression in Multidimensions. (<https://arxiv.org/abs/2401.12753>)
2. Mukherjee, S., **Sen, B.**, and Sen, S. (2023+). A Mean Field Approach to Empirical Bayes Estimation in High-dimensional Linear Regression. (<https://arxiv.org/abs/2309.16843>)
3. González-Sanz, A., Hallin, M., and **Sen, B.** (2023+). Monotone Measure-Preserving Maps in Hilbert Spaces: Existence, Uniqueness, and Stability. (<https://arxiv.org/abs/2305.11751>)
4. Huang, Z., and **Sen, B.** (2023+). Multivariate Symmetry: Distribution-Free Testing via Optimal Transport. (<https://arxiv.org/abs/2305.01839>)
5. Ghosh, A., Deb, N., Karmakar, B., and **Sen, B.** (2021+). Efficiency of Regression (Un)-Adjusted Rosenbaum’s Rank-based Estimator in Randomized Experiments. (<https://arxiv.org/abs/2111.15524>)
6. Deb, N., Bhattacharya, B., and **Sen, B.** (2021+). Pitman Efficiency Lower Bounds for Multivariate Distribution-Free Tests Based on Optimal Transport. (status: “major revision” at *J. Roy. Stat. Soc. Ser. B.*; <https://arxiv.org/abs/2104.01986>)
7. Deb, N., Ghosal, P., and **Sen, B.** (2020+). Measuring Association on Topological Spaces Using Kernels and Geometric Graphs. (status: “Reject with resubmit” at *Ann. Statist.*; <https://arxiv.org/abs/2010.01768>)

## Publications or accepted papers

8. García Trillos, N., and **Sen, B.** (2023+). A New Perspective On Denoising Based On Optimal Transport. *Inf. Inference*. (“accepted”; <https://arxiv.org/abs/2312.08135>)
9. Kur, G., Gao, F., Guntuboyina, A., and **Sen, B.** (2020+). Convex Regression in Multidimensions: Suboptimality of Least Squares Estimators. *Ann. Statist.* (“accepted”; <https://arxiv.org/abs/2006.02044>)
10. Ignatiadis, N., and **Sen, B.** (2023+). Empirical partially Bayes multiple testing and compound  $\chi^2$  decisions. *Ann. Statist.* (“accepted”; <https://arxiv.org/abs/2303.02887>)
11. Slawski, M., and **Sen, B.** (2022+). Permuted and Unlinked Monotone Regression in  $\mathbb{R}^d$ : an approach based on mixture modeling and optimal transport. *J. Mach. Learn. Res.* (“accepted”; <https://arxiv.org/abs/2201.03528>)
12. Soloff, J., Guntuboyina, A., and **Sen, B.** (2021+). Multivariate, Heteroscedastic Empirical Bayes via Nonparametric Maximum Likelihood. *J. Roy. Stat. Soc. Ser. B.* (“accepted”; <https://arxiv.org/abs/2109.03466>)
13. Huang, Z., and **Sen, B.** (2022+). A Kernel Measure of Dissimilarity between  $M$  Distributions. *J. Amer. Statist. Assoc.* (to appear; <https://arxiv.org/abs/2210.00634>)
14. Zhang, Y., Cui, Y., **Sen, B.** and Toh, K.-C. (2024). On Efficient and Scalable Computation of the Nonparametric Maximum Likelihood Estimator in Mixture Models. *J. Mach. Learn. Res.*, **25**, Paper No. 8, 1–46.
15. Deng, H., Han, Q., and **Sen, B.** (2023). Inference for local parameters in convexity constrained models. *J. Amer. Statist. Assoc.*, **118**, 2721–2735.
16. Kuchibhotla, A., Patra, R., and **Sen, B.** (2023). Semiparametric Efficiency in Convexity Constrained Single Index Model. *J. Amer. Statist. Assoc.*, **118**, 272–286.
17. Deb, N., and **Sen, B.** (2023). Multivariate Rank-based Distribution-free Nonparametric Testing using Measure Transportation. *J. Amer. Statist. Assoc.*, **118**, 192–207.
18. Deb, N., Saha, S., Guntuboyina, A., and **Sen, B.** (2022). Two-component Mixture Model in the Presence of Covariates. *J. Amer. Statist. Assoc.*, **117**, 1820–1834.
19. Huang, Z., Deb, N., and **Sen, B.** (2022). Kernel Partial Correlation Coefficient — a Measure of Conditional Dependence. *J. Mach. Learn. Res.*, **23**, Paper No. 216, 1–58.
20. Ghosal, P., and **Sen, B.** (2022). Multivariate Ranks and Quantiles using Optimal Transportation and Applications to Goodness-of-fit Testing. *Ann. Statist.*, **50**, 1012–1037.

21. Han, Q., **Sen, B.**, and Shen, Y. (2022). High dimensional asymptotics of likelihood ratio tests in Gaussian sequence model under convex constraint. *Ann. Statist.*, **50**, 376–406.
22. Ratcliffe, B., Ness, M., Buck, T., Johnston, K.V., **Sen, B.**, Beraldo e Silva, L., and Debatista, V.P. (2022). Tracing birth properties of stars with abundance clustering. *Astrophysical Journal*, **924**, 60.
23. Deb, N., Ghosal, P., and **Sen, B.** (2021). Rates of Estimation of Optimal Transport Maps using Plug-in Estimators via Barycentric Projections. *Advances in Neural Information Processing Systems*, **34**.
24. Datta, P., and **Sen, B.** (2021). Optimal Inference with a Multidimensional Multiscale Statistic. *Electron. J. Stat.*, **51**, 5203–5244.
25. Fang, B., Guntuboyina, A., and **Sen, B.** (2021). Multivariate extensions of isotonic regression and total variation denoising via entire monotonicity and Hardy-Krause variation. *Ann. Statist.*, **49**, 769–792.
26. Ratcliffe, B., Ness, M., Johnston, K.V., and **Sen, B.** (2020). Tracing the assembly of the Milky Way’s disk through abundance clustering. *Astrophysical Journal*, **900**, 165.
27. Chen, X., Lin, Q., and **Sen, B.** (2020). On Degrees of Freedom of Projection Estimators with Applications to Multivariate Nonparametric Regression. *J. Amer. Statist. Assoc.*, **115**, 173–186.
28. Guntuboyina, A., Lieu, D., Chatterjee, S., and **Sen, B.** (2020). Adaptive risk bounds in univariate total variation denoising and trend filtering. *Ann. Statist.*, **48**, 205–229.
29. Mukherjee, R., and **Sen, B.** (2019). Estimation of Integrated Functionals of a Monotone Density. *Electron. J. Stat.*, **13**, 4416–4448.
30. Hendel, D., Johnston, K., Patra, R., and **Sen, B.** (2019). A machine-vision method for automatic classification of stellar halo substructure. *Monthly Notices of the Royal Astronomical Society*, **486**, 3604–3616.
31. Mazumder, R., Choudhury, A., Iyengar, G., and **Sen, B.** (2019). A Computational Framework for Multivariate Convex Regression and its Variants. *J. Amer. Statist. Assoc.*, **114**, 318–331.
32. Banerjee, M., Durot, C., and **Sen, B.** (2019). Divide and Conquer in Non-standard Problems and the Super-efficiency Phenomenon. *Ann. Statist.*, **47**, 720–757.
33. Cui, Y., Pang, J-S., and **Sen, B.** (2018). Composite Difference-Max Programs for Modern Statistical Estimation Problems. *SIAM J. Optim.*, **28**, 3344–3374.

34. Guntuboyina, A., and **Sen, B.** (2018). Nonparametric Shape-restricted Regression. *Statist. Sci.*, **33**, 568–594. (Invited paper in the special issue on shape constrained function estimation)
35. Patra, R., Seijo, E., and **Sen, B.** (2018). A consistent bootstrap procedure for the maximum score estimator. *J. Econometrics*, **205**, 488–507.
36. Chatterjee, S., Guntuboyina, A., and **Sen, B.** (2018). On matrix estimation under monotonicity constraints. *Bernoulli*, **24**, 1072–1100.
37. Ghosal, P., and **Sen, B.** (2017). On Univariate Convex Regression. *Sankhyā A*, **79**, 215–253. (Invited paper in the special issue on Applications of Concentration Inequalities and Empirical Processes to Modern Statistics)
38. **Sen, B.**, and Meyer, M. (2017). Testing against a parametric regression function using ideas from shape restricted estimation. *J. Roy. Statist. Soc. Ser. B*, **79**, 423–448.
39. Patra, R., and **Sen, B.** (2016). Estimation in a two-component mixture model with applications to multiple testing. *J. Roy. Statist. Soc. Ser. B*, **78**, 869–893.
40. Mallik, A., **Sen, B.**, Banerjee, M. and Michailidis, G. (2016). Asymptotics for  $p$ -value based threshold estimation in dose-response settings. *J. Statist. Plann. Inference*, **174**, 85–103.
41. Patra, P., **Sen, B.**, and Székely, G. (2016). On a Nonparametric Notion of Residual and its Applications. *Statist. Probab. Lett.*, **106**, 208–213.
42. Chatterjee, S., Guntuboyina, A., and **Sen, B.** (2015). On Risk Bounds in Isotonic and Other Shape Restricted Regression Problems. *Ann. Statist.*, **43**, 1774–1800.
43. Guntuboyina, A., and **Sen, B.** (2015). Global risk bounds and adaptation in univariate convex regression. *Probab. Theory Related Fields*, **163**, 379–411.
44. **Sen, B.**, and Xu, G. (2015). Model based Bootstrap Methods for Interval Censored Data. *Comput. Statist. Data Anal.*, **81**, 121–129.
45. Lee, D. M., Johnston, K. V., **Sen, B.**, and Jessop, W. (2015). Reconstructing the Accretion History of the Galactic Stellar Halo from Chemical Abundance Ratio Distributions. *Astrophysical Journal*, **802**, 48.
46. Xu, G., **Sen, B.**, and Ying, Z. (2014). Bootstrapping a change-point Cox model for survival data. *Electron. J. Stat.*, **8**, 1345–1379.
47. Sen, A. and **Sen, B.** (2014). On Testing Independence and Goodness-of-fit in Linear Models. *Biometrika*, **101**, 927–942.

48. Mallik, A., Banerjee, M., and **Sen, B.** (2013). Asymptotics for  $p$ -value based threshold estimation in regression settings. *Electron. J. Stat.*, **7**, 2477–2515.
49. Guntuboyina, A. and **Sen, B.** (2013). Covering Numbers for Convex Functions. *IEEE Trans. Inf. Theory*, **59**, 1957–1965.
50. Lee, D. M., Johnston, K. V., Tumlinson, J., **Sen, B.**, and Simon, J. D. (2013). A Mass-Dependent Yield Origin of Neutron-Capture Element Abundance Distributions in Ultra-Faint Dwarfs. *Astrophysical Journal*, **774**, 103.
51. Guntuboyina, A., and **Sen, B.** (2012).  $L_1$  covering numbers for Uniformly Bounded Convex Functions. *Proceedings of the 2012 Conference on Learning Theory (COLT)*, JMLR W&CP 23: 12.1–12.13.
52. **Sen, B.**, and Chaudhuri, P. (2012). On fractile transformation of covariates in regression. *J. Amer. Statist. Assoc.*, **107**, 349–361.
53. **Sen, B.**, and Woodroffe, M. (2012). Bootstrap Confidence Intervals for Isotonic Estimators in a Stereological Problem. *Bernoulli*, **18**, 1249–1266.
54. Alonso, J., Mateo, M., **Sen, B.**, Banerjee, M., Catelan, M. and Minniti, D. (2012). Un-cloaking globular clusters in the inner Galaxy. *The Astronomical Journal*, **143**, 70.
55. Mallik, A., **Sen, B.**, Banerjee, M. and Michailidis, G. (2011). Threshold estimation based on a  $P$ -value framework in dose-response and regression settings. *Biometrika*, **98**, 887–900.
56. **Sen, B.**, and Chaudhuri, P. (2011). Mahalanobis’s Fractile Graphs: Some History and New Developments. *International Journal of Statistical Sciences*, **11**, 17–35. (Invited paper for the special issue in honor of Prasanta Chandra Mahalanobis).
57. Seijo, E., and **Sen, B.** (2011). Nonparametric least squares estimation of a multivariate convex regression. *Ann. Statist.*, **39**, 1633–1657.
58. Seijo, E., and **Sen, B.** (2011). A continuous mapping theorem for the smallest argmax functional. *Electron. J. Stat.*, **5**, 421–439.
59. Alonso, J., Mateo, M., **Sen, B.**, Banerjee, M. and Braun, K. (2011). Mapping differential reddening in the inner Galactic globular cluster system. *The Astronomical Journal*, **141**, 146.
60. Seijo, E., and **Sen, B.** (2011). Change-point in stochastic design regression and the bootstrap. *Ann. Statist.*, **39**, 1580–1607.

61. McKeague, I., and **Sen, B.** (2010). Fractals with point impact in functional linear regression. *Ann. Statist.*, **38**, 2559–2586.
62. **Sen, B.**, Banerjee, M. and Woodroffe, M. (2010). Inconsistency of Bootstrap: the Grenander Estimator. *Ann. Statist.*, **38**, 1953–1977.
63. **Sen, B.**, Banerjee, M., Woodroffe, M., Walker, M.G., and Mateo, M. (2009). Streaming Motion in Leo I. *Ann. Appl. Statist.*, **3**, 96–116.
64. **Sen, B.**, Walker, M. and Woodroffe, M. (2009). On the Unified Method with Nuisance Parameters. *Statist. Sinica*, **19**, 301–314.
65. Walker, M.G., Mateo, M., Olszewski, E.W., **Sen, B.**, and Woodroffe, M. (2008). Clean Kinematic Samples in Dwarf Spheroidals: An Algorithm for Evaluating Membership and Estimating Distribution Parameters When Contamination is Present. *Astronomical Journal*, **137**, 3109–3138.
66. Alonso, J., Mateo, M., and **Sen, B.** (2008). Uncloaking globular clusters of the inner Galaxy. *IAU Symposium 245: Formation and Evolution of Galaxy Bulges*, 359–360.
67. Woodroffe, M., and **Sen, B.** (2007). Discussion on ‘The small-N Problem in High Energy Physics’ by G.Cowan and ‘Bayesian Methods in Particle Physics from Small-N to Large’ By H.B. Prosper. *Statistical Challenges in Modern Astronomy (SCMA) IV*, (Eds. G.J.Babu and E.D.Feigelson), *ASP Conference Series*, **371**, 98–100.
68. Walker, M.G., Mateo, M., Olszewski, E.W., Bernstein, R., **Sen, B.**, and Woodroffe, M. (2007). The Michigan/MIKE Fiber System Survey of Stellar Radial Velocities in Dwarf Spheroidal Galaxies: Acquisition and Reduction of Data. *Astrophysical Journal Supplement Series*, **171**, 389–418.
69. Walker, M.G., Mateo, M., Olszewski, E.W., Gnedin, O.Y., Wang, X., **Sen, B.**, and Woodroffe, M. (2007). Velocity Dispersion Profiles of Seven Dwarf Spheroidal Galaxies, *Astrophysical Journal*, **667**, L53–L56.
70. **Sen, B.**, and Banerjee, M. (2006). A Pseudo-Likelihood Method for Analyzing Interval Censored Data. *Biometrika*, **94**, 71–86.
71. Walker, M.G., Mateo, M., Olszewski, E.W., Pal, J.K., **Sen, B.**, and Woodroffe, M. (2006). On Kinematic Substructure in the Sextans Dwarf Spheroidal Galaxy. *Astrophysical Journal*, **642**, L41–L44.
72. **Sen, B.** (2005). Estimation and Comparison of Fractile Graphs using Kernel Smoothing Techniques. *Sankhyā*, **67**, 305–334. (Special issue on Quantile Regression and Related Methods)

## Other publications

1. **Sen, B.** (2024). “Book review: Mathematical Foundations of Infinite-Dimensional Statistical Models (by Evarist Giné and Richard Nickl, 2021).” *J. Amer. Statist. Assoc.* (to appear).
2. Samworth, R., and **Sen, B.** (2018). Editorial: Special Issue on “Nonparametric Inference Under Shape Constraints”. *Statist. Sci.*, **33**, 469–472.
3. Banerjee, M. and **Sen, B.** (2016). A Conversation with Michael Woodroffe. *Statist. Sc.*, **31**, 433–441.

## Other honors and awards

1. IMS Laha Travel Award to attend the Joint Statistical Meetings (JSM)/IMS Annual Meeting in Salt Lake City, Utah, July 29–August 2, 2007.
2. Rackham Travel Grant (2006, 2007) to present at the JSM.
3. Dewesh-Kamal scholarship for studies abroad from the Ramakrishna Mission Institute of Culture, Kolkata, August 2004.
4. Best student in the Visiting Student’s Summer Program at the Harish Chandra Research Program, Allahabad, India (June – July, 2002).

## Professional Services and Activities

1. IISA program committee chair for invited (and topic contributed) sessions for JSM 2024.
2. IMS program committee chair for invited sessions for JSM 2021.
3. IMS Committee on Publications: 2021-2023 (chair of the committee during 2022-2023).
4. Served (multiple times) as a National Science Foundation (NSF) panel member for the Statistics Program under the Division of Mathematical Sciences (DMS).
5. *Refereeing for Journals:* Advances in Statistical Analysis; Annals of Applied Statistics; Annals of Statistics; Bernoulli; Biometrika; Canadian Journal of Statistics; Computational Statistics and Data Analysis; Electronic Communications in Probability; Electronic Journal of Statistics; International Journal of Biostatistics; International Statistical Review; Journal of the American Statistical Association; Journal of Computational and Graphical Statistics; Journal of Machine Learning Research; Journal of Nonparametric Statistics; Journal of the Royal Statistical Society (Series B); Journal of Statistical Planning and Inference; Journal of Statistical Software; Journal of Statistical Theory and Practice; Mathematical Programming; Mathematics of Operations Research; Sankhyā; Scandinavian Journal of Statistics; Statistica Sinica; STAT; Statistical Methodology; Statistics in Medicine; Technometrics.
6. *Membership in Professional Societies:* (Life) Member of IMS (Institute of Mathematical Statistics), ASA (American Statistical Association), Bernoulli Society, and IISA (International Indian Statistical Association).
7. *Grant review:* National Security Agency Mathematical Sciences (NSA); Natural Sciences and Engineering Research Council of Canada (NSERC); Israel Science Foundation (ISF).
8. Member of the student paper award committee for ASA Nonparametric Statistics Section for the year 2010.
9. Member of the student paper award committee for IISA conference for the years 2012, 2018, 2020 (chair).

## Departmental Services

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|--|------------------|
| Statistics tenure-track faculty search committee (chair) | 2021             |
| Director of graduate studies (DGS)                       | 2015, 2017, 2018 |
| Recruiting: Postdoc                                      | 2020             |
| Summer courses   | 2020–2021        |
| Statistics faculty search committee                      | 2013–2018, 2023  |
| Ph.D. student recruiting committee                       | 2013–2018, 2020  |
| Ph.D. qualifying exam review committee                   | 2008–2021        |
| Ph.D. curriculum committee                               | 2009             |
| Seminar organization committee                           | 2008             |

## Teaching Experience

- Columbia University

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|---|--------------------------|
| Stat GR5203: Probability  | Fall 2024                |
| Stat GR8201: Empirical Bayes  | Spring 2023              |
| Stat GR6203: Statistical Inference Theory III (Empirical Process Theory and Applications) | Fall 2021                |
| Stat GR6202: Statistical Inference Theory II  | Spring 2021              |
| Stat GR5204: Introduction to Statistical Inference  | Fall 2017–20, 2022–23    |
| Stat GU4204: Introduction to Statistical Inference  | Spring 2020, Spring 2022 |
| Stat GR8325: Semiparametric Inference and Empirical Processes                             | Spring 2018              |
| Stat GR6109: Statistical Inference Theory III (Nonparametrics)                            | Spring 2016              |
| Stat GR8325: Empirical Process Theory and Applications                                    | Spring 2015              |
| Stat 4109: Introduction to Probability and Statistical Inference (double credit course)   | Fall 2009, Fall 2013–15  |
| Stat 4315: Linear Regression Models   | Fall 2012                |
| Stat 6108: Theoretical Statistics II  | Spring 2011              |
| Stat 6107: Theoretical Statistics I   | Fall 2010                |
| Stat 4107: Introduction to Statistical Inference  | Spring 2010              |
| Stat 1211: Introduction to Statistics (with Calculus)                                     | Fall 2010, Fall 2008     |
| Stat 4413: Introduction to Nonparametric Statistics                                       | Spring 2009              |

- Stanford University

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|---|-------------------------|
| “Empirical Process Theory and Applications” | Spring (Apr.–Jun.) 2017 |
|---|-------------------------|

- University of Cambridge (UK)

|                                       |                            |
|---------------------------------------|----------------------------|
| Part II course “Statistical Modeling” | Lent term (Jan.–Mar.) 2012 |
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- Graduate Student Instructor, University of Michigan

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|--|------------------------|
| Statistics 250: Introduction to Stats. and Data Ana. | Fall 2004, Winter 2005 |
| Statistics 425: Introduction to Probability          | Fall 2005              |

Statistics 531: Analysis of Time Series  
Statistics 611: Large Sample Theory  
Statistics 621: Theory of Probability II

Fall 2005  
Winter 2006  
Winter 2006

### Conference/Workshop/Session Organization

1. 2023 IMS International Conference on Statistics and Data Science (ICSIDS), Lisbon, Portugal, December 18-21, 2023. (Co)-organizer of the invited sessions “Applications of Optimal Transport to Statistics and Machine Learning I-II”.
2. 16th International Conference of the ERCIM WG on Computational and Methodological Statistics (CMStatistics 2023), Berlin (Germany), 16–18 December 2023. Organizer of the organized invited session “EO220: Optimal transport and statistics”.
3. **Chair** of the organizing committee for the Michael Woodroffe memorial conference (<https://sites.lsa.umich.edu/woodroffememorial/>), 29–30 September 2023, Ann Arbor, Michigan.
4. Joint Statistical Meetings (JSM), 5–10 August 2023, Toronto, Canada. Organizer of the invited session “Optimal Transport and Applications to Statistics”.
5. 15th International Conference of the ERCIM WG on Computational and Methodological Statistics (CMStatistics 2022), 17–19 December 2022. Organizer of the invited session “Recent advances in nonparametric methods”.
6. Co-organizer of the Institute for Mathematical and Statistical Innovation (IMSI) workshop on “Applied Optimal Transport”, the University of Chicago, 16–20 May 2022.
7. Joint Statistical Meetings (JSM), 6–11 August 2022, Washington DC. Organizer of the invited session “On Recent Progress in Measuring Dependence and Conditional Dependence”.
8. Organizer of the invited session “Measuring Dependence and Conditional Dependence with Applications” in the 34th New England Statistics Symposium (NESS) at the University of Rhode Island at Providence, Sep 30 – Oct 2, 2021.
9. Member of the Scientific Programme Committee (SPC) in the International Indian Statistical Association (IISA) 2021 conference at University of Illinois at Chicago (UIC Chicago), May 20–23, 2021.
10. Organizer of the invited session “On Recent Advances in Shape-constrained Estimation” in the IISA 2021 conference at the University of Illinois at Chicago, May 20–23, 2021.
11. Organizer of the invited session “On Statistical applications of optimal transport” in the IISA 2021 conference at the University of Illinois at Chicago, May 20–23, 2021.
12. Organizer of the invited session “Recent Advances in Shape Constrained Inference” at World Congress in Probability and Statistics (Seoul, South Korea), jointly sponsored by the Bernoulli Society and the IMS, July 19–23, 2021.
13. Organizer of the session “Current Trends in Statistical Theory and Applications” at the “Young Statisticians’ Meet : Data Science in action” (virtual), March 6, 2021.
14. Organizer of the invited session “New Developments in Modern Statistical Theory” at the JSM 2019 (Denver), July 27–August 1, 2019.
15. Organizer of the invited session “Recent Advances in Shape-constrained Estimation and Inference” at the IISA 2018 conference at the University of Florida, Gainesville, May 17–20, 2018.

16. Co-organizer of the Banff IRS workshop “Shape-Constrained Methods: Inference, Applications, and Practice” (18w5112). (Jan 28–Feb 02, 2018)
17. Organizer (and discussant) of the invited session “On Shape Constrained Estimation and Inference” at the JSM 2017, July 29–August 3, 2017.
18. Organizer of the invited session “Estimation of Ridges and Manifolds” in the IISA 2016 conference at the Oregon State University (Corvallis), August 19-21, 2016.
19. Organizer of the invited session “Shape Constrained Inference” in the IISA 2016 conference at the Oregon State University, Corvallis on August 19–21, 2016.
20. European Meeting of Statisticians (EMS), July 6–10, 2015, Amsterdam. Organizer of an invited contributed session on “Shape restricted function estimation”.
21. Joint Statistical Meetings (JSM), 2–7 August 2014, Boston. Organizer of the invited session on “Shape-restricted function estimation”.
22. Co-organizer of 2013-2014 Focus Year on “Measures of Dependence” by the Department of Statistics, Columbia University.
23. 59th World Statistics Congress, 25–30 August, 2013, Hong Kong. Organizer of the invited session on “Statistical Challenges in Astronomy”.
24. 2nd Institute of Mathematical Statistics (IMS) Asia Pacific Rim Meetings, 2–4 July 2012, Tsukuba, Japan. Organizer and Chair of an Invited session on “Recent developments in Nonparametrics and related topics”.
25. International Conference on Probability, Statistics and Data Analysis (ICPSDA-2011), April 21-24, 2011, Raleigh, USA. Organizer and Chair of an Invited session.
26. JSM, August 2010 (Vancouver, Canada). Organizer and Chair of Topic Contributed Session on “Shape Restricted Estimation and Inference”.
27. JSM, August 2009 (Washington DC, USA). Organizer and Chair of Topic Contributed Session on “Inference in Non-standard Problems”.
28. Co-organizer of the New York Workshop on Computer, Earth, and Space Sciences, at the NASA Goddard Institute for Space Studies, New York, N.Y. (February 6, 2009).

### **Presentations at Conferences and Workshops**

1. “Workshop on Optimal Transport and PDEs”, Institute for Mathematical Sciences (Singapore), 15–26 January, 2024. (Invited speaker)
2. 2023 IMS International Conference on Statistics and Data Science (ICSDDS), Lisbon, Portugal, December 18-21, 2023. (Invited speaker)
3. JSM 2023 (Toronto, Canada), 05–10, August 2023. Speaker in the invited session “Combinatorial and graph methods in causal inference”.
4. ICERM workshop (at Brown University) on “Optimal Transport in Data Science”, May 8-12, 2023. (Invited speaker)
5. Berkeley-Columbia Meeting in Engineering and Statistics, April 20-21, 2023, New York. (Invited speaker)
6. *Special invited talk* at IISA Meeting, Bangalore, December 26–30, 2022.
7. 2022 IMS International Conference on Statistics and Data Science (ICSDDS), Florence, Italy, December 13-16, 2022. (Invited speaker)

8. Workshop on “Measure-theoretic Approaches and Optimal Transportation in Statistics”, Institut Henri Poincaré (IHP, Paris), 21–25 November, 2022. (Invited speaker)
9. JSM 2022 (Washington DC), 06–11, August 2022. Speaker in the Invited session “New areas in complex high dimensional data analysis”.
10. IMS Annual meeting, London, 27–30, June 2022. Speaker in the Invited session “Optimal transport methods for statistical data analysis”.
11. 5<sup>th</sup> ISNPS Conference in Paphos, Cyprus, 20–24 June, 2022. (Invited speaker)
12. Workshop on “Robustness and Resilience in Stochastic Optimization and Statistical Learning: Mathematical Foundations”, Erice, Italy, 19–25 May, 2022. (Invited speaker)
13. ICMS workshop (Edinburgh, UK) on “Structural breaks and shape constraints”, 16–20 May 2022. (Invited member)
14. Workshop on “Quantile Regression and Data Heterogeneity”, University of Miami, February 12–13, 2022. (Invited member)
15. 14<sup>th</sup> International Conference of the ERCIM WG on Computational and Methodological Statistics (CMStatistics 2021), 18–20 December 2021. Invited speaker at the session “Association and Dependence”.
16. Lectures on “Optimal transport and machine learning”, hosted by the math departments at King’s College London and University Dresden in Germany (virtual), December 01, 2021.
17. Workshop co-instructor (virtual) at the program “Introduction to Decision Making and Uncertainty” on “Optimal transport and machine learning”, IMSI, July 06, 2021.
18. IISA 2021 conference at the University of Illinois at Chicago (Invited speaker in the session “Multiple testing”), May 20–23, 2021.
19. Invited participant and speaker at the Banff IRS workshop “Optimization under Uncertainty: Learning and Decision Making” (21w5167), Feb 08–12, 2021.
20. JSM 2020 (online), August 1-6, 2020. Speaker at the topic-contributed session “Section on Statistical Learning and Data Science”.
21. Workshop on “Statistics meet Machine Learning”, Jan 26 – Feb 1, 2020, Oberwolfach, Germany. (Invited member)
22. Fall Eastern Sectional Meeting of the American Mathematical Society, Department of Mathematical Sciences at Binghamton University, October 12-13, 2019, Binghamton, New York. (Invited speaker)
23. University of Michigan Statistics 50th Anniversary Symposium, September 20-21, 2019, Ann Arbor, Michigan. (Invited speaker)
24. JSM 2019 (Denver), July 27–August 1, 2019. Speaker in the Invited session “Recent advances in nonparametric statistics”.
25. International Conference on Computer Age Statistics (Pune, India) January 3–5, 2019. (Invited speaker)
26. International Conference on Computer Age Statistics (Pune, India) January 2, 2019. Pre-conference workshop speaker on “Introduction to Optimal Transport and Statistics”.
27. Workshop on “Advanced Statistics for Physics Discovery”, Padova, Italy, September 24-25, 2018. (**Keynote** speaker)

28. Joint 2018 IMS Annual Meeting/12th International Vilnius Conference on Probability Theory & Mathematical Statistics, Vilnius, Lithuania, July 02–06, 2018. (Invited speaker in the session on shape restricted inference)
29. 4th ISNPS Conference in Salerno, Italy, 11–15 June, 2018. (Invited speaker)
30. International Indian Statistical Association (IISA) 2018 conference at the University of Florida, Gainesville, May 17–20, 2018 (Invited speaker in the session “Recent Advances in Shape-constrained Estimation and Inference”).
31. 6th Workshop on Biostatistics and Bioinformatics in Atlanta, May 4–6, 2018 (Invited speaker).
32. 32nd New England Statistics Symposium, University of Massachusetts, Amherst, 13-14 April, 2018. (Invited speaker)
33. Workshop on “Statistics of geometric features and new data types” (STSW02), Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, 19–23 March 2018. (Invited speaker)
34. 2018 Annual Winter Workshop at the University Florida, January 18–20, 2018. (Invited speaker)
35. PCM 125: International Conference in Statistics and Probability, January 2–4, 2018.
36. JSM 2017, July 29–August 3, 2017. Invited speaker in the session “Non-standard regression models”.
37. Fudan International Conference on Data Science, December 17–19, 2016, Shanghai, China. (Invited speaker)
38. Nonparametric Statistics Workshop: Integration of Theory, Methods and Applications, October 6–7, 2016, University of Michigan, Ann Arbor. (Invited speaker)
39. JSM, July 30–August 4, 2016, Chicago. Invited speaker in the session “Estimation and inference for massive data sets”.
40. Workshop on “Statistics for Shape and Geometric Features”, July 3–9, 2016, Oberwolfach, Germany. (Invited member)
41. “Statistical Challenges in Modern Astronomy (SCMA) VI”, June 6–10, 2016, Carnegie Mellon University, Pittsburgh. (Invited speaker)
42. “Shape Constrained Inference” in the International Indian Statistical Association (IISA) 2016 conference at the Oregon State University, Corvallis on August 19–21, 2016. (Invited speaker)
43. Workshop on “Nonparametric statistical inference under shape constraints”, May 16–20, 2016, Edinburgh, UK. (Invited member)
44. Workshop on “Shape Constrained Inference: Open Problems and New Directions”, October 5-9, 2015, Leiden, Netherlands. Invited member.
45. JSM, August 2015, Seattle. Invited speaker in the session “Inference Under Shape Constraints”.
46. European Meeting of Statisticians (EMS), July 6–10, 2015, Amsterdam. Speaker in an invited contributed session on “Shape restricted function estimation”.
47. JSM (Aug. 2014, Boston). Invited speaker in the session “Statistica Sinica Young Statisticians Invited Session”.

48. Second Conference on Risk and Dependence: Theory and Applications, June 2014, Columbia University, New York (Invited speaker)
49. 2014 International Indian Statistical Association (IISA) Conference, July 2014, Riverside. (Invited speaker)
50. Statistical Society of Canada (May 2014, Toronto): Invited speaker in the session “Shape-Constrained Maximum Likelihood: Methods and Applications”.
51. 2nd Institute of Mathematical Statistics (IMS) Asia Pacific Rim Meetings, July 2-4, 2012, Tsukuba, Japan. Invited speaker in the session on “Bootstrap methods”.
52. International Conference on Nonparametric Statistics, June 15-19, 2012, Chalkidiki, Greece. Invited speaker in the session “Nonparametric inference under shape constraints”.
53. IMS-China International Conference on Statistics and Probability 2011, July 8-11, 2011, Xi’an, China. Invited speaker in the session on “High dimensional statistical inference”.
54. Graybill 2011 conference on “Modern Nonparametric Methods”, June 23-24, 2011, Fort Collins, Colorado. Invited speaker in the session on “Nonparametric estimation and inference with shape restrictions”.
55. International Conference on Probability, Statistics and Data Analysis (ICPSDA-2011), April 21-24, 2011, Raleigh, USA. Invited speaker in the session on “Bootstrap methods”.
56. 3rd International Conference of the ERCIM on COMPUTING & STATISTICS, December 10-12, 2010, Senate House, University of London, UK. Invited speaker in the track on “Quantile Regression and Semiparametric Methods”.
57. Joint Statistical Meetings, August 2010 (Vancouver, Canada). Speaker at a Topic contributed session.
58. Statistical issues relevant to significance of discovery claims, July 2010 (Banff, Canada). Invited to the workshop at BIRS.
59. New England Statistics Symposium (NESS), April 2010 (Harvard, MA). (Invited speaker)
60. Conference on Resampling methods and High Dimensional Data, College Station, Texas (March 25-26, 2010). (Invited speaker)
61. International Indian Statistical Association Conference, Visakhapatnam, Andhra University, India (Jan 4-8, 2010). (Invited speaker)
62. Joint Statistical Meetings (JSM), 2009, Washington DC. Invited speaker in the session on “Threshold Estimation”.
63. 1st Institute of Mathematical Statistics Asia Pacific Rim Meetings, June 28-July 1, 2009, Seoul, South Korea. Invited speaker in the session on “Recent developments in resampling methods and inference”.
64. Symposium on “New Directions in Asymptotic Statistics”, May 15-16, 2009 at the University of Georgia, Athens. (Invited speaker)
65. Twelfth North American Meeting of New Researchers in Statistics and Probability, July 28 - July 31, 2009 at Baltimore. (Invited speaker)
66. Statistical inference Problems in High Energy Physics and Astronomy, July 2006, Banff, Canada. (Invited speaker)
67. SAMSI High Energy Physics working group, March 2006. (Invited speaker)
68. Joint Statistical Meetings (JSM) 2008, Denver. (Topic contributed session)
69. Joint Statistical Meetings (JSM) 2007, Salt Lake City. (Contributed session)

70. Rackham Interdisciplinary Workshop on Statistical Topics, July 2007.
71. Poster presentation at Michigan Student Symposium for Interdisciplinary Statistical Sciences (MSSISS), March 2007.
72. Joint Statistical Meetings (JSM) 2006, Seattle. (Topic contributed session)
73. Poster presentation in “Statistical Challenges in Modern Astronomy IV” at Penn State University, June 2006.
74. SAMSI Astro-statistics Workshop, January 2006.
75. Quantitative Methodology Program Seminar Series, University of Michigan, March 2005.

## Departmental Seminars

1. *Extending the scope of Nonparametric Empirical Bayes*
  - University of Texas at Austin, April 2024.
  - University of Illinois at Urbana-Champaign, April 2024.
  - Princeton University, April 2024.
  - Cornell University, Ithaca, April 2024.
  - Georgia Tech, Atlanta, November 2023.
  - University of Wisconsin at Madison, October 2023.
2. *Multivariate Distribution-free Nonparametric Testing using Optimal Transport*
  - Cornell University, Ithaca, October 2023.
  - Florida State University, Tallahassee, October 2023.
  - University of Pennsylvania (Wharton Business School), April 2023.
  - Purdue University (Graduate Student Organization annual seminar), March 2023.
  - Joint Statistics Seminars of CREST (ENSAE) and CMAP (Ecole Polytechnique), April 2021.
  - Gatsby Computational Neuroscience Unit (Centre for Computational Statistics and Machine Learning at UCL), June 2020.
  - European Center for Advanced Research in Economics and Statistics (ECARES), Brussels, January 2020.
  - Stat. & Math. Unit, ISI, Kolkata, January 2020.
3. *On the Efficiency of Multivariate Distribution-free Tests defined using Optimal Transport.* Colloquium (virtual), Stat. & Math. Unit, ISI, Kolkata, September 2021.
4. *Empirical Process Theory Through Examples.* Stochastic Colloquium (virtual), Georg-August-Universität Göttingen, Institut für Mathematische Stochastik, July 2021.
5. *Measuring Association on Topological Spaces Using Kernels and Geometric Graphs*
  - Columbia Statistics student seminar, December 2020.
  - Applied Statistics Unit, Indian Statistical Institute (ISI), Kolkata, December 2020.
6. *Optimal Transportation and Statistics*
  - George Mason University, April 2019.
  - Stat. & Math. Unit, ISI, Kolkata, December 2018.

- Columbia Statistics student seminar, November 2018.
7. *Optimal Inference with a Multidimensional Multiscale Statistic*
    - Laboratoire de Probabilités, Statistique et Modélisation (LPSM) Sorbonne Université, Jussieu Paris, France, June 2018.
    - Stat. & Math. Unit, Indian Statistical Institute (ISI), Kolkata, June 2018.
  8. *Nonparametric Shape-restricted Regression*. Epstein Institute Seminar, Department of Industrial & Systems Engineering, University of Southern California, Los Angeles, March 2018.
  9. *Estimation of a Two-component Mixture Model with Applications to Multiple Testing*.
    - University of Georgia at Athens, February 2019.
    - Stanford University, May 2017.
    - Oregon State University at Corvallis, April 2017.
    - University of Washington at Seattle, March 2017.
    - University of California at Berkeley, October 2016.
  10. A Few Problems in Statistics and Astronomy. Columbia University Science Research Fellows seminar, November 2017.
  11. *Lectures in Nonparametrics and High-dimensional statistics*. Lecture series (10 hours) at Indian Statistical Institute (ISI), Kolkata, India, January 2017.
  12. *Shape Constrained Regression*.
    - Department of Economics, Columbia University, May 2018.
    - C. R. Rao Advanced Institute of Mathematics, Statistics and Computer Science (AIM-SCS), Hyderabad, India, December 2016.
  13. *Nonparametric Convex Regression*.
    - Department of Engineering Systems & Design, Singapore University of Technology and Design, Singapore, January 2017.
    - Department of Industrial and Systems Engineering, Texas A & M University, College Station, TX, March 2016.
  14. *Two Applications of Shape Constrained Inference: Estimation in a Two-component Mixture Model & Single Index Models*. Department of Statistics, Texas A & M University, College Station, TX, March 2016.
  15. *Adaptation in Shape Constrained Regression*.
    - Department of Statistics and Applied Probability, National University of Singapore, January 2017.
    - Department of Operations Research and Financial Engineering, Princeton University, April 2016.
    - Department of Statistics, University of Connecticut, Storrs, CT, March 2016.
    - Department of Mathematical Sciences Seminar, New Jersey Institute of Technology (NJIT), Newark, November 2015.
    - Statistics Student Seminar, Columbia University, November 2015.
  16. *Nonparametric Convex Regression*.

- University of Michigan, Ann Arbor, September 2015.
  - Virginia Tech., Blacksburg, October 2014.
  - University of Minnesota, Minneapolis, September 2014.
  - Bio. Stat. Dept., University of North Carolina, Chapel Hill, March 2014.
  - Stat. & Math. Unit, Indian Statistical Institute, Kolkata, March 2014.
  - University of California, Davis, March 2014.
17. *Nonparametric Shape Restricted Regression*. University of Florida, Gainesville, January 2014.
  18. *Shape Restricted Functions: Some Theory and Applications*. Department of Statistics, Wharton School, University of Pennsylvania, Philadelphia, November 2012.
  19. *Estimation of a Two-component Mixture model*. Statistics and Mathematics Unit, Indian Statistical Institute, Calcutta, August 2012.
  20. *Shape Constrained Estimation and Inference*. ETH Zurich, Switzerland, May 2012.
  21. *A statistical application in astronomy: Streaming motion in Leo I*. Seminar on applied Statistics, ETH Zurich, Switzerland, May 2012.
  22. *Bootstrap in Some Non-standard Problems*.
    - University of Cambridge, UK, January 2011.
    - Yale University, September 2009.
    - City University of New York, March 2009.
  23. *Shape Restricted Estimation and Inference in Non-standard Problems*.
    - University of Toronto, Canada, April 2011.
    - Lehigh University, Bethlehem, November 2010.
    - New York University, Stern School of Business, April 2010.
  24. *(In)-consistency of Bootstrap in Non-standard Problems*. University of Maryland at Baltimore County, October 2009.
  25. *Detecting Streaming motion in Leo I (2008)*. Columbia University, Astronomy department, October 2008.
  26. *Bootstrap in Non-standard Problems*.
    - North Carolina State University, January 2008.
    - Columbia University, January 2008.
    - University of California at Berkeley, January 2008.
    - University of California at Davis, January 2008.
    - Colorado State University, February 2008.
    - Texas A and M University, February 2008.
    - University of Minnesota, February 2008.
    - Rutgers University, February 2008.
    - University of Florida, February 2008.
    - Harvard University, February 2008.
    - Carnegie Mellon University, February 2008.

27. *Bootstrap in Non-standard Problems* (2007). University of Michigan, Ann Arbor, weekly Statistics Seminar, October 2007.
28. *Statistical Challenges in High Energy Physics* (2006). Bayesian Statistics and Interdisciplinary Research Unit, Indian Statistical Institute, Kolkata, September 2006.
29. *Resampling and Likelihood based Confidence Intervals in some non-regular problems* (2006). Statistics and Mathematics Unit, Indian Statistical Institute, Kolkata, August 2006.
30. *Fractile Graphical Analysis with Multiple Covariates* (2004). Mahalanobis International Symposium on Statistics, Indian Statistical Institute, Kolkata, July 2004.

### **Scientific Softwares Skills**

1. Extensive experience with C/C++ and Matlab, including software development for research projects.
2. Statistical packages: SPSS, S-Plus and R, Matlab.
3. Knowledge of Windows, Linux and Mac Operating systems.