

## RESEARCH SUMMARY

My research focuses on “**mathematics and computation for data science**” In particular, I design, analyze, and implement algorithms and models for large-scale problems in **machine learning, statistics, data analytics, and scientific computing**. I care about convex optimization, nonlinear programming, statistics, computer science, signal processing, differential geometry, {convex, functional, harmonic, *matrix*, and *numerical*} *analysis*. My work also focuses on distributed and parallel computation, as well as applications in computational science (chemistry, physics), time-series analysis, business data analytics, information retrieval, healthcare, and finance.

## EDUCATION

### Ph.D. in Computer Science

The University of Texas at Austin, Aug. 2007

Title: *Matrix Nearness Problems in Data Mining*. Advisor: I. S. Dhillon

### M.S. in Computer Science

University of Texas at Austin, Aug. 2006

### B. Engg. (Hons.) in Computer Science

Birla Inst. of Tech. & Science, Pilani, India, Jun. 1999

## POSITIONS HELD

**Principal Research Scientist (PI)** at Laboratory for Information & Decision Systems (LIDS), Massachusetts Institute of Technology (MIT); Jan. 2015–

**Visiting Assistant Professor**, Machine Learning Department, School of Computer Science (SCS), Carnegie Mellon University, Pittsburgh; Sep. 2013–May 2014

**Visiting faculty**, EECS, University of California, Berkeley; Jan.–May 2013

**Senior Research Scientist** in Prof. Bernhard Schölkopf’s group  
Max Planck Institute for Intelligent Systems Tübingen, Germany; Jul. 2012–Aug. 2014

**Research Scientist** hosted by Prof. Bernhard Schölkopf  
Max Planck Institute for Intelligent Systems Tübingen, Germany;  
(formerly MPI for Biological Cybernetics). Oct. 2007–Jun. 2012

**Visiting Researcher** hosted by Prof. Jeff Bilmes  
EE Department, University of Washington, Seattle. Jul.–Aug. 2011

**Research Assistant** to Prof. I. S. Dhillon  
Univ. of Texas at Austin, Austin, TX, USA. Jan. 2002–Aug. 2007 (*several times*)

**Research Intern** with Arun Surendran in John Platt’s group  
Microsoft Research, Redmond, WA, USA. May 2005–Aug. 2005.

## HONORS & AWARDS

### SIAM Outstanding Paper Prize, July 2011

For the paper “*The Metric Nearness Problem*,” (with J. Brickell, I. Dhillon, and J. Tropp in *SIMAX* 2008)—**one of three papers amongst all papers published in SIAM journals within 2008–2010.**

(More information at: [http://www.siam.org/prizes/sponsored/outstanding\\_paper.php](http://www.siam.org/prizes/sponsored/outstanding_paper.php))

### Best Paper Runner Up Award, Sep., 2011

European Conference on Machine Learning (ECML 2011), Athens, Greece.

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**Best Student Paper**, Jun. 2007  
(with J. Davis, B. Kulis, P. Jain, and I. S. Dhillon)  
International Conference on Machine Learning (ICML)

**Best of SDM Papers** Apr. 2007  
(with D. Kim and I. S. Dhillon)  
SIAM Data Mining Conference (SDM)

**Householder Symposium Attendance Award**, Jun., 2011  
Award for attending the Householder Symposium XVIII, Tahoe City.

**MIC Postdoc Trainee Award**, Oct. 2009  
IEEE Nuclear Science Symposium, Medical Imaging Conference (NSS / MIC)

**Best poster award**, Jul. 2009  
(with S. Harmeling, M. Hirsch, and B. Schölkopf)  
International Conference on Cosmology and Statistics (COSMOSTATS), Ascona, Switzerland

**Recipient of Microelectronics and Computer Development (MCD) Fellowship**  
Univ. of Texas at Austin, Aug. 2000–Aug. 2004

**Careful reading rewarded** (1998–2001)  
Received  $\geq 7$  checks from Donald Knuth for reporting errors in:  
*The Art of Computer Programming* and *Concrete Mathematics*

## TEACHING EXPERIENCE

**Introduction to Machine Learning** (Spring 2016)  
Course: 6.036, EECS Department, MIT  
(co-teaching with T. Jaakkola and R. Barzilay)

**OPTML++: Optimization for Machine Learning** (Fall 2015)  
Research seminar series, LIDS, EECS, MIT  
(Research seminar run by me, with guest presentations)

**Introduction to Machine Learning** (Spring 2015)  
Course: 6.036, EECS Department, MIT  
(co-taught with T. Jaakkola and R. Barzilay)

**Advanced Optimization and Randomized Methods** (Spring 2014)  
Graduate course, *ML Department, Carnegie Mellon University, Pittsburgh*  
(I created and co-taught this course with Prof. Alex Smola)

**Introduction to Machine Learning** (April 2014)  
*Invited short-course at the EU Regional School, 2014. RWTH Aachen, Germany.*

**Convex optimization; EE 227A** (Spring 2013) (by invitation)  
Graduate course, *EECS Department, University of California, Berkeley.*

**Introduction to large-scale optimization;** (Jan 2013) (by invitation)  
Intensive graduate level course (20 hrs); *University Carlos III of Madrid (Spain)*

**Optimization in Machine Learning.** (April 2011)  
*Invited lecture for CS graduate students at: Universidad Autónoma de Madrid (Spain).*

**Introductory Lectures on Scientific Writing.** (Sep.–Oct. 2009)  
*Three lectures in Scientific Writing, given at Max-Planck Institute, Tübingen, Germany*

**Matrix Factorization and Approximation Problems.** (April 2010)  
*Invited short-course at the EU Regional School, 2010. RWTH Aachen, Germany.*

**Introduction to Logic.** (Univ. of Texas at Austin; Spring 2006)  
*Teaching Assistant for CS313K; Lecturing component: 3 hours per week*

**Elements of Java.** (Univ. of Texas at Austin; Spring 2005, Fall 2003)  
*Teaching Assistant for CS303E; Lecturing component: 3 hours per week*

**Graduate level numerical linear algebra.** (Univ. of Texas at Austin; Fall 2002)

*Teaching Assistant for CS383C*

**Analysis of Programs.** (Univ. of Texas at Austin; Fall 2001)

*Teaching Assistant for CS336*

## GRANTS / FUNDING

- **Elsevier Mathematical Sciences Sponsorship Fund** \$2000 (declined).
- **Lincoln Labs** (PI; \$50,000); Jan 2016–Jun 2016.
- **NSF-Medium** (Co-PI; Big-Data ML; 3 yrs; \$1,200,000); Jan 2015–Aug 2017.  
*CSR: Distributed Inference Algorithms for Machine Learning and Optimization.*
- **Funding for OPT 2013**, 6th Int. Workshop on Optimization for Machine Learning  
Value: GBP 2000 from **MSR, Cambridge**
- **OPT 2012**: €3040 from **PASCAL2**  
**OPT 2011**: €2500 from **PASCAL2**  
**OPT 2010**: €1550 from **PASCAL2**, \$4000 from Microsoft.  
**OPT 2009**, €1000 from **PASCAL2**, \$2500 from **MOSEK**, \$1000 from **Microsoft Research**  
**OPT 2008**, €4855 from **PASCAL2**, Oct. 2008
- **Funding for NUMML 2010**, NIPS Workshop on Numerical Challenges in Machine Learning  
Value: €2500 from **PASCAL2**  
**NUMML 2009**, ICML 2009 Workshop, €4100, Mar. 2009
- **Helped prepare NSF proposal** (PI: Inderjit Dhillon): *Non-Negative Matrix and Tensor Approximations: Algorithms, Software and Applications*, NSF, CCF-0728879, \$250,000, 01/01/08-12/31/10

## PUBLICATIONS

### Notes about the publications

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1. A star (e.g., A. Student\*) signifies a student who received supervision from me on that paper.
  2. Full online list: <http://suvrit.de/research.html>; [Google Scholar](#).
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## Preprints

1. Ke Jiang, **Suvrit Sra**, and Brian Kulis. “Combinatorial Topic Models using Small-Variance Asymptotics”. *arXiv:1604.02027*, 2016
2. Zelda Mariet\* and **Suvrit Sra**. “Kronecker Determinantal Point Processes”. *arXiv:1605.08374*, 2016
3. Sashank Reddi\*, **Suvrit Sra**, Barnabas Poczos, and Alex Smola. “Fast incremental method for smooth nonconvex optimization”. *arXiv:1603.06159*, 2016
4. Sashank Reddi\*, **Suvrit Sra**, Barnabas Poczos, and Alex Smola. “Fast Stochastic Methods for Nonsmooth Nonconvex Optimization”. *arXiv:1605.07147*, 2016
5. **Suvrit Sra**. “Directional Statistics in Machine Learning: a Brief Review”. 2016
6. Hongyi Zhang\*, Sashank Reddi\*, and **Suvrit Sra**. “Fast stochastic optimization on Riemannian manifolds”. *arXiv:1605.06900*, 2016
7. **Suvrit Sra**. “Inequalities under elementary symmetric polynomial dominance”. *arXiv:1509.01618*, Sep. 2015. ▲
8. Anoop Cherian and **Suvrit Sra**. “Riemannian Dictionary Learning and Sparse Coding for Positive Definite Matrices”. *arXiv:1507.02772*, 2015. □

9. Álvaro J. Barbero and **Suvrit Sra**. “Modular proximal optimization with application to total variation regularization”. *arXiv*, Oct. 2013. □

## Books and Monographs

10. Suvrit Sra, Sebastian Nowozin, and Stephen J. Wright, editors. *Optimization for Machine Learning*. MIT Press, Oct. 2011. Our book distills research at the confluence of optimization and machine learning. It includes contributions from leading researchers in both fields; we aim to achieve a cogent summary of the state-of-the-art, while still remaining didactic.

## Journal Articles and Book Chapters

11. Lev Borisov, Patrizio Neff, **Suvrit Sra**, and Christian Thiel. “The sum of squared logarithms inequality in arbitrary dimensions”. *Linear Algebra and its Applications (LAA)*, 2016. ▲
12. Anoop Cherian and **Suvrit Sra**. “Positive Definite Matrices: Data Representation and Applications to Computer Vision”. In *Algorithmic Advances in Riemannian Geometry and Applications*. Springer, 2016. to appear. □
13. **Suvrit Sra**. “Directional Statistics in Machine Learning”. In C. Ley and T. Verdebout, editors, *Modern Directional Statistics*. Chapman and Hall, 2016. *Invited chapter; to appear*. □
14. **Suvrit Sra** and Reshad Hosseini. “Geometric Optimization in Machine Learning”. In *Algorithmic Advances in Riemannian Geometry and Applications*. Springer, 2016. to appear. □
15. **Suvrit Sra**. “On inequalities for normalized Schur functions”. *European J. Combinatorics*, Volume 51:492—494, 2016. ▲
16. **Suvrit Sra**. “On the matrix square root and geometric optimization”. *Electronic Journal on Linear Algebra (ELA)*, 2016. to appear. ▲
17. **Suvrit Sra**. “Positive definite matrices and the S-divergence”. *Proceedings American Mathematical Society (PAMS)*, 2016. ▲
18. Anoop Cherian and **Suvrit Sra**. “Positive Definite Matrices: Data Representation and Applications to Computer Vision”. In M. H. Quang and V. Murino, editors, *Riemannian geometry in machine learning, statistics, optimization, and computer vision*. Springer, December 2015. *Invited chapter; to appear*. □▲
19. **Suvrit Sra** and Reshad Hosseini. “Geometric optimization in machine learning”. In M. H. Quang and V. Murino, editors, *Riemannian geometry in machine learning, statistics, optimization, and computer vision*. Springer, December 2015. *Invited chapter; to appear*. □▲
20. **Suvrit Sra**. “On inequalities for normalized Schur functions”. *European J. Combinatorics*, May 2015. *Accepted*
21. Wolfgang Berndt and **Suvrit Sra**. “Hlawka inequalities for positive definite matrices”. *Linear Algebra and its Applications*, 2015. *Accepted*
22. Minghua Lin and **Suvrit Sra**. “A proof of Thompson’s determinantal inequality”. *Mathematical Notes*, 2015. ▲
23. **Suvrit Sra** and Reshad Hosseini. “Conic geometric optimisation on the manifold of positive definite matrices”. *SIAM J. Optimization (SIOPT)*, 2015
24. **Suvrit Sra**. “Nonconvex proximal splitting: batch and incremental algorithms”. In J.A.K. Suykens, M. Signoretto, and A. Argyriou, editors, *Regularization, Optimization, Kernels, and Support Vector Machines*. Cambridge University Press, March 2014. □
25. Anoop Cherian, **Suvrit Sra**, V. Morellas, and N. Papanikolopoulos. “Efficient nearest neighbors via robust sparse hashing”. *IEEE Transactions Image Processing*, 2014. *Accepted*. □
26. Reshad Hosseini, **Suvrit Sra**, Lucas Theis, and M. Bethge. “Statistical inference with the Elliptical Gamma Distribution”. *Computational Statistics and Data Analysis (CSDA)*, 2014. □

27. **Suvrit Sra**. “Tractable Large-Scale Optimization in Machine Learning”. In L. Bordeaux, Y. Hamadi, P. Kohli, and R. Matesescu, editors, *Advances in Tractability*. Cambridge University Press, December 2013. 29 pages. □
28. Carlos M. Alaíz\*, Francesco Dinuzzo, and **Suvrit Sra**. “Correlation matrix nearness and completion under observation uncertainty”. *IMA Journal of Numerical Analysis*, Oct. 2013. 16 pages. □
29. **Suvrit Sra**. “Explicit eigenvalues of certain scaled trigonometric matrices”. *Linear Algebra and its Applications (LAA)*, 438:173–181, 2013. 9 pages. ▲
30. **Suvrit Sra** and Dmitrii Karp. “The multivariate Watson distribution: Maximum-likelihood estimation and other aspects”. *Journal of Multivariate Analysis (JMVA)*, 114:256–269, 2013. □
31. Anoop Cherian\*, **Suvrit Sra**, A. Banerjee, and N. Papanikolopoulos. “Jensen-Bregman LogDet Divergence with Application to Efficient Similarity Search for Covariance Matrices”. *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, Dec. 2012. 14 pages. □
32. **Suvrit Sra**. “Fast projections onto mixed-norm balls with applications”. *Data Mining and Knowledge Discovery (DMKD)*, 25(2), Nov. 2012. 20 pages. □
33. Dongmin Kim, **Suvrit Sra**, and Inderjit S. Dhillon. “A non-monotonic method for large-scale non-negative least squares”. *Optimization Methods and Software (OMS)*, Dec. 2011. 28 pages. □
34. Mark Schmidt, Dongmin Kim\*, and **Suvrit Sra**. “Projected Newton-type methods in machine learning”. In S. Sra, S. Nowozin, and S. J. Wright, editors, *Optimization for Machine Learning*. MIT Press, Oct. 2011. 25 pages. □
35. Michael Hirsch\*, Stefan Harmeling, **Suvrit Sra**, and Bernhard Schölkopf. “Online Multi-frame Blind Deconvolution with Super-resolution and Saturation Correction”. *Astronomy & Astrophysics (AA)*, Feb. 2011. 11 pages
36. **Suvrit Sra**. “A short note on parameter approximation for von Mises-Fisher distributions: and a fast implementation of  $I_s(x)$ ”. *Computational Statistics*, Jan. 2011. 14 pages. □
37. Dongmin Kim\*, **Suvrit Sra**, and Inderjit S. Dhillon. “Tackling box-constrained convex optimization via a new projected quasi-Newton approach”. *SIAM J. Scientific Computing (SISC)*, 32(6):3548–3563, Dec. 2010. 16 pages. □
38. Arindam Banerjee, Inderjit S. Dhillon, Joydeep Ghosh, and **Suvrit Sra**. *Text Mining: Theory, Applications, and Visualization A. Srivastava and M. Sahami (eds.)*, chapter Text clustering with mixture of von Mises-Fisher distributions. Data Mining & Knowledge Discovery Series. Chapman-Hall / CRC Press, 2009. □
39. Justin Brickell, Inderjit S. Dhillon, **Suvrit Sra**, and Joel A. Tropp. “The Metric Nearness Problem”. *SIAM J. Matrix Analysis and Applications (SIMAX)*, 30(1):375–396, 2008. **SIAM Outstanding Paper Prize, 2011**. (one out of three papers selected from papers across all SIAM Journals in the years 2008–2010). □
40. Dongmin Kim, **Suvrit Sra**, and Inderjit S. Dhillon. “Fast Projection-Based Methods for the Least Squares Nonnegative Matrix Approximation Problem”. *Statistical Analysis and Data Mining*, 1:38–51, 2007. □
41. Arindam Banerjee, Inderjit S. Dhillon, Joydeep Ghosh, and **Suvrit Sra**. “Clustering on the Unit Hypersphere using von Mises-Fisher Distributions”. *J. Mach. Learning Research (JMLR)*, 6:1345–1382, Sep 2005. □

## Refereed Conference Papers

42. Justin Solomon, Gabriel Peyré, Vladimir Kim, and **Suvrit Sra**. “Entropic Metric Alignment for Correspondence Problems”. In *ACM SIGGRAPH*, Jul. 2016
43. Chengtao Li\*, Stefanie Jegelka, and **Suvrit Sra**. “Fast DPP Sampling for Nyström with Application to Kernel Methods”. In *International Conference on Machine Learning (ICML)*, Jun. 2016. □
44. Chengtao Li\*, **Suvrit Sra**, and Stefanie Jegelka. “Gaussian quadrature for matrix inverse forms with applications”. In *International Conference on Machine Learning (ICML)*, Jun. 2016. □

45. Sashank Reddi\*, Ahmed Hefny\*, **Suvrit Sra**, Barnabas Poczos, and Alexander J. Smola. “Stochastic variance reduction for nonconvex optimization”. In *International Conference on Machine Learning (ICML)*, Jun. 2016. □
46. Yu-Xiang Wang\*, Veeranjaneyulu Sadhanala\*, Wei Dai\*, Willie Neiswanger\*, **Suvrit Sra**, and Eric P. Xing. “Parallel and Distributed Block-Coordinate Frank-Wolfe Algorithms”. In *International Conference on Machine Learning (ICML)*, Jun. 2016. □
47. Pourya H. Zadeh\*, Reshad Hosseini, and **Suvrit Sra**. “Geometric Mean Metric Learning”. In *International Conference on Machine Learning (ICML)*, Jun. 2016. □
48. Hongyi Zhang\* and **Suvrit Sra**. “First-order methods for geodesically convex optimization”. In *Conference on Learning Theory (COLT)*, Jun. 2016. □▲
49. Chengtao Li\*, Stefanie Jegelka, and **Suvrit Sra**. “Efficient Sampling for K-Determinantal Point Processes”. In *Artificial Intelligence and Statistics (AISTATS’16)*, May 2016. □
50. Zelda Mariet\* and **Suvrit Sra**. “Diversity Networks”. In *International Conference on Learning Representations (ICLR)*, May 2016. arXiv:1511.0577. □
51. **Suvrit Sra**, Adams W. Yu\*, Mu Li\*, and Alexander Smola. “AdaDelay: Delay Adaptive Distributed Stochastic Optimization”. In *Artificial Intelligence and Statistics (AISTATS’16)*, May 2016. □
52. Reshad Hosseini and **Suvrit Sra**. “Matrix Manifold Optimization for Gaussian Mixtures”. In *Advances in Neural Information Processing Systems (NIPS)*, December 2015. □
53. Sashank Reddi\*, Ahmed Hefny\*, **Suvrit Sra**, Barnabas Poczos, and Alexander Smola. “Asynchronous variance reduced stochastic gradient descent”. In *Advances in Neural Information Processing Systems (NIPS)*, December 2015. □
54. Zelda Mariet\* and **Suvrit Sra**. “Fixed-point algorithms for learning determinantal point processes”. In *International Conf. on Machine Learning (ICML)*, Jun. 2015
55. Reshad Hosseini, **Suvrit Sra**, Lucas Theis, and Matthias Bethge. “Statistical inference with the Elliptical Gamma Distribution”. In *Artificial Intelligence and Statistics (AISTATS)*, 2015
56. Sashank Reddi\*, Ahmed Hefny\*, Carlton Downey\*, Avinava Dubey\*, and **Suvrit Sra**. “Large-scale randomized-coordinate descent methods with non-separable linear constraints”. In *Uncertainty in Artificial Intelligence (UAI)*, 2015
57. Adams W. Yu\*, Wanli Ma\*, Yaoliang Yu, Jaime G. Carbonell, and **Suvrit Sra**. “Efficient Structured Matrix Rank Minimization”. In *Advances in Neural Information Processing Systems (NIPS)*, December 2014. □
58. Samaneh Azadi\* and **Suvrit Sra**. “Towards optimal stochastic alternating direction method of multipliers”. In *Int. Conf. on Mach. Learning (ICML)*, Jun 2014. □
59. Anoop Cherian and **Suvrit Sra**. “Riemannian Sparse Coding of Positive Definite Matrices”. In *European Conf. Computer Vision (ECCV)*, Jun 2014. □
60. David Lopez-Paz\*, **Suvrit Sra**, Alexander J. Smola, Zoubin Ghahramani, and Bernhard Schölkopf. “Randomized nonlinear component analysis”. In *Int. Conf. Machine Learning (ICML)*, Jun 2014. □
61. Matt Wytock, **Suvrit Sra**, and Zico Kolter. “Fast Newton methods for the group fused lasso”. In *Uncertainty in Artificial Intelligence (UAI)*, Jun 2014. □
62. Stefanie Jegelka, Francis Bach, and **Suvrit Sra**. “Reflection methods for user-friendly submodular optimization”. In *Advances in Neural Information Processing Systems (NIPS)*, December 2013. □
63. **Suvrit Sra** and Reshad Hosseini. “Geometric optimization on positive definite matrices with application to elliptically contoured distributions”. In *Advances in Neural Information Processing Systems (NIPS)*, December 2013. □▲
64. **Suvrit Sra**. “A new metric on the manifold of kernel matrices with application to matrix geometric means”. In *Advances in Neural Information Processing Systems (NIPS)*, December 2012. □▲
65. **Suvrit Sra**. “Scalable nonconvex inexact proximal splitting”. In *Advances in Neural Information Processing Systems (NIPS)*, December 2012. □

66. Anoop Cherian\*, **Suvrit Sra**, A. Banerjee, and N. Papanikolopoulos. “Efficient Similarity Search for Covariance Matrices via the Jensen-Bregman LogDet Divergence”. In *International Conference on Computer Vision (ICCV)*, Nov. 2011. □
67. **Suvrit Sra** and Anoop Cherian\*. “Generalized Dictionary Learning for Symmetric Positive Definite Matrices with Application to Nearest Neighbor Retrieval”. In *European Conf. Machine Learning (ECML)*, Sep. 2011. □
68. **Suvrit Sra**. “Fast projections onto  $\ell_{1,q}$ -norm balls for grouped feature selection”. In *European Conf. Machine Learning (ECML)*, Sep. 2011. **Best paper runner up award**. □
69. Álvaro J. Barbero\* and **Suvrit Sra**. “Fast Newton-type Methods for Total-Variation with Applications”. In *Proceedings of the International Conference on Machine Learning (ICML)*, Jun. 2011. □
70. Anoop Cherian\*, **Suvrit Sra**, and Nikos Papanikolopoulos. “Denoising sparse noise via online dictionary learning”. In *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, May 2011. □
71. Michael Hirsch\*, **Suvrit Sra**, Bernhard Schölkopf, and Stefan Harmeling. “Efficient Filter Flow for Space-Variant Multiframe Blind Deconvolution”. In *IEEE Conf. Computer Vision & Pattern Recognition (CVPR)*, Jun. 2010. □
72. Stefan Harmeling, **Suvrit Sra**, Michael Hirsch\*, and Bernhard Schölkopf. “Multiframe Blind Deconvolution, Super-Resolution, and Saturation Correction via Incremental EM”. In *IEEE International Conference on Image Processing (ICIP)*, 2010. □
73. Dongmin Kim\*, **Suvrit Sra**, and Inderjit S. Dhillon. “A scalable trust-region algorithm with application to mixed-norm regression”. In *Int. Conf. Machine Learning (ICML)*, 2010. □
74. **Suvrit Sra**, Dongmin Kim, Inderjit S. Dhillon, and Bernhard Schölkopf. “A new non-monotonic algorithm for PET image reconstruction”. In *IEEE Nuclear Science Symp. / Medical Imaging Conf. (NSS/MIC)*, Oct. 2009. □
75. Stefanie Jegelka, **Suvrit Sra**, and Arindam Banerjee. “Approximation Algorithms for Tensor clustering”. In *Algorithmic Learning Theory (ALT)*, Jun. 2009. also arXiv: cs.DS/0812.0389. □
76. Stefan Harmeling, Michael Hirsch\*, **Suvrit Sra**, and Bernhard Schölkopf. “Online Blind Deconvolution for Astronomy”. In *IEEE Int. Conf. on Computational Photography (ICCP)*, Apr. 2009. □
77. Brian Kulis, **Suvrit Sra**, and Inderjit S. Dhillon. “Convex Perturbations for Scalable Semidefinite Programming”. In D. van Dyk and M. Welling, editors, *Int. Conf. Artificial Intelligence and Statistics (AISTATS)*, volume 5 of *JMLR W & CP*, pages 296–303, Apr. 2009. □
78. **Suvrit Sra**. “Block-Iterative Algorithms for Non-negative Matrix Approximation”. In *IEEE Int. Conf. Data Mining (ICDM)*, pages 1037–1042, Dec. 2008. □
79. Jason V. Davis, Brian Kulis, Prateek Jain, **Suvrit Sra**, and Inderjit S. Dhillon. “Information-theoretic Metric Learning”. In *Int. Conf. Machine Learning (ICML)*, Jun. 2007. **Best Student Paper**. □
80. Dongmin Kim, **Suvrit Sra**, and Inderjit S. Dhillon. “Fast Newton-type Methods for the Least Squares Nonnegative Matrix Approximation Problem”. In *SIAM Int. Conf. Data Mining (SDM)*, Apr. 2007. **Best of SDM papers**. □
81. Arun Surendran and **Suvrit Sra**. “Incremental Aspect Models for Mining Document Streams”. In *Principles and Practice of Knowledge Discovery in Databases (PKDD)*, Sep. 2006. □
82. **Suvrit Sra**. “Efficient Large Scale Linear Programming Support Vector Machines”. In *Euro. Conf. Machine Learning (ECML)*, pages 767–774, Sep. 2006. □
83. **Suvrit Sra** and Joel A. Tropp. “Row-action Methods for Compressed Sensing”. In *Int. Conf. on Acoustics, Speech, and Signal Processing (ICASSP)*. IEEE, May 2006. □
84. Inderjit S. Dhillon and **Suvrit Sra**. “Generalized Nonnegative Matrix Approximations with Bregman Divergences”. In *Advances Neural Information Processing Systems (NIPS)*, Dec. 2005. □
85. Inderjit S. Dhillon, **Suvrit Sra**, and Joel A. Tropp. “Triangle Fixing Algorithms for the Metric Nearness Problem”. In *Advances in Neural Information Processing Systems (NIPS)*, Dec. 2004. □

86. Hyuk Cho, Inderjit S. Dhillon, Yuqiang Guan, and **Suvrit Sra**. “Minimum Sum Squared Residue based Co-clustering of Gene Expression data”. In *SIAM Conf. on Data Mining (SDM)*, Apr. 2004. □
87. Arindam Banerjee, Inderjit S. Dhillon, Joydeep Ghosh, and **Suvrit Sra**. “Generative Model-Based Clustering of Directional Data”. In *ACM Int. Conf. Knowledge Discovery and Data Mining (KDD)*, Aug. 2003. □

### Selected Technical Reports (with $\geq 8$ citations)

88. Rashish Tandon and **Suvrit Sra**. “Sparse nonnegative matrix approximation: new formulations and algorithms”. Technical Report 193, Max Planck Institute for Intelligent Systems, 2010. **(13 citations)**
89. **Suvrit Sra**, Stefanie Jegelka, and Arindam Banerjee. “Approximation algorithms for Bregman clustering, co-clustering and tensor clustering”. Technical Report 177, MPI for Biological Cybernetics, Jun. 2008. **(9 citations)**. □
90. **Suvrit Sra**, Dongmin Kim, and Bernhard Schölkopf. “Non-monotonic Poisson likelihood maximization”. Technical Report 170, Jun. 2008. **(12 citations)**. □
91. **Suvrit Sra** and Inderjit S. Dhillon. “Nonnegative Matrix Approximation: Algorithms and Applications”. Technical Report TR-06-27, Jun. 2006. **(53 citations)**. □
92. Dongmin Kim, **Suvrit Sra**, and Inderjit S. Dhillon. “A New Projected Quasi-Newton Approach for Nonnegative Least Squares Problem”. Technical Report TR-06-54, May 2006. **(30 citations)**. □
93. Inderjit S. Dhillon, **Suvrit Sra**, and Joel A. Tropp. “Triangle fixing algorithms for the Metric Nearness problem”. Technical Report TR-04-22, Jun. 2004. **(8 citations)**. □
94. Arindam Banerjee, Inderjit S. Dhillon, Joydeep Ghosh, and **Suvrit Sra**. “Clustering on Hyperspheres using Expectation Maximization”. Technical Report TR-03-07, Feb. 2003. **(12 citations)**. □
95. Inderjit S. Dhillon and **Suvrit Sra**. “Modeling data using directional distributions”. Technical Report TR-03-06, Jan. 2003. **(61 citations)**. □

### Miscellaneous

96. **S. Sra**. “A new metric on the manifold of kernel matrices”. In *NIPS Workshop on Algebraic Topology and Machine Learning*, Dec. 2012. ▲□
97. M. Langovoy and **S. Sra**. “Statistical estimation for optimization problems on graphs”. In *NIPS Workshop on Discrete Optimization for Machine Learning*, Dec. 2011. □
98. **S. Sra**. *Matrix Nearness Problems in Data Mining*. PhD thesis, Univ. of Texas at Austin, Aug. 2007. □
99. J. V. Davis, B. Kulis, **S. Sra**, and I. S. Dhillon. “Information-theoretic Metric Learning”. In *NIPS Workshop on Learning to Compare Examples*, Dec. 2006. □

### INVITED TALKS AND LECTURES

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| ▶ <i>SIAM Annual Meeting '16, Boston</i>   | Jul 11 2016 |
| ▶ <i>(Canceled) Plenary in “Matrix Inequalities and Operator Means” at ILAS 2016, Belgium</i>  | Jul 2016    |
| ▶ <i>Advances in Non-convex analysis and Optimization, Workshop, ICML 2016</i>                 | Jun 23 2016 |
| ▶ <i>Google Machine Learning Workshop, New York</i>  | Mar 03 2016 |
| ▶ <i>MIT Lincoln Laboratory, PED Seminar</i>   | Feb 09 2016 |
| ▶ <i>Lectures on large-scale optimization, Hausdorff Institute of Mathematics</i>              | Jan 2016    |
| ▶ <i>Computer Vision Seminar, Boston University</i>  | Sep 2015    |
| ▶ <i>Machine Learning Summer School Lecturer (Microsoft Research India)</i>                    | June 2015   |
| ▶ <i>New England Machine Learning Conference (NEML)</i>  | May 18 2015 |
| ▶ <i>Massachusetts Institute of Technology (MIT), Math Dept., Combinatorics Seminar</i>        | Mar 13 2015 |
| ▶ <i>Invited talk: “Riemannian geometry in machine learning”, Workshop@NIPS 2014, Montreal</i> | Dec 05 2014 |



▶ <i>University of California San Diego, CSE Dept., San Diego, CA</i>	May 29 2014
▶ <i>Massachusetts Institute of Technology (MIT), LIDS, Cambridge, MA</i>	May 8 2014
▶ <i>Cornell University, ORIE Seminar, Ithaca, NY</i>	May 5 2014
▶ <i>Invited short-course, EU Regional School 2014, RWTH Aachen, Germany</i>	Apr 11 2014
▶ <i>Microsoft Research, Cambridge, UK</i>	Mar 17 2014
▶ <i>University of Cambridge, Engineering Dept., Cambridge, UK</i>	Mar 17 2014
▶ <i>University of British Columbia, Computer Science Dept.; Vancouver</i>	Feb 26 2014
▶ <i>Carnegie Mellon University, Tepper School of Business; Pittsburgh</i>	Feb 21 2014
▶ <i>Carnegie Mellon University, Machine Learning Dept.; Pittsburgh, PA</i>	Feb 19 2014
▶ <i>Carnegie Mellon University, Statistics Department Seminar, Pittsburgh, PA</i>	Nov 11 2013
▶ <i>Massachusetts Institute of Technology (MIT), LIDS, Cambridge, MA</i>	Oct 18 2013
▶ <i>Washington University at St. Louis, CSE Dept. Colloquium, St. Louis, MO</i>	Oct 15 2013
▶ <i>École polytechnique fédérale de Lausanne, Math Department, Lausanne</i>	Sep 18 2013
▶ <i>Technische Universität, München, Math Department.</i>	Sep 17, 2013
▶ <i>École polytechnique fédérale de Lausanne, School of Computer Sci., Lausanne</i>	Apr 15 2013
▶ <i>University of California Davis, Algebra and Discrete Math Seminar, Davis, CA</i>	Mar 14 2013
▶ <i>Carnegie Mellon University, Machine Learning Department, Pittsburgh</i>	Feb 28 2013
▶ <i>University College London, Gatsby Computational Neuroscience Unit, London</i>	Feb 18 2013
▶ <i>Cornell University, Computer Science Colloquium, Ithaca</i>	Feb 14 2013
▶ <i>Duke University, ECE Department Colloquium</i>	Feb 11 2013
▶ <i>INRIA Rocquencourt (ENS/CNRS/ENS joint laboratory), Paris</i>	Jan 21, 2013
▶ <i>Oxford University, The Mathematical Institute, Oxford</i>	Jan 09, 2013
▶ <i>University of British Columbia (UBC), ECE Dept., Vancouver.</i>	Oct 10, 2012
▶ <i>Kyungpook National Univ., Dept. of Mathematics, South Korea (5 day workshop)</i>	Jun 26–30, 2012
▶ <i>Google Research, Mountain View, CA</i>	May 24, 2012
▶ <i>IBM Research, New York, NY</i>	May 8, 2012
▶ <i>University of Massachusetts Amherst, ECE Dept., Amherst, MA</i>	Apr 10, 2012
▶ <i>Yahoo! Research Tech Talk, Sunnyvale, CA.</i>	Mar 9, 2012
▶ <i>LinkedIn Tech Talk, Mountain View, CA.</i>	Mar 6, 2012
▶ <i>Microsoft Research Tech Talk, Redmond, WA</i>	Aug 29, 2011
▶ <i>University of Washington, Seattle, EE, CS, Math Seminar, Seattle</i>	Aug 25, 2011
▶ <i>Yahoo Research, Sunnyvale, CA</i>	Aug 18, 2011
▶ <i>Toyota Technological Institute (TTI) Chicago.</i>	Aug 16, 2011
▶ <i>University of Chicago, Statistics Colloquium, Chicago</i>	Aug 15, 2011
▶ <i>Householder Symposium XVIII, Tahoe</i>	Jun 2011
▶ <i>ETH Zürich, Informatik Seminar, Zürich</i>	Apr 2011
▶ <i>Universidad Autónoma de Madrid, CS Dept, Madrid</i>	Apr 2011
▶ <i>Institute for Pure and Applied Mathematics, UCLA, Applications of Optimization in Science and Engineering workshop</i>	Dec 2010
▶ <i>First I.S.T. Austria Symposium on Computer Vision and Machine Learning, Klosterneuburg</i>	Oct 2010
▶ <i>Invited short-course at the EU Regional School 2010, RWTH Aachen, Germany.</i>	Apr 2010
▶ <i>Microsoft Research Tech Talk, Redmond.</i>	Dec 2008
▶ <i>Google, Mountain View, CA.</i>	Mar 2007

- ▶ *Yahoo Inc., Sunnyvale, CA.*
- ▶ *SAGE Days 3, IPAM, UCLA*

Mar 2007  
Feb 2007

## PROFESSIONAL SERVICE

**ASSOCIATE EDITOR:** Optimization Methods and Software (OMS); 2014–

**AREA CHAIR / SENIOR PROGRAM COMMITTEE**

1. International Conference on Machine Learning (ICML) 2016, 2015, 2014
2. Neural Information Processing Systems (NIPS), 2016, 2014, 2013
3. Artificial Intelligence & Statistics (AISTATS) 2016, 2014

**SPONSORSHIP CHAIR:** Artificial Intelligence and Statistics (AISTATS) 2012

**MINISYMPOSIUM ORGANIZER:** “Advances in large-scale optimization”

Invited minisymposium at *SIAM Annual Meeting, 2016*

**WORKSHOP ORGANIZER AND CO-CHAIR:** OPT 2008—OPT 2015

International workshops help at the *Neural Information Processing Systems (NIPS)* Conference

**PROGRAM COMMITTEE MEMBER / REVIEWER**

- *Uncertainty in Artificial Intelligence (UAI)* 2016, 2009
- *ACM SIGMOD* 2016
- *SIGKDD Int. Conf. Knowledge Discovery and Data Mining (KDD)* (2016, 2015, 2011, 2003–2007)
- *International Joint Conf. Artificial Intelligence (IJCAI)* 2013
- *Artificial Intelligence and Statistics (AISTATS)* 2011, 2013
- *Conference on Learning Theory (COLT)* (2016, 2011)
- *Neural Information Processing Systems (NIPS)* (2005–2010)
- *International Conference on Machine Learning (ICML)* (2006–2010)
- *Snowbird Abstracts* (2008–2011)
- *IEEE Symposium on Foundations of Computer Science (FOCS)* (2009)
- *IEEE Int. Conference on Semantic Computing (ICSC)* (2008)
- *IEEE Int. Conference Data Mining (ICDM)* (2003–2007)
- *ACM Conf. on Information and Knowledge Management (CIKM)* (2005)
- *SIAM Int. Conference on Data Mining (SDM)* (2003–2008)

## JOURNAL REVIEWING

1. *SIAM Review (SIREV)*
2. *SIAM J. on Optimization (SIOPT)*
3. *SIAM J. of Scientific Computing (SISC)*
4. *SIAM J. Control and Optimization (SICON)*
5. *SIAM J. Matrix Analysis and Applications (SIMAX)*
6. *SIAM J. on Imaging Sciences (SIIMS)*
7. *Machine Learning Journal (Springer)*
8. *Journal of Machine Learning Research (JMLR)*
9. *Annals of Applied Statistics (AoAS)*
10. *IEEE Special Topics in Signal Processing (JSTSP)*
11. *IEEE Signal Processing Letters (SPL)*
12. *IEEE Transactions on Information Theory (IT)*
13. *IEEE Transactions on Signal Processing (TSP)*
14. *IEEE Journal Selected Topics in Signal Processing (JTSP)*
15. *IEEE Transactions on Image Processing (TIP)*
16. *IEEE Transactions Knowledge and Data Engineering (TKDE)*
17. *IEEE Transactions on Neural Networks and Learning Systems (TNNLS)*

18. *IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)*
19. *Statistics and Computing (STCO)*
20. *Computational Statistics and Data Analysis (CSDA)*
21. *Computational Statistics (COST)*
22. *Entropy*
23. *Journal of Statistical Computation and Simulation (JSCS)*
24. *Linear Algebra and its Applications (LAA)*
25. *Optimization (Taylor & Francis)*
26. *Optimization and Engineering (OPTE)*
27. *Optimization Letters (Springer)*
28. *Signal Processing (Elsevier)*
29. *Numerical Algorithms (Springer)*
30. *Pattern Recognition (PR)*
31. Reviewer for [MATHSCINET](#)
32. *American Mathematical Monthly*

#### GRANT REVIEWER

Have reviewed NSF and NASA grant proposals

#### ADMINISTRATIVE SERVICE

Graduate admissions, EECS department, MIT  
Reviewing Postdoc, PhD, and Master's applications at Max-Planck Institute  
Interviewing Postdoc and PhD candidates at Max Planck Institute  
ACM and SCS Doctoral Dissertation Committee, Carnegie Mellon University

## STUDENTS

- ▶ *Ph.D.* committee member for Álvaro Barbero (UAM Madrid; July 2011); ▶ external reviewer for Aaron Defazio's PhD thesis (Australian National University, ANU)
- ▶ *Graduate students; supervised for  $\geq 1$  research projects:*
  - Zelda Mariet (Jan 2015–now, PhD student CSAIL, MIT)
  - Chengtao Li (Jan 2015–now, PhD student CSAIL, MIT)
  - Hongyi Zhang (Jul 2015–now, PhD student, BCS, MIT)
  - Anoop Cherian (2011–2013, PhD student UMN, now Researcher ANU, Australia)
  - Álvaro Barbero (2010–2011, PhD student UAM Madrid, Chief Data Scientist, IIC, UAM Madrid)
  - Namhyoung Kim (2010, PhD student POSTECH, Korea, now Assistant Professor)
  - Carlos María Gudín (2011–2012, PhD student UAM Madrid, now Postdoc KU Leuven)
  - Radha Chitta (2013, Research Scientist PARC)
  - Michael Hirsch (2008–2010) (PhD student Max-Planck, Tübingen, now Group Leader Max-Planck)
  - Veeranjanyulu Sadhanala (2013-14, PhD student CMU)
  - Adams Wei Yu (2013-14, MS student CMU, now PhD student CMU)
  - Ahmed Hefny (2013-14, PhD student CMU)
  - Sashank Reddi (2013-14, PhD student CMU)
  - Yu-Xiang Wang (2013-14, PhD student CMU)
- ▶ *Undergraduates supervised for research projects:*
  - Flora Tan (Fall 2015–Spring 2016, SuperUROP; EECS MIT)
  - Lingfu Zhang (Fall 2015–Spring 2016, SuperUROP; EECS/Math MIT)
  - Hayley Song (Fall 2015–Spring 2016, SuperUROP; EECS MIT)
  - Alexander Amini (Summer 2015, UROP; EECS MIT)
  - Rashish Tandon (2010, Max-Planck; now PhD student in CS, UT Austin)

- 
- Samaneh Azadi (2013, UC Berkeley, now PhD student in EECS, UC Berkeley)

## **PATENTS**

### **Method and device for recovering a digital image from a sequence of observed digital images**

S. Harmeling, M. Hirsch, S. Sra, B. Schölkopf, and C. Schuler

International Patent: WO/2012/041492; 5th April, 2012.

### **Combining spectral and probabilistic clustering**

A. C. Surendran and S. Sra

United States Patent: US 7,809,704 B2

## **SOFTWARE WRITTEN**

MYSVD, EIGS: Sparse singular and eigenvector decomposition in C++

NMA: Optimized implementations of various nonnegative matrix factorization algorithms

SSLIB: Sparse matrix manipulation library (C/C++)

FSOLVER: Optimization software for large-scale linear and quadratic programs

Other software for clustering, co-clustering, Bessel functions, etc., available from my webpage

## **PERSONAL**

### **LANGUAGES**

Native to near-native proficiency: English, Hindi, Punjabi

Fluent: German; Intermediate: Italian, Urdu; Beginner: French, Russian.

## **REFERENCES**

BERNHARD SCHÖLKOPF (Director, Max Planck Institute for Intelligent Systems, Tübingen, Germany)

ALEXANDER J. SMOLA (Professor, Carnegie Mellon University, Pittsburgh)

INDERJIT S. DHILLON (Professor, The University of Texas at Austin)