Bharath Kumar Sriperumbudur Vangeepuram

Department of Statistics
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University Park, PA 16802

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Research Interests

Machine Learning, Statistical Learning Theory, Non-parametric Estimation, Regularization and Inverse Problems, Reproducing Kernel Spaces in Probability and Statistics, Functional Data Analysis, Topological Data Analysis, Optimal Transport and Gradient Flows

Education

University of California, San Diego 09/2005–11/2010
Ph.D., Electrical and Computer Engineering (emphasis in Machine Learning and Computational Statistics)
Dissertation: *Reproducing Kernel Space Embeddings and Metrics on Probability Measures*
Advisor: Prof. Gert R. G. Lanckriet

Indian Institute of Technology, Kanpur, India 08/2000– 03/2002
M.Tech., Electrical Engineering (emphasis in Signal Processing)
Thesis: *A Model Based Approach to Non-Uniform Vowel Normalization*
Advisor: Prof. S. Umesh

Sri Venkateswara University, Tirupati, India 07/1995–06/1999
B.Tech., Electronics and Communication Engineering

Employment

Academic Positions

Department of Statistics, The Pennsylvania State University
Associate Professor 06/2020–present
Assistant Professor 08/2014–05/2020

Statistical Laboratory, University of Cambridge 09/2012–08/2014
Research Fellow in Statistics

Gatsby Computational Neuroscience Unit, University College London 12/2010–09/2012
Post-doctoral Research Associate

Visiting Positions

The Institute of Statistical Mathematics, Tokyo 10/2012
Host: Prof. Kenji Fukumizu

National ICT Australia, Canberra 10/2011
Host: Prof. Robert Williamson

Faculty of Mathematical Sciences, Queensland University of Technology 10/2011
Host: Prof. Peter Bartlett (also with the Department of Statistics, University of California-Berkeley)

Institute for Stochastics and Applications, University of Stuttgart 04/2011
Host: Prof. Dr. Ingo Steinwart

Internships

The Institute of Statistical Mathematics, Tokyo 10–12/2009
Advisor: Prof. Kenji Fukumizu

Max Planck Institute for Biological Cybernetics, Tübingen 2007/2008
Advisors: Prof. Dr. Bernhard Schölkopf and Dr. Arthur Gretton

Swartz Center for Computational Neuroscience, University of California San Diego 06–08/2006
Advisor: Dr. Scott Makeig

Industry Positions

Imaging Technologies Lab, General Electric Global Research, Bangalore, India 04/2002–08/2005
Research Engineer

Wipro Technologies, Bangalore, India 11/1999–07/2000
Systems Engineer

Honors, Awards & Fellowships

NSF CAREER Award 2020

Travel Award, Fourth Conference of the International Society for Nonparametric Statistics, Salerno 2018

Travel Award, Third Conference of the International Society for Nonparametric Statistics, Avignon 2016

Travel Award, Spring School on "Structural Inference in Statistics", Berlin 2014

Herman Goldstine Memorial Postdoctoral Fellowship in Mathematical Sciences, IBM Research[1] 2012

Travel Award, Workshop on "Machine Learning: Theory and Computation", Institute for Mathematics and its Applications, University of Minnesota 2012

Honorable Mention, Best Student Paper, Twenty-Third Annual Conference on Neural Information Processing Systems 2009

Travel Award, Twenty-Third Annual Conference on Neural Information Processing Systems 2009

Travel Award, International Conference on Machine Learning 2007, 2008

Travel Award, Machine Learning Summer School, Tübingen 2007

Cal-$(IT)^2$ Fellowship, University of California, San Diego 2005–2006

Bronze Patent Medal, General Electric Global Research, Bangalore 2004

Hats-off Award, General Electric Global Research, Bangalore 2003

General Electric Scholarship 2000–2002

Publications

Available for download from `http://www.personal.psu.edu/bks18/Publications.html`

[1] Declined to accept the Research Fellow position at Statslab, University of Cambridge.

Monograph

1. Muandet, K., K. Fukumizu, B. K. Sriperumbudur and B. Schölkopf (2017). Kernel Mean Embedding of Distributions: A Review and Beyond. *Foundations and Trends in Machine Learning*, 10(1-2), 1–141.

Journal Articles

1. Steinwart, I., B. K. Sriperumbudur and P. Thomann (2023). Adaptive Clustering using Kernel Density Estimators. *Journal of Machine Learning Research. To appear.*

2. Sheng, T. and B. K. Sriperumbudur (2023). On Distance and Kernel Measures of Conditional Dependence. *Journal of Machine Learning Research*, 24(7): 1–16.

3. Reimherr, M., B. K. Sriperumbudur and H. B. Kang (2023). Optimal Function-on-Scalar Regression over Complex Domains. *Electronic Journal of Statistics*, 17(1): 156–197.

4. Sterge, N. and B. K. Sriperumbudur (2022). Statistical Optimality and Computational Efficiency of Nyström Kernel PCA. *Journal of Machine Learning Research*, 23(337): 1–32.

5. Sriperumbudur, B. K. and N. Sterge (2022). Approximate Kernel PCA Using Random Features: Computational vs. Statistical Trade-off. *Annals of Statistics*, 50(5): 2713–2736.

6. Lam-Weil, J., A. Carpentier and B. K. Sriperumbudur (2022). Local minimax rates for closeness testing of discrete distributions. *Bernoulli*, 28(2): 1179–1197.

7. Kanagawa, M., B. K. Sriperumbudur and K. Fukumizu (2020). Convergence Analysis of Deterministic Kernel-based Quadrature Rules in Misspecified Settings. *Foundations of Computational Mathematics*, 20: 155–194.

8. Reimherr, M., B. K. Sriperumbudur and B. Taoufik (2018). Optimal Prediction for Additive Function-on-function Regression. *Electronic Journal of Statistics*, 12(2), 4571–4601.

9. Szabó, Z. and B. K. Sriperumbudur (2018). Characteristic and Universal Tensor Product Kernels. *Journal of Machine Learning Research*, 18(233), 1–29.

10. Tolstikhin, I., B. K. Sriperumbudur and K. Muandet (2017). Minimax Estimation of Kernel Mean Embeddings. *Journal of Machine Learning Research*, 18(86), 1–47.

11. Sriperumbudur, B. K., K. Fukumizu, R. Kumar, A. Gretton, and A. Hyvärinen (2017). Density Estimation in Infinite Dimensional Exponential Families. *Journal of Machine Learning Research*, 18(57), 1–59.

12. Szabó, Z., B. K. Sriperumbudur, B. Póczos and A. Gretton (2016). Learning Theory for Distribution Regression. *Journal of Machine Learning Research*, 17(152), 1–40.

13. Muandet, K., B. K. Sriperumbudur, K. Fukumizu, A. Gretton and B. Schölkopf (2016). Kernel Mean Shrinkage Estimators. *Journal of Machine Learning Research*, 17(48), 1–41.

14. Sriperumbudur, B. K. (2016). On the Optimal Estimation of Probability Measures in Weak and Strong Topologies. *Bernoulli*, 22(3): 1839–1893.

15. Sejdinovic, D., B. K. Sriperumbudur, A. Gretton and K. Fukumizu (2013). Equivalence of Distance-based and RKHS-based Statistics in Hypothesis Testing. *Annals of Statistics*, 41(5): 2263-2291.

16. Sriperumbudur, B. K., K. Fukumizu, A. Gretton, B. Schölkopf and G. R. G. Lanckriet (2012). On the Empirical Estimation of Integral Probability Metrics. *Electronic Journal of Statistics*, 6: 1550–1599.

17. Sriperumbudur, B. K. and G. R. G. Lanckriet (2012). A Proof of Convergence of the Concave-Convex Procedure Using Zangwill's Theory. *Neural Computation*, 24(6): 1391–1407.

18. Sriperumbudur, B. K., K. Fukumizu and G. R. G. Lanckriet (2011). Universality, Characteristic Kernels and RKHS Embedding of Measures. *Journal of Machine Learning Research*, 12(Jul): 2389–2410.

19. Sriperumbudur, B. K., D. A. Torres and G. R. G. Lanckriet (2011). A Majorization-Minimization Approach to the Sparse Generalized Eigenvalue Problem. *Machine Learning*, 85(1): 3–39.

20. Sriperumbudur, B. K., A. Gretton, K. Fukumizu, B. Schölkopf and G. R. G. Lanckriet (2010). Hilbert Space Embeddings and Metrics on Probability Measures. *Journal of Machine Learning Research*, 11(Apr): 1297–1322.

21. Gretton, A., K. Fukumizu and B. K. Sriperumbudur (2009). Discussion of: Brownian Distance Covariance. *The Annals of Applied Statistics*, 3(4): 1285–1294.

22. Bharath Kumar, S. V. and S. Umesh (2008). Non-Uniform Speaker Normalization Using Affine Transformation. *Journal of the Acoustic Society of America*, 124(3): 1727–1738.

Under Submission

1. Hagrass, O., B. K. Sriperumbudur and B. Li (2023). Spectral Regularized Kernel Goodness-of-Fit Tests. *http://arxiv.org/pdf/2308.04561.pdf*. Submitted to *Journal of Machine Learning Research*.

2. Arya, S. and B. K. Sriperumbudur (2023). Kernel ϵ-Greedy for Contextual Bandits. Submitted to *Journal of Machine Learning Research*. *https://arxiv.org/pdf/2306.17329.pdf*.

3. Hagrass, O., B. K. Sriperumbudur and B. Li (2022). Spectral Regularized Kernel Two-Sample Tests. *http://arxiv.org/pdf/2212.09201.pdf*. Major revision submitted to *Annals of Statistics*.

4. Utpala, S. and B. K. Sriperumbudur (2023). Shrinkage Estimation of Higher Order Bochner Integrals. *https://arxiv.org/pdf/2207.06357*. Major revision submitted to *Bernoulli*.

5. Zhang, Z., Z. Goldfeld, Y. Mroueh and B. K. Sriperumbudur (2023). Gromov-Wasserstein Distances: Entropic Regularization, Duality and Sample Complexity. *https://arxiv.org/pdf/2212.12848.pdf*. Submitted to *Annals of Statistics*.

6. Vishwanath, S., K. Fukumizu, S. Kuruki and B. K. Sriperumbudur (2022). On the Limits of Topological Data Analysis for Statistical Inference. *https://arxiv.org/pdf/2001.00220.pdf*. Submitted to *Foundations of Data Science*.

7. Vishwanath, S., B. K. Sriperumbudur, K. Fukumizu, and S. Kuruki (2022). Robust Topological Inference in the Presence of Outliers. *https://arxiv.org/pdf/2206.01795.pdf*. Submitted to *Foundations of Computational Mathematics*.

8. Singh, S., B. K. Sriperumbudur and B. Póczos (2020). Minimax Estimation of Quadratic Fourier Functionals. *https://arxiv.org/pdf/1803.11451.pdf*. Submitted to *Electronic Journal of Statistics.*

Under Revision

1. He, Y., K. Balasubramanian, B. K. Sriperumbudur, and J. Lu (2022). Regularized Stein Variational Gradient Flow. *https://arxiv.org/pdf/2211.07861*. Major Revision. *Foundations of Computational Mathematics*.

2. Siapoutis, N., D. Richards and B. K. Sriperumbudur (2022). Mean Shrinkage Estimation for High-Dimensional Diagonal Natural Exponential Families. *https://arxiv.org/pdf/2010.08071.pdf*. Major Revision. *Annals of the Institute of Statistical Mathematics*.

3. Balasubramanian, K., H-G. Müller, and B. K. Sriperumbudur (2022). Unified RKHS Methodology and Analysis for Functional Linear and Single-Index Models. *https://arxiv.org/pdf/2206.03975.pdf*. Major Revision. *Bernoulli*.

4. Kangawa, M., P. Henning, D. Sejdinovic and B. K. Sriperumbudur (2018). Gaussian Processes and Kernel Methods: A Review on Connections and Equivalences. *https://arxiv.org/pdf/1807.02582.pdf*. Major Revision. *Journal of Machine Learning Research*.

Peer Reviewed Conference Papers

1. Zhang, Z., Y. Mroueh, Z. Goldfeld and B. K. Sriperumbudur (2022). Cycle Consistent Probability Divergences Across Different Spaces. In *Proceedings of the 24th International Conference on Artificial Intelligence and Statistics*. (Accepted: 492/1685, 29%)

2. Vishwanath, S., K. Fukumizu, S. Kuruki and B. K. Sriperumbudur (2020). Robust Persistence Diagrams Using Reproducing Kernels. In *Advances in Neural Information Processing Systems* 34. (Accepted: 1900/9454, 20%)

3. Kpotufe, S. and B. K. Sriperumbudur (2020). Gaussian Sketching yields J-L Lemma in RKHS. In *Proceedings of the 23rd International Conference on Artificial Intelligence and Statistics*, Palermo, Italy.

4. Sterge, N., B. K. Sriperumbudur, L. Rosasco and A. Rudi (2020). Gain with No Pain: Efficient Kernel PCA by Nyström Sampling. In *Proceedings of the 23rd International Conference on Artificial Intelligence and Statistics*, Palermo, Italy.

5. Szabó, Z. and B. K. Sriperumbudur (2019). On Kernel Derivative Approximation with Random Fourier Features. In *Proceedings of the 22nd International Conference on Artificial Intelligence and Statistics*, Okinawa, Japan. (Accepted: 360/1111, 32%)

6. Tolstikhin, I., B. K. Sriperumbudur and B. Schölkopf (2016). Minimax Estimation of Maximal Mean Discrepancy with Radial Kernels. In *Advances in Neural Information Processing Systems* 28. (Accepted: 568/2500, 23%)

7. Kanagawa, M., B. K. Sriperumbudur and K. Fukumizu (2016). Convergence Guarantees for Kernel-Based Quadrature Rules in Misspecified Settings. In *Advances in Neural Information Processing Systems* 28. (Accepted: 568/2500, 23%)

8. Sriperumbudur, B. K. and Z. Szabó (2015). Optimal Rates for Random Fourier Features. In *Advances in Neural Information Processing Systems* 27. (Accepted for spotlight: 67/1838, 4%; Overall: 403/1838, 22%)

9. Szabó, Z., A. Gretton, B. Póczos and B. K. Sriperumbudur (2015). Two-stage Sampled Learning Theory on Distributions. In *Proceedings of the 18th International Conference on Artificial Intelligence and Statistics*, San Diego, USA. (Accepted for plenary oral: 27/442, 6%; Overall: 127/442, 29%)

10. Muandet, K., B. K. Sriperumbudur and B. Schölkopf (2014). Kernel Mean Estimation via Spectral Filtering. In *Advances in Neural Information Processing Systems* 27. (Accepted: 370/1467, 25%)

11. Muandet, K., K. Fukumizu, B. K. Sriperumbudur, A. Gretton and B. Schölkopf (2014). Kernel Mean Estimation and Stein's Effect. In *Proceedings of the 31st International Conference on Machine Learning*, Beijing, China. (Accepted: 310/1238, 25%)

12. Kar, P., B. K. Sriperumbudur, P. Jain and H. Karnick (2013). On the generalization ability of online learning algorithms for pairwise loss functions. In *Proceedings of the 30th International Conference on Machine Learning*, Atlanta, USA.

13. Balasubramanian, K., B. K. Sriperumbudur and G. Lebanon (2013). Ultrahigh Dimensional Feature Screening Using RKHS Embeddings. In *Proceedings of the 16th International Conference on Artificial Intelligence and Statistics*, 126–134, Scottsdale, Arizona, USA. (Accepted: 71/211, 34%)

14. Gretton, A., B. K. Sriperumbudur, D. Sejdinovic, H. Strathmann, S. Balakrishnan, M. Pontil and K. Fukumizu (2012). Optimal Kernel Choice for Large-Scale Two-Sample Tests. In *Advances in Neural Information Processing Systems* 25. (Accepted: 370/1467, 25%)

15. Sejdinovic, D., A. Gretton, B. K. Sriperumbudur and K. Fukumizu (2012). Hypothesis Testing Using Pairwise Distances and Associated Kernels. In *Proceedings of the 29th International Conference on Machine Learning*, 1111–1118. (Accepted: 243/890, 27%)

16. Sriperumbudur, B. K. and I. Steinwart (2012). Consistency and Rates for Clustering with DBSCAN. In *Proceedings of the 15th International Conference on Artificial Intelligence and Statistics*, 1090–1098, La Palma, Canary Islands. (Accepted: 134/400, 34%)

17. Sriperumbudur, B. K., K. Fukumizu and G. R. G. Lanckriet (2011). Learning in Hilbert vs. Banach Spaces: A Measure Embedding Viewpoint. In *Advances in Neural Information Processing Systems* 24. (Accepted: 305/1400, 22%)

18. Sriperumbudur, B. K. (2011). Mixture Density Estimation Via Hilbert Space Embedding of Measures. In *Proceedings of the 2011 IEEE International Symposium on Information Theory*, 1027–1030, St. Petersburg, Russia.

19. Sriperumbudur, B. K., K. Fukumizu, A. Gretton, B. Schölkopf and G. R. G. Lanckriet (2010). Non-Parametric Estimation of Integral Probability Metrics. In *Proceedings of the 2010 IEEE International Symposium on Information Theory*, 1428–1432, Austin, Texas.

20. Sriperumbudur, B. K., K. Fukumizu and G. R. G. Lanckriet (2010). On the Relation Between Universality, Characteristic Kernels and RKHS Embedding of Measures. In *Proceedings of the 13th International Conference on Artificial Intelligence and Statistics*, 773–780, Sardinia, Italy. (Accepted for plenary oral: 24/308, 8%; Overall: 125/308, 41%)

21. Jegelka, S., A. Gretton, B. Schölkopf, B. K. Sriperumbudur and U. von Luxburg (2009). Generalized Clustering via Kernel Embeddings. In *Proceedings of the 32nd Annual German Conference on Artificial Intelligence*, 144–152, Paderborn, Germany.

22. Sriperumbudur, B. K., K. Fukumizu, A. Gretton, G. R. G. Lanckriet and B. Schölkopf (2009). Kernel Choice and Classifiability for RKHS Embeddings of Probability Distributions. In *Advances in Neural Information Processing Systems* 22. (Accepted for plenary oral: 22/1105, 2%; Overall: 263/1105, 24%) **Honorable Mention for the Outstanding Student Paper Award**

23. Sriperumbudur, B. K. and G. R. G. Lanckriet (2009). On the Convergence of the Concave-Convex Procedure. In *Advances in Neural Information Processing Systems* 22. (Accepted: 263/1105, 24%)

24. Gretton, A., K. Fukumizu and Z. Harchaoui, B. K. Sriperumbudur (2009). A Fast, Consistent Kernel Two-sample Test. In *Advances in Neural Information Processing Systems* 22. (Accepted for poster spotlight: 64/1105, 6%; Overall: 263/1105, 24%)

25. Fukumizu, K., B. K. Sriperumbudur, A. Gretton and B. Schölkopf (2008). Characteristic Kernels on Groups and Semigroups. In *Advances in Neural Information Processing Systems* 21. (Accepted for plenary oral: 32/1022, 3%; Overall: 250/1022, 24%)

26. Schölkopf, B., B. K. Sriperumbudur, A. Gretton and K. Fukumizu (2008). RKHS Representation of Measures applied to Homogeneity, Independence and Fourier Optics. In *Oberwolfach Report 30*, Mathematisches Forschungsinstitut, Oberwolfach-Walke, Germany.

27. Sriperumbudur, B. K., A. Gretton, K. Fukumizu, G. R. G. Lanckriet and B. Schölkopf (2008). Injective Hilbert Space Embeddings of Probability Measures. In *Proceedings of the 21st Annual Conference on Learning Theory*, 111–122, Helsinki, Finland. (Accepted: 44/126, 35%)

28. Sriperumbudur, B. K., O. A. Lang and G. R. G. Lanckriet (2008). Metric Embedding for Kernel Classification Rules. In *Proceedings of the 25th International Conference on Machine Learning*, 1008-1015, Helsinki, Finland. (Accepted: 158/583, 27%)

29. Sriperumbudur, B. K., D. A. Torres and G. R.G. Lanckriet (2007). Sparse Eigen Methods by D.C. Programming. In *Proceedings of the 24th International Conference on Machine Learning*, 831–838, Corvallis, Oregon, USA. (Accepted: 152/522, 29%)

30. Bharath Kumar, S. V., S. Umesh and R. Sinha (2006). Study of Non-Linear Frequency Warping Functions for Speaker Normalization. In *Proceedings of the 2006 IEEE International Conference on Acoustics, Speech and Signal Processing*, I, 14–17, Toulouse, France.

31. Gopalakrishnan, G., S. V. Bharath Kumar, R. Mullick, A. Narayanan and S. Suryanarayanan (2006). A Framework for Parameter Optimization in Mutual Information (MI)-based Registration Algorithms. In *Proceedings of the 2006 SPIE Medical Imaging*, 6144, 880–887, San Diego, California, USA.

32. Bharath Kumar, S. V., R. Mullick and U. Patil (2005). Textural Content in 3T MR: An Image-Based Marker for Alzheimer's Disease. In *Proceedings of the 2005 SPIE Medical Imaging*, 5747, 1366–1376, San Diego, California, USA.

33. Bharath Kumar, S. V. and S. Umesh (2004). Non-Uniform Speaker Normalization Using Frequency-Dependent Scaling Function. In *Proceedings of the 2004 International Conference on Signal Processing and Communications*, 305–309, Bangalore, India.

34. Bharath Kumar, S. V. and S. Ramaswamy (2004). A Texture Analysis Approach for Automatic Flaw Detection in Pipelines. In *Proceedings of the 2004 International Conference on Signal Processing and Communications*, 320–323, Bangalore, India.

35. Bharath Kumar, S. V., S. Mukhopadhyay and V. Nandedkar (2004). A Novel Progressive Thick Slab Paradigm for Volumetric Medical Image Compression. In *Proceedings of the 2004 IEEE International Conference on Image Processing*, 3, 1899–1902, Singapore.

36. Bharath Kumar, S. V., S. Umesh and R. Sinha (2004). Non-Uniform Speaker Normalization Using Affine Transformation. In *Proceedings of 2004 IEEE International Conference on Acoustics, Speech and Signal Processing*, I, 121–124, Montréal, Canada.

37. Umesh, S., R. Sinha and S. V. Bharath Kumar (2004). An Investigation into Front-end Signal Processing for Speaker Normalization. In *Proceedings of the 2004 IEEE International Conference on Acoustics, Speech and Signal Processing*, I, 345–348, Montréal, Canada.

38. Bharath Kumar, S. V., N. Nagaraj, S. Mukhopadhyay and X. Xu (2003). Block-Based Conditional Entropy Coding for Medical Image Compression. In *Proceedings of the 2003 SPIE Medical Imaging*, 5033, 375–381, San Diego, California.

39. Umesh, S., S. V. Bharath Kumar, M. K. Vinay, R. Sharma and R. Sinha (2002). A Simple Approach to Non-Uniform Vowel Normalization. In *Proceedings of the 2002 IEEE International Conference on Acoustics, Speech and Signal Processing*, I, 517–520, Orlando, Florida, USA.

Invited & Contributed Talks

Spectral Regularized Kernel Two-Sample Tests

Session on Statistical Learning and Inference Using Kernel, Distance, and Rank, ICSA Applied Statistics Symposium, Michigan, June 13, 2023

Department of Mathematics, State University of New York, Albany, April 3, 2023

Session on Advances in Statistical Learning Theory, IISA Conference, Bengaluru, India, December 27, 2022

Workshop on Measure-theoretic Approaches and Optimal Transportation in Statistics, November 24, 2022

Regularized Stein Variational Gradient Flow

MaD Seminar, New York University, November 17, 2022

Kernel Measures of Dependence and Conditional Dependence

The 34th New England Statistics Symposium, Providence, RI, October 2, 2021

Robust Persistence Diagrams Using Reproducing Kernels

Fourth International Conference on Econometrics and Statistics, June 25, 2021

SIAM Conference on Computational Science and Engineering, March 4, 2021

Johnson & Lindenstrauss Meet Hilbert at a Kernel

International Conference on Analysis, Inverse Problems and Applications, July 18, 2022

Fifth International Conference on Econometrics and Statistics, June 5, 2022

IBM T. J. Watson Research Center, New York, July 15, 2021

52émes Journées de Statisque de la Société Française de Statistique, Semi-Plenary Session, June 8, 2021

Statistics Seminar, CREST-CMAP, University of Paris-Saclay, April 19, 2021

Gain with No Pain: Efficient Kernel PCA by Nyström Sampling

Third International Conference on Econometrics and Statistics, Taichung, June 25, 2019

Approximation Theory 16, Nashville, TN, May 20, 2019

The 33rd New England Statistics Symposium, Hartford, CT, May 17, 2019

Distribution Regression: Computational vs. Statistical Trade-off

Department of Mathematics, Pennsylvania State University, University Park, September 30, 2019

Third International Conference on Mathematics of Data Science, Hong Kong, June 21, 2019

Inverse Problems and Machine Learning Workshop, University of Montréal, May 29, 2019

Rao Prize Conference, Pennsylvania State University, May 6, 2019

Functional Inference and Machine Intelligence Workshop, The Institute of Statistical Mathematics, Tokyo, March 28, 2019

Minimax Estimation of Quadratic Fourier Functionals

Data, Learning and Inference (DALI) Workshop, George, January 5, 2019

Measures of (In)dependence Using Positive Definite Kernels

Theoretical Statistics and Mathematics Unit, Indian Statistical Institute, Bangalore, August 24, 2018

Recent Developments in Dependence Metrics and their Applications, 4th ISNPS Conference, June 13, 2018

Approximate Kernel PCA: Computational vs. Statistical Trade-off

Department of Mathematics, Indian Institute of Technology, New Delhi, July 28, 2022

Department of Mathematics, State University of New York, Albany, October 12, 2020

Stochastic Seminar, Department of Mathematics, Georgia Tech, October 8, 2020

Department of Statistics, University of Georgia, September 24, 2020

International Conference on Statistical Distributions and Applications, Grand Rapids, MI, October 12, 2019

Department of Industrial and Manufacturing Engineering, Pennsylvania State University, University Park, October 10, 2019

Department of Statistics, University of Kentucky, Lexington, September 20, 2019

Microsoft Research, Bangalore, August 30, 2018

Department of Computer Science and Automation, Indian Institute of Science, Bangalore, August 21, 2018

IBM India Research Lab, Bangalore, August 14, 2018

9th International Purdue Syposium on Statistics, June 8, 2018

50émes Journées de Statisque, Semi-Plenary Session, Paris-Saclay, May 29, 2018

Functional Inference and Machine Intelligence Workshop, The Institute of Statistical Mathematics, Tokyo, February 20, 2018

Inverse Problems and Machine Learning Workshop, Caltech, February 11, 2018

Statistical Consistency of Kernel PCA with Random Features

Session on Nonparametrics, 55th Annual Allerton Conference on Communication, Control and Computing, October 6, 2017

Center for Applied Mathematics, École Polytechnique, July 6, 2017

Department of Mathematics, University of Stuttgart, June 29, 2017

Shrinkage Estimation in Reproducing Kernel Hilbert Spaces

BLISS Seminar, Department of EECS, University of California, Berkeley, November 15, 2017

Center for Applied Mathematics, École Polytechnique, July 4, 2017

Machine Learning Seminar, Carnegie Mellon University, February 7, 2017

Random Fourier Features and Beyond

New Directions for Learning with Kernels and Gaussian Processes, Dagstuhl Seminar 16481, December 1, 2016

On the Kernel Choice in RKHS-based Two Sample Tests

Third Conference of International Society for Nonparametric Statistics, Avignon, June 12, 2016

Minimax Estimation of Kernel Mean Embeddings

Gatsby Unit, University College London, May 4, 2016

Department of Statistics, University of Oxford, May 3, 2016

Density Estimation in Infinite Dimensional Exponential Families

Department of Statistics, George Mason University, March 23, 2018

Flexible Modeling Workshop, The 10th ICSA International Conference, December 22, 2016

Department of Statistics, London School of Economics & Political Science, April 29, 2016

Department of Mathematics, University of Delaware, April 6, 2016

Department of Operations Research and Financial Engineering, Princeton University, April 4, 2016

Department of Statistics, Pennsylvania State University, September 18, 2015

Department of Statistics, University of Wisconsin-Madison, April 29, 2015

Data, Learning and Inference (DALI) Workshop, La Palma, April 12, 2015

Modern Non-parametrics Workshop, NIPS 2014, December 13, 2014

Department of Statistical Science, University College London, June 19, 2014

Department of Engineering, University of Cambridge, May 14, 2014

Department of Statistics, University of Oxford, May 9, 2014

Department of Statistics, Columbia University, May 2, 2014

Sixth International Conference of the ERCIM WG on Computational and Methodological Statistics (ERCIM 2013), December 14, 2013

Max Planck Institute for Intelligent Systems, October 9, 2013

Kernel Mean Shrinkage Estimators

Department of Statistics, University of Wisconsin-Madison, April 29, 2015

RKHS Induced Infinite Dimensional Exponential Families: Density Estimation and Beyond

Weierstrass Institute for Applied Analysis and Stochastics, July 10, 2013

Mixture Sieve Density Estimation and Hilbert Space Embedding of Measures

School of Computing, National University of Singapore, October 31, 2011

National ICT Australia, Canberra, October 27, 2011

Faculty of Mathematical Sciences, Queensland University of Technology, Brisbane, Australia, October 20, 2011

Hilbert Space Embeddings and Metrics on Probability Measures

Statistische Woche 2013 (German Statistical Week), Freie Universität Berlin, September 20, 2013

School of Engineering, Computing and Mathematics, University of Exeter, December 10, 2012

Eighth World Congress in Probability and Statistics, Istanbul, Turkey, July 9, 2012

Department of Pure Mathematics and Mathematical Statistics, University of Cambridge, UK, March 9, 2012

Department of Computer Science and Engineering, Pennsylvania State University, State College, February 24, 2012

Department of Statistics, Pennsylvania State University, State College, February 23, 2012

Department of Mathematics, London School of Economics and Political Science, UK, February 9, 2012

Toyota Technological Institute, Chicago, Illinois, March 3, 2011

Department of Statistics, University of Warwick, Coventry, UK, February 25, 2011

Gatsby Computational Neuroscience Unit, University College London, June 8, 2010

Machine Learning Group, University of Tokyo, Japan, November 18, 2009

Workshop on Machine Learning Methods in Statistical Science, The Institute of Statistical Mathematics, Tokyo, October 23, 2009

Department of Electrical Communication Engineering, Indian Institute of Science, Bangalore, India, December 16, 2008

Non-Parametric Estimation of Integral Probability Metrics

IEEE International Symposium on Information Theory, Austin, Texas, June 15, 2010

On the Relation Between Universality, Characteristic Kernels and RKHS Embedding of Measures

Thirteenth International Conference on Artificial Intelligence and Statistics, Sardinia, Italy, May 15, 2010

On the Convergence of the Concave-Convex Procedure

Workshop on Optimization for Machine Learning, Whistler, Canada, December 12, 2009

Kernel Choice and Classifiability for RKHS Embeddings of Probability Distributions

Twenty-Third Annual Conference on Neural Information Processing Systems, Vancouver, Canada, December 9, 2009

The Sparse Eigenvalue Problem

Department of Computer Science and Automation, Indian Institute of Science, Bangalore, India, December 10, 2008

Injective Hilbert Space Embeddings of Probability Measures

Twenty-First Annual Conference on Learning Theory, Helsinki, Finland, July 10, 2008

Max Planck Institute for Biological Cybernetics, Tübingen, Germany, July 1, 2008

Metric Embedding for Kernel Classification Rules

Twenty-Fifth International Conference on Machine Learning, Helsinki, Finland, July 8, 2008

Finding Musically Meaningful Words Using Sparse CCA

Music, Brain and Cognition Workshop, Whistler, Canada, December 7, 2007

Sparse Eigen Methods by D.C. Programming

Max Planck Institute for Biological Cybernetics, Tübingen, Germany, July 11, 2007

Twenty-Fourth International Conference on Machine Learning, Corvallis, Oregon, June 23, 2007

Conference/Workshop/Session Organization

Organizer, Invited Session on *Recent Advances in Machine Learning* at EcoSta Conference, Kyoto, Japan, June 2022

Organizer, Invited Session on *Approximation, Learning and Inference with Positive-Definite Kernels* at ISNPS Conference, Salerno, Italy, June 2018

Co-organizer, NIPS Workshop on *Learning on Distributions, Functions, Graphs and Groups*, Long Beach, California, USA, December 8, 2017

Co-organizer, NIPS Workshop on *Adaptive and Scalable Nonparametric Methods in Machine Learning*, Barcelona, Spain, December 10, 2016

Co-organizer, ICML Workshop on *RKHS and Kernel-based Methods: Theoretical Topics and Recent Advances*, Edinburgh, UK, July 1, 2012

Grants

Reproducing Kernel Hilbert Space Embedding of Measures: Theory and Applications to Statistical Learning. NSF DMS 1713011. 2017-2020

Statistical Learning, Inference and Approximation with Reproducing Kernels. NSF DMS CAREER 1945396. 2020-2025

Professional Activities

Action Editor, Journal of Machine Learning Research (2021–present)

Associate Editor, Mathematical Foundations of Computing (2020–present)

Editorial Board, Journal of Machine Learning Research (2015–2021)

Scientific Committee, Workshop on Lifting Inference with Kernel Embeddings (2022, 2023)

Senior Program Committee Member, International Conference on Machine Learning (2018)

Senior Program Committee Member, Neural Information Processing Systems (2013, 2015, 2016, 2017, 2018, 2019)

Senior Program Committee Member, Artificial Intelligence and Statistics (2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023)

Senior Program Committee Member, Conference on Learning Theory (2021, 2022, 2023)

Senior Program Committee Member, Algorithmic Learning Theory (2020)

Journal Reviewing: Annals of Statistics, Annals of the Institute of Statistical Mathematics, Analysis Mathematica, Applied and Computational Harmonic Analysis, Bernoulli, Biometrika, Electronic Journal of Statistics, Foundations of Computational Mathematics, IEEE Transactions on Information Theory, IEEE Transactions on Pattern Recognition and Machine Intelligence, Memoirs of the American Mathematical Society, IEEE Transactions on Signal Processing, Journal of Machine Learning Research, Journal of Royal Statistical Society (Series B), Machine Learning, Neural Computation, Scandinavian Journal of Statistics, Signal Processing Magazine, Statistics and Computing, Statistical Science

Conference Reviewing: International Conference on Machine Learning (ICML), International Conference on Artificial Intelligence and Statistics (AISTATS), Advances in Neural Information Processing Systems (NIPS), Conference on Learning Theory (COLT), International Symposium on Information Theory (ISIT), International Conference on Acoustics, Speech and Signal Processing (ICASSP), International Joint Conference on Artificial Intelligence (IJCAI)

NSF DMS Statistics Panelist (2019, 2021)

Teaching

Instructor, Research School: Statistical and Geometric Divergences for Machine Learning, University of Rennes 2, Rennes 06/2022
Kernel Based Distances and Applications in Statistics and Machine Learning

Instructor, Data Science Summer School, École Polytechnique, Paris 06/2019
Learning with Positive Definite Kernels: Theory and Applications

Instructor, Machine Learning Summer School, MPI for Intelligent Systems, Tübingen 06/2017
Introduction to Kernel Methods

Instructor, Pennsylvania State University
STAT 508 *Applied Data Mining* 01–05/2023
STAT 597 *Nonparametric Methods and Learning Theory* 08-12/2022
STAT 515 *Stochastic Processes and Monte-Carlo Methods* 01-05/2022
STAT 508 *Applied Data Mining* 01-05/2022
MATH/STAT 415 *Mathematical Statistics* 08–12/2021
STAT 515 *Stochastic Processes and Monte-Carlo Methods* 01-05/2021
MATH/STAT 415 *Mathematical Statistics* 01–05/2021
STAT 597 *Nonparametric Methods and Learning Theory* 08–12/2020
STAT 515 *Stochastic Processes and Monte-Carlo Methods* 01-05/2020
MATH/STAT 415 *Mathematical Statistics* 08–12/2019
STAT 514 *Theory of Statistics II* 08–12/2019
STAT 515 *Stochastic Processes and Monte-Carlo Methods* 01-05/2019
MATH/STAT 415 *Mathematical Statistics* (2 sections) 01–05/2019
STAT 597 *Nonparametric Methods and Learning Theory* 01–05/2018
MATH/STAT 415 *Mathematical Statistics* 01–05/2018
STAT 514 *Theory of Statistics II* 08–12/2017
STAT 514 *Theory of Statistics II* 08–12/2016
MATH/STAT 415 *Mathematical Statistics* (2 sections) 08–12/2016
STAT 514 *Theory of Statistics II* 08–12/2015
MATH/STAT 415 *Mathematical Statistics* 08–12/2015
MATH/STAT 415 *Mathematical Statistics* 01–05/2015
STAT 401 *Experimental Methods* 01–05/2015

Supervisor (King's College), University of Cambridge 01–06/2013
1B *Statistics*

Lecturer, University of Cambridge 01–03/2013
IIC *Statistical Modelling*

Co-Instructor, University College London 01–04/2012
COMPGI13 *Advanced Topics in Machine Learning*
Adaptive Modelling of Complex Data

Teaching Assistant, University of California San Diego 04–06/2010
ECE 273 *Convex Optimization and Applications*

Instructor, Edison Engineer Development Program, General Electric Global Research 2004-2005
Signals & Systems

Teaching Assistant, Indian Institute of Technology Kanpur
EE 380 *Electrical Engineering Lab* 08–12/2001
EE 370 *Digital Electronics and Microprocessor Technology* 01–05/2001

Advising

Postdoctoral Mentor:

Sakshi Arya (08/2021–07/2023) [*Tenure-Track Assistant Professor, Department of Mathematics, Applied Mathematics, and Statistics, Case Western Reserve University*]

PhD Thesis Advisor:

Nicholas Sterge (08/2016–10/2021) [*Flow Traders, New York*]

Siddharth Viswanath (08/2018–06/2023) [*SEW Visiting Assistant Professor, Department of Mathematics, UC San Diego*]

Sowmya Mukherjee (06/2022–present)

Aratrika Mustafi (06/2022–present)

PhD Thesis Co-advisor:

Omar Hagrass (08/2019–present)

Nikolas Siapoutis (08/2018–05/2022) [*Teaching Assistant Professor, Department of Statistics, University of Pittsburgh*]

Tianhong Sheng (08/2018–07/2022) [*Data Scientist, Pinterest, San Francisco*]

MS Thesis Advisor:

Benjamin Straub (08/2017–05/2018) [*Principal Programmer, GSK, Philadelphia*]

Aniruddha Rajendra Rao (08/2017–06/2019) [*Machine Learning Researcher, Hitachi America, Santa Clara*],

Nikolas Siapoutis (08/2018–06/2019) [*Teaching Assistant Professor, Department of Statistics, University of Pittsburgh*]

PhD Academic Advisor:

Jordan Awan, Aniruddha Rajendra Rao, Roopali Singh and Alex Zhao, Department of Statistics, Pennsylvania State University 08/2016–05/2018

Undergraduate Honor's Thesis Advisor:

Zhenyuan Yuan (12/2016–05/2018) [*PhD Candidate, Department of EECS, Pennsylvania State University*]

PhD Committees

Chair

Elena Hadjicosta, Department of Statistics, Pennsylvania State University 2017–19

Member

Chaegeun Song, Department of Statistics, Pennsylvania State University 07/2023–present
Yin Tang, Department of Statistics, Pennsylvania State University 04/2023–present
Anping Pan, Department of Mathematics, Pennsylvania State University 03/2023–present
Wilson Peoples, Department of Mathematics, Pennsylvania State University 01/2022–present
Bokgyeong Kang, Deparment of Statistics, Pennsylvania State University 2021–23
Seong-ho Lee, Deparment of Statistics, Pennsylvania State University 2021–23
Mihir Mehta, Deparment of Industrical Engineering, Pennsylvania State University 2021–23
Huy Dang, Deparment of Statistics, Pennsylvania State University 2021–23
Jeremy Seeman, Deparment of Statistics, Pennsylvania State University 2021–23
Stephen White, Deparment of Mathematics, Pennsylvania State University 2021–23
Harris Quach, Deparment of Statistics, Pennsylvania State University 2021–22
Ilias Moysidis, Deparment of Statistics, Pennsylvania State University 2019–21
Faheem Gilani, Department of Mathematics, Pennsylvania State University 2019–21

Zhanrui Cai, Department of Statistics, Pennsylvania State University 2019–21
Peng Cheng, Department of Industrial and Manufacturing Engineering, Pennsylvania State University 2018–20
Jordan Awan, Department of Statistics, Pennsylvania State University 2018–20
Kyongwon Kim, Department of Statistics, Pennsylvania State University 2018–20
Patrick Godwin, Department of Physics, Pennsylvania State University 2017–20
Cheng-Bang Chen, Department of Industrial and Manufacturing Engineering, Pennsylvania State University 2017–19
Sanghack Lee, Information Sciences and Technology, Pennsylvania State University 2016–18
Junli Lin, Department of Statistics, Pennsylvania State University 2017
Hyunphil Choi, Department of Statistics, Pennsylvania State University 2016–17
Zachary Jones, Department of Political Science, Pennsylvania State University 2016–17
Adrian Maler, Department of Mathematics, Pennsylvania State University 2015

External Examiner

Wojciech Reise, Université Paris-Saclay and INRIA, France 06/2023–present
Luc Brogat-Motte, Télécom Paris, Institut Polytechnique de Paris, France 2023
Tamim El Ahmad, LTCI, Télécom Paris, Institut Polytechnique de Paris, France 12/2022–present
Ülker Okur, Department of Mathematics, University of Stuttgart, Germany 11/2016–present
Shashank Singh, Machine Learning Department, Carnegie Mellon University, USA 2018–19
Damien Garreau, École Normale Supérieure, France 2017
Aurélien Guetsop Nangue, Department of Statistics, University of Montréal, Canada 2016
K. Balasubramanian, Department of Electronics and Communication Engineering, Amrita School of Engineering, India 2016

Department/University Activities

Chair, Graduate Admissions Committee, Pennsylvania State University 2022–present
Chair, Graduate Curriculum Committee, Pennsylvania State University 2021–present
Member, Data Science Working Group, Pennsylvania State University 2021–present
Member, Eberly Fellow Hiring Committee, Pennsylvania State University 2021
Sub-committee Chair, Strategic Planning Committee, Pennsylvania State University 2020–21
Chair, Ph.D. Qualifying Exam Committee, Pennsylvania State University 2020–21
Member, Graduate Admission Committee, Pennsylvania State University 2019–22
Committee Member, 2019 Rao Prize Conference, Pennsylvania State University 2018–19
Member, Faculty Hiring Committee, Pennsylvania State University 2018–19
Committee Member, 2018 Chemerda Lecture, Pennsylvania State University 2017–18
Committee Member, 2017 Marker Lecture, Pennsylvania State University 2017
Committee Member, 2017 Rao Prize Conference, Pennsylvania State University 2017
Interviewer, Millenium Scholars Program, Pennsylvania State University 2017
Committee Member, 2017 Clifford Clogg Lecture, Pennsylvania State University 2017
Committee Member, 2016 Clifford Clogg Lecture, Pennsylvania State University 2016
Committee Member, 2016 Marker Lecture, Pennsylvania State University 2016
Co-organizer, Statistics Colloquium, Pennsylvania State University 2015–16
Member, Ph.D. Qualifying Exam Committee, Pennsylvania State University 2014–15