Karthik Sridharan

Contact Information

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Research Interests

Machine Learning, Statistical Learning Theory, Online Learning and Decision Making, Optimization, Empirical Process Theory, Concentration Inequalities, Game Theory

Education

Ph.D., Computer Science, Sep 2006 - Oct 2011

- Institute : Toyota Technological Institute at Chicago
- Advisor: Nathan Srebro
- Area of Study: Theoretical Machine Learning

M.S., Computer Science, Aug 2004 - Jun 2006

- Institute : University at Buffalo, State University of New York
- Advisor: Venu Govindaraju
- Area of Study: Biomtrics/Applied Machine Learning

B.E., Computer Science and Engineering, Aug 2000 - Jun 2004

- Institute : M.S. Ramaiah Institute of Technology, Bangalore, India

Work Experience

Associate Professor, **(2020-current)**

- Department : Computer Science
- Institute : Cornell University

Assistant Professor, **(2014-2019)**

- Department : Computer Science
- Institute : Cornell University

Postdoctoral Research Scholar, (Nov 2011 to 2014)

- Institute : Department of Statistics, University of Pennsylvania
- Supervisor : Prof. Alexander Rakhlin , co-supervisor : Prof. Michael Kearns

Internship, Summer'09

- Institute : Microsoft Research, Redmond
- Mentor : Ofer Dekel
- Projects : Robust selective sampling from single and multiple teachers

Research Assistant, Sep 2004 - Jun 2006

- Institute : Center for Unified Biometrics and Sensors, SUNY Buffalo
- Mentor : Venu Govindaraju
- Projects : Semantic Face Retrieval, Facial Expression Recognition and Analysis

Grants, Fellowships, Awards

Student Best Paper Award - Conference on Learning Theory (COLT), 2019

Best Paper Award - Algorithmic Learning Theory (ALT), 2019

Student Best Paper Award - Conference on Learning Theory (COLT), 2018

Linkedin Research Award- 2022

Alfred P. Sloan Research Fellow in Computer Science, 2018

NSF CAREER Award, CAREER: New Paradigms for Online Machine Learning, Award Number:1750575, Robust Intelligence, March 2018.

Simons-Berkeley Research Fellowship, long-term visitor, Foundations of ML, Spring'16

NSF (DMS-1521529) Collaborative Research: Novel Computational and Statistical Approaches to Prediction and Estimation (co-PI with A. Rakhlin), CDS&E-MSS, Start: Aug, 2015

Best Paper Award - Conference on Learning Theory (COLT), 2011

Best Paper Award - Conference on Learning Theory (COLT), 2010

Best Paper Award (Second Prize) - IEEE Automatic Identification Advanced Technologies (AutoID), 2005

Graduate Students

Past Students:

- Dylan J. Foster, PhD, Fall 2018. Currently Senior Researcher at Microsoft Research New England/NY
- Chuan Guo, PhD, Co-advised by Kilian Weinberger. Currently Researcher at Meta AI (FAIR)
- Ayush Sekhari, PhD, Co-advised by Robert Kleinberg. Currently postdoc at MIT

Current Students:

- August Chen, PhD (optimization, sampling and generative AI)
- Linda Lu, PhD (machine unlearning)
- Wilson Yoo, PhD (safety in ML)

Teaching Experience

Spring 2024, Spring 2025

- Course : Introduction to Machine Learning (CS 3780/5780)
- Institution : Cornell University

Spring 2022, Fall 2023

- Course : Mathematical Foundations of Machine Learning (CS 4783/5783)
- Institution : Cornell University

Fall 2014, 2015, Spring 2018, Fall 2018, Fall 2019, Fall 2021, Fall 2022, Fall 2024

- Course : Machine Learning Theory (CS 6783)
- Institution : Cornell University

Spring 2015, 2016, Fall 2016, 2017, Spring 2019, 2020

- Course : Machine Learning for Data Sciences (CS 4786/5786)
- Institution : Cornell University

Spring 2012, 2014 (Co-Taught with Prof. Alexander Rakhlin)

- Course : Statistical Learning Theory and Sequential Prediction
- Institution : University of Pennsylvania

Teaching Assistant, Winter 2011

- Course : Computational and Statistical Learning Theory
- Instructor : Nathan Srebro
- Institute : TTIC/ University of Chicago

Teaching Assistant, Spring 2010

- Course : Convex Optimization
- Instructor : Nathan Srebro
- Institute : TTIC/ University of Chicago

Publications (other than publications marked by * all others are listed by alphabetical order)

Conferences :

1. **Selective Sampling and Imitation Learning via Online Regression** Ayush Sekhari, Karthik Sridharan, Wen Sun, and Runzhe Wu Neural Information Processing Systems (NeurIPS), 2023

2. **Contextual Bandits and Imitation Learning via Preference-Based Active Queries** Ayush Sekhari, Karthik Sridharan, Wen Sun, and Runzhe Wu Neural Information Processing Systems (NeurIPS), 2023

3. **From Gradient Flow on Population Loss to Learning with Stochastic Gradient Descent** Chris De Sa, Satyen Kale, Jason D. Lee, Ayush Sekhari, Karthik Sridharan Neural Information Processing Systems (NeurIPS), 2022

4. **On the Complexity of Adversarial Decision Making** Dylan J. Foster, Alexander Rakhlin, Ayush Sekhari, Karthik Sridharan Neural Information Processing Systems (NeurIPS), 2022
   (Oral)

5. **Guarantees for Epsilon-Greedy Reinforcement Learning with Function Approximation** Christoph Dann, Yishay Mansour, Mehryar Mohri, Ayush Sekhari, Karthik Sridharan International Conference on Machine Learning (ICML 2022) . Short version at RLDM 2022 - Reinforcement Learning and Decision Making conference.

6. **SGD: The role of Implicit Regularization, Batch-size and Multiple Epochs** Satyen Kale, Ayush Sekhari, Karthik Sridharan Neural Information Processing Systems (NeurIPS), 2021

7. **Agnostic Reinforcement Learning with Low-Rank MDPs and Rich Observations** Christoph Dann, Yishay Mansour, Mehryar Mohri, Ayush Sekhari, Karthik Sridharan Neural Information Processing Systems (NeurIPS), 2021

8. **Online learning with dynamics: A minimax perspective** Kush Bhatia, Karthik Sridharan Neural Information Processing Systems (NeurIPS), 2020

9. **Reinforcement Learning with Feedback Graphs** Christoph Dann, Yishay Mansour, Mehryar Mohri, Ayush Sekhari, Karthik Sridharan NeurIPS 2020. Short version at ICML 2020 Theoretical Foundations of RL workshop.

10. **Second-Order Information in Non-Convex Stochastic Optimization: Power and Limitations** Yossi Arjevani, Yair Carmon, John C Duchi, Dylan J Foster, Ayush Sekhari, Karthik Sridharan COLT 2020.

11. **Hypothesis Set Stability and Generalization** Dylan J. Foster, Spencer Greenberg, Satyen Kale, Haipeng Luo, Mehryar Mohri, Karthik Sridharan Neural Information Processing System (NeurIPS 2019)

12. **The Complexity of Making the Gradient Small in Stochastic Convex Optimization** Dylan J. Foster, Ayush Sekhari, Ohad Shamir, Nathan Srebro, Karthik Sridharan, Blake Woodworth Conference on Learning Theory (COLT 2019) ***(Student Best paper award)***

13. **Distributed Learning with Sublinear Communication** Jayadev Acharya, Christopher De Sa, Dylan J. Foster, Karthik Sridharan International Conference on Machine Learning (ICML 2019) ***(oral*** $\approx 4.5\%$ ***acceptance)***.

14. **Training Well-Generalizing Classifiers for Fairness Metrics and Other Data-Dependent Constraints** Andrew Cotter, Maya Gupta, Heinrich Jiang, Nathan Srebro, Karthik Sridharan, Serena Wang, Blake Woodworth, Seungil You International Conference on Machine Learning (ICML 2019)

15. **Two-Player Games for Efficient Non-Convex Constrained Optimization** Andrew Cotter, Heinrich Jiang and Karthik Sridhara
    Algorithmic Learning Theory (ALT 2019) ***(Best paper award)***

16. **Uniform Convergence of Gradients for Non-Convex Learning and Optimization** Dylan Foster, Ayush Sekhari, Karthik Sridharan
    Neural Information Processing System (NeurIPS 2018)

17. **Online Learning: Sufficient Statistics and the Burkholder Method**
    Dylan Foster, Alexander Rakhlin, Karthik Sridharan
    Conference on Learning Theory (COLT 2018)

18. **Logistic Regression: The Importance of Being Improper**
Dylan Foster, Satyen Kale, Haipeng Luo, Mehryar Mohri, Karthik Sridharan
Conference on Learning Theory (COLT 2018) ***(Student Best paper award)***

19. **Small-loss bounds for online learning with partial information**
Thodoris Lykouris, Karthik Sridharan, Eva Tardos
Conference on Learning Theory (COLT 2018)

20. **Inference in Sparse Graphs with Pairwise Measurements and Side Information**
Dylan Foster, Daniel Reichman, Karthik Sridharan
Artificial Intelligence and Statistics (AISTATS 2018)

21. **Parameter-Free Online Learning via Model Selection**
Dylan Foster, Satyen Kale, Mehryar Mohri, Karthik Sridharan
Neural Information Processing Systems (NIPS 2017) ***(spotlight*** $\approx 4.94\%$ ***acceptance)***

22. **ZIGZAG: A new approach to adaptive online learning**
Dylan Foster, Alexander Rakhlin, Karthik Sridharan
Conference on Learning Theory (COLT 2017)

23. **On Equivalence of Martingale Tail Bounds and Deterministic Regret Inequalities**
Alexander Rakhlin, Karthik Sridharan
Conference on Learning Theory (COLT 2017)

24. **Efficient Multiclass Prediction on Graphs via Surrogate Losses**
Alexander Rakhlin, Karthik Sridharan
Artificial Intelligence and Statistics (AISTATS 2017)

25. **Learning in Games: Robustness of Fast Convergence**
Dylan Foster, Zhiyuan Li, Thodoris Lykouris, Karthik Sridharan, Eva Tardos
Neural Information Processing Systems (NIPS 2016)

26. **Exploiting the Structure: Stochastic Gradient Methods Using Raw Clusters**[*]
Zeyuan Allen-Zhu*, Yang Yuan*, Karthik Sridharan
Neural Information Processing Systems (NIPS 2016) (* - main contributors)

27. **BISTRO: An Efficient Relaxation-Based Method for Contextual Bandits**
Alexander Rakhlin, Karthik Sridharan
International Conference on Machine Learning (ICML 2016)

28. **Differentially Private Causal Inference**
Matt Kusner, Yu Sun, Karthik Sridharan, Kilian Weinberger
Artificial Intelligence and Statistics (AISTATS 2015)

29. **Adaptive Online Learning**
Dylan Foster, Alexander Rakhlin, Karthik Sridharan
Neural Information Processing Systems (NIPS 2015) ***(spotlight*** $\approx 4.46\%$ ***acceptance)***

30. **Hierarchies of Relaxations for Online Prediction Problems with Evolving Constraints**
Alexander Rakhlin, Karthik Sridharan
Conference on Learning Theory (COLT), 2015

31. **Learning with Square Loss: Localization through Offset Rademacher Complexity**
Tengyuan Liang, Alexander Rakhlin, Karthik Sridharan
Conference on Learning Theory (COLT), 2015

32. **Online Optimization : Competing with Dynamic Comparators**
Ali Jadbabaie, Alexander Rakhlin, Shahin Shahrampour, Karthik Sridharan
Artificial Intelligence and Statistics (AISTATS), 2015

33. **Online Non-parametric Regression**
Alexander Rakhlin, Karthik Sridharan
Conference on Learning Theory (COLT), 2014

34. **On Semi-Probabilistic Universal Prediction**
Alexander Rakhlin, Karthik Sridharan
Proceedings of IEEE Information Theory Workshop, 2013. Invited paper

35. **Optimization, Learning, and Games with Predictable Sequences**
Alexander Rakhlin, Karthik Sridharan
Neural Information Processing Systems (NIPS) 2013.

36. **Competing With Strategies**
Wei Han, Alexander Rakhlin, Karthik Sridharan
Conference on Learning Theory (COLT) 2013.

37. **Online Learning With Predictable Sequences**
Alexander Rakhlin, Karthik Sridharan
Conference on Learning Theory (COLT) 2013.

38. **Localization and Adaptation in Online Learning**
Alexander Rakhlin, Ohad Shamir, Karthik Sridharan
Artificial Intelligence and Statistics (AISTATS) 2013.

39. **Relax and Randomize : From Value to Algorithms**
Alexander Rakhlin, Ohad Shamir, Karthik Sridharan
Neural Information Processing Systems (NIPS) 2012 ***(oral*** $\approx 1.36\%$ ***acceptance)***.

40. **Making Stochastic Gradient Descent Optimal for Strongly Convex Problems**
Alexander Rakhlin, Ohad Shamir, Karthik Sridharan
International Conference on Machine Learning (ICML), 2012

41. **Minimizing The Misclassification Error Rate Using a Surrogate Convex Loss**
Shai Ben-David, David Loker, Nathan Srebro, Karthik Sridharan
International Conference on Machine Learning (ICML), 2012

42. **On the Universality of Online Mirror Descent**
Nathan Srebro, Karthik Sridharan, Ambuj Tewari
Neural Information Processing Systems (NIPS), 2011

43. **Better Mini-Batch Algorithms via Accelerated Gradient Methods**
Andrew Cotter, Ohad Shamir , Nathan Srebro, Karthik Sridharan
Neural Information Processing Systems (NIPS), 2011

44. **Online Learning: Stochastic and Constrained Adversaries**
Alexander Rakhlin, Karthik Sridharan, Ambuj Tewari
Neural Information Processing Systems (NIPS), 2011

45. **Online Learning: Beyond Regret**
Alexander Rakhlin, Karthik Sridharan, Ambuj Tewari
Conference on Learning Theory (COLT) 2011 ***(Best paper award)***.

46. **Complexity-based Approach to Calibration with Checking Rules**
Dean Foster, Alexander Rakhlin, Karthik Sridharan, Ambuj Tewari
Conference on Learning Theory (COLT) 2011.

47. **Online Learning: Random Averages, Combinatorial Parameters and Learnability**
Alexander Rakhlin, Karthik Sridharan, Ambuj Tewari
Neural Information Processing Systems (NIPS) 2010 ***(oral*** $\approx 1.64\%$ ***acceptance)***.

48. **Smoothness, Low Noise and Fast Rates**
Nathan Srebro, Karthik Sridharan, Ambuj Tewari
Neural Information Processing Systems (NIPS) 2010.

49. **Learning Kernel-Based Halfspaces with the Zero-One Loss**
Shai Shalev-Shwartz, Ohad Shamir, Karthik Sridharan
Conference on Learning Theory (COLT), 2010 ***(Best paper award)***.

50. **Robust Selective Sampling from Single and Multiple Teachers**
Ofer Dekel, Claudio Gentile, Karthik Sridharan
Conference on Learning Theory (COLT), 2010

51. **Convex Games in Banach Spaces**
Karthik Sridharan, Ambuj Tewari
Conference on Learning Theory (COLT), 2010

52. **Learning exponential families in high-dimensions: Strong convexity and sparsity**
Sham Kakade, Ohad Shamir, Karthik Sridharan, Ambuj Tewari
International Conference on Artificial Intelligence and Statistics (AISTATS), 2010

53. **Learnability and Stability in the General Learning Setting**
Shai Shalev-Shwartz, Ohad Shamir, Nathan Srebro, Karthik Sridharan
Conference on Learning Theory (COLT), 2009

54. **Stochastic Convex Optimization**
Shai Shalev-Shwartz, Ohad Shamir, Nathan Srebro, Karthik Sridharan
Conference on Learning Theory (COLT), 2009

55. **The Complexity of Improperly Learning Large Margin Halfspaces**
Shai Shalev-Shwartz, Ohad Shamir, Karthik Sridharan
Open Problems, Conference on Learning Theory (COLT), 2009

56. **Multi-View Clustering via Canonical Correlation Analysis**
Kamalika Chaudhuri, Sham Kakade, Karen Livescue, Karthik Sridharan
International Conference on Machine Learning (ICML), 2009

57. **On the Complexity of Linear Prediction: Risk Bounds, Margin Bounds and Regularization**
Sham Kakade, Karthik Sridharan, Ambuj Tewari
Neural Information Processing Systems (NIPS), 2008

58. **Fast Rates for Regularized Objectives**
Shai Shalev-Shwartz, Nathan Srebro, Karthik Sridharan
Neural Information Processing Systems (NIPS), 2008

59. **Information Theoretic Framework for Multi-view Learning**[*]
Karthik Sridharan, Sham Kakade
Conference on Learning Theory (COLT), 2008

60. **Competitive Mixtures of Simple Neurons**[*]
Karthik Sridharan, Matthew J Beal, Venu Govindaraju
International Conference on Pattern Recognition (ICPR), 2006

61. **Identifying handwritten text in mixed documents**[*]
Faisal Farooq, Karthik Sridharan, Venu Govindaraju
International Conference on Pattern Recognition (ICPR), 2006

62. **Classification of Machine Print and Handwritten Arabic Documents**[*]
Karthik Sridharan, Faisal Farooq, Venu Govindaraju
Symposium on Document Image Understanding Technology (SDIUT), 2005

63. **A Sampling Based Approach to Facial Feature Extraction**[*]
Karthik Sridharan, Venu Govindaraju
IEEE Automatic Identification Advanced Technologies (AUTOID), 2005
(Best paper award, 2nd prize)

64. **A Probabilistic Approach to Semantic Face Retrieval**[*]
Karthik Sridharan, Sankalp Nayak, Sharat Chikkerur, Venu Govindaraju
Audio and Video-based Biometric Person Authentication (AVBPA), 2005

65. **A Dynamic Migration Model for Self-adaptive Genetic Algorithms**[*]
K.G. Srinivasa, Karthik Sridharan, P. D. Shenoy, Venugopal K.R., L.M. Patnaik
International Conference on Intelligent Data Engineering and Automated Learning, 2004

66. **An Effective Content-Based Image Retrieval System Using STI features and Relevance feedback**[*]
K.G. Srinivasa, Karthik Sridharan, P. D. Shenoy, Venugopal K.R., L.M. Patnaik
International Conference on Knowledge Based Computer Systems (KBCS), 2004

67. **EASOM: An Efficient Soft Computing Method for Predicting the Share Values**[*]
K.G. Srinivasa, Karthik Sridharan, P. D. Shenoy, Venugopal K.R., L.M. Patnaik
International Conference on Artificial Intelligence and Applications (AIA), 2004

Journals :

68. Small-loss Bounds for Online Learning with Partial Information
Lykouris, Thodoris, Karthik Sridharan, and Eva Tardos
To appear, Mathematics of Operations Research.

69. Optimization with Non-Differentiable Constraints with Applications to Fairness, Recall, Churn, and Other Goals
Andrew Cotter, Heinrich Jiang, Serena Wang, Taman Narayan, Maya Gupta, Seungil You, Karthik Sridharan
Journal of Machine Learning Research, (to appear) 2019

70. Empirical Entropy, Minimax Regret and Minimax Risk
Alexander Rakhlin, Karthik Sridharan, Alexandre Tsybakov
Bernoulli Journal, Volume 23, Number 2, 789-824.

71. Online Learning via Sequential Complexities
Alexander Rakhlin, Karthik Sridharan, Ambuj Tewari
Journal of Machine Learning Research (JMLR), vol 16, pp. 155–186, 2015

72. Sequential Complexities and Uniform Martingale Laws of Large Numbers
Alexander Rakhlin, Karthik Sridharan, Ambuj Tewari
Probability Theory and Related Fields, 2015, Volume 161, Issue 1-2, pp 111-153.

73. Selective Sampling and Active Learning from Single and Multiple Teachers
Ofer Dekel, Claudio Gentile, Karthik Sridharan
Journal of Machine Learning Research (JMLR), 2012

74. Learning Kernel Based Half-spaces with the 0-1 Loss
Shai Shalev-Shwartz, Ohad Shamir, Karthik Sridharan
SIAM Journal of Computing, 2011

75. Learnability, Stability and Uniform Convergence
Shai Shalev-Shwartz, Ohad Shamir, Nathan Srebro, Karthik Sridharan
Journal of Machine Learning Research (JMLR), 2010.

76. A Neural Network based CBIR System using STI Features and Relevance Feedback*
K.G. Srinivasa, Karthik Sridharan, P. D. Shenoy, Venugopal K.R., L.M. Patnaik
International Journal on Intelligent Data Analysis, Volume 10, Number 2, 2006.

Theses :

77. Learning From an Optimization Viewpoint
Karthik Sridharan, Ph.D. Thesis
Advisor : Nathan Srebro
Committee : David McAllester, Arkadi Nemirovski, Alexander Razborov, Nati Srebro
Toyota Technological Institute, Chicago, 2011

78. Semantic Face Retrieval
Karthik Sridharan, Master's Thesis
Advisor : Venu Govindaraju
Computer Science, SUNY Buffalo, 2006

Books and Book Chapters:

79. Prediction of Sequences
Alexander Rakhlin, Karthik Sridharan
Book, in Preparation.

80. On Martingale Extensions of Vapnik-Chervonenkis Theory with Applications to Online Learning
Alexander Rakhlin, Karthik Sridharan
Chapter 15 in Measures of Complexity, Festschrift in honor of A. Chervonenkis.

Program Chair Algorithmic Learning Theory (ALT) 2018 along with Prof. Mehryar Mohri

Area chair or senior PC

COLT 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022,2023, 2024; ALT 2015, 2018, 2019, 2020, 2021,2022; ICML 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, NeurIPS 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024 IJCAI 2019, AAAI 2018

Refereeing

Conference Refereeing : NIPS, ICML, COLT, AISTATS, ALT, IJCAI, AAAI, STOC, FOCS

Journal Refereeing : Journal of Machine Learning Research, Machine Learning, Pattern Recognition Letters, IEEE Transactions on Information Theory, Mathematical Programming SERIES A and B, Bernoulli Journal, Annals of Statistics, SIAM journal of Optimization, Mathematics of Operations Research

Selected Invited Talks

FIND seminar, ECE Cornell, Fall 2024

Invited Talk, TTICs 20th Anniversary 2023

Keynote speaker for Mathematics in ML mini symposium at CDSE day in University at Buffalo April 2019

Center for Applied Mathematics, Colloquium, Fall, 2018

Information Theory and Applications, 2018

Information Theory and Applications, 2017

Wilks Statistics Seminar, Princeton, 2016

Workshop on Learning From Easy Data, Lorentz Center, Leiden, Amsterdam, 2016

Invited talk in Online Learning session at World Congress in Probability and Statistics, Toronto, 2016

Workshop on Optimization and Statistical Learning, Les Houches, France, 2016

Information Theory and Applications, 2016

Workshop on Online Algorithms and Learning, Lorentz Center, Leiden, Amsterdam, 2015

IMS Program on Stochastic Methods in Game Theory, Singapore, Nov, 2015

"Convexity and Optimization: Theory and Applications", Institute for Mathematics and its Applications, Minnesotta, 2015

Workshop on Optimization and Statistical Learning, Les Houches, France, 2015

Information Theory and Applications, 2015

Mathematics of Machine Learning Program, April-July 2014, Barcelona, Spain, 2014

Information Theory and Applications, 2014

Meeting in Mathematical Statistics, CIRM, Marsille, France, 2014

Cornell Graduate Field Memberships

Computer Science

Statistics

Operations Research and Industrial Engineering

Center for Applied Mathematics

Cornell Services

Faculty Recruitment Commitee CS 2024

PhD Admissions committee member for Computer Science Department in 2015, 2016, 2017 , 2019, 2020, 2022, 2023

Served part-time on Faculty Recruitment committee for Computer Science Department 2018 (jointly with Prof. Weinberger)

PhD Admissions committee member for Center of Applied Maths in 2016

Faculty Recruitment committee for Statistics (DSS) 2019

Fall 2019 Colloquium Committee

Cornell University (CALS) Diversity Hosting Meet and Greet 2019