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**Title:** *Research Scientist*  
**Email:** [suvrit@gmail.com](mailto:suvrit@gmail.com)  
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**Social:** <http://mathoverflow.net/users/8430/suvrit>

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**Suvrit Sra**  
*curriculum vitae*

## RESEARCH SUMMARY

My research focuses on “large-scale data analysis.” In particular, I design, analyze, and implement algorithms for large-scale (data intensive) problems in **scientific computing, statistics, and machine learning**. My mathematical tools are drawn from: statistics, theoretical computer science, signal processing, functional analysis, operator algebra, convex and nonconvex optimization, stochastic programming, linear algebra, and numerical analysis.

## EDUCATION

### Ph.D. in Computer Science

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

## ACADEMIC POSITIONS

**Research Scientist** hosted by Prof. Bernhard Schölkopf

Max Planck Institute for Intelligent Systems Tübingen, Germany;

(formerly MPI for Biological Cybernetics). Oct. 2007–Present

**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 on “*The Metric Nearness Problem*,” which was selected as: **one of three papers selected out of all papers published in SIAM journals in the three years 2008–2010.**

(Some other winners (past and present): A. Edelman, D. Karger, L. Levin, A. Lewis, C. H. Papadimitriou, ...)

(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.

**Householder Symposium Travel 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)

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

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

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

**Travel awards**  
SIAM Data Mining Conference 2007, 2004; Neural Information Processing Systems (NIPS) 2005

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

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

## TEACHING EXPERIENCE

**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

**Funding for OPT 2011**, 4th Int. Workshop on Optimization for Machine Learning  
Value: €2500 from PASCAL2

**Funding for OPT 2010**, 3rd Int. Workshop on Optimization for Machine Learning  
Value: €1550 from PASCAL2, \$4000 from Microsoft.

**Funding for NUMML 2010**, Workshop on Numerical Mathematical Challenges in Machine Learning  
Value: €2500 from PASCAL2

**Funding for OPT 2009**, Int. Workshop on Optimization for Machine Learning  
Value: €1000 from PASCAL2, \$2500 from MOSEK (mosek.com), \$1000 from Microsoft Research

**PASCAL2 Grant for NUMML 2009**, ICML 2009 Workshop  
Value: €4100, Mar. 2009

**PASCAL2 Grant for OPT 2008**, NIPS 2008 Workshop  
Value: €4855, Oct. 2008

**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

**Attended** two day European Union Framework 7 Grant Writing Workshop  
Given by: Dr. Sean McCarthy, Hyperion Ltd., Jul. 2009

## PUBLICATIONS

### Important notes about the publications

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1. Author ordering on some of my earlier papers (upto 2008) is mostly *alphabetic*, because our research group used to follow alphabetic ordering. So, I have highlighted the principal authors in **bold**.
  2. Some of my recent work is strongly collaborative, and it is difficult to single out one main author; thus, to be fair to all the main authors, I have highlighted their names in **bold**.
  3. A star e.g., A. Name\*, signifies a student author who worked under my supervision.
  4. I have roughly color-coded my publications by research area as follows:  
(i) ■—optimization; (ii) ■—machine learning & statistics; (iii) □—scientific computing.
  5. Electronic copies, when available, are at: <http://people.kyb.tuebingen.mpg.de/suvrit/work/newchron.html>.
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## Manuscripts in the Pipeline

### NEAR COMPLETION

1. **Á. J. Barbero** and **S. Sra**. Fast multidimensional anisotropic total variation. Jan. 2012. *Journal article under preparation*
2. **A. Cherian**, **S. Sra**, A. Banerjee, and N. Papanikolopoulos. Jensen-Bregman LogDet Divergence with Application to Efficient Similarity Search for Covariance Matrices. *IEEE PAMI*, 2012. *Journal article under preparation*. ■
3. **S. Sra** and **D. Kim**. A trust-region proximal framework for nonsmooth regression. 2012. *Journal article under preparation*. ■■
4. **S. Sra**. Nonconvex proximal splitting: batch and incremental algorithms. *Preprint: arXiv:1109.0258*, Nov. 2011. *Final article under preparation*. ■□

### SUBMITTED / UNDER REVIEW

5. **S. Sra**. Explicit eigenvalues of certain scaled trigonometric matrices. *Preprint: arXiv:1201.4651*, 2012. *Submitted journal article*. □
6. **S. Sra**. Tractable large-scale optimization in machine learning. In L. Bordeaux, Y. Hamadi, P. Kohli, and R. Mateescu, editors, *Advances in Tractability*. Cambridge University Press, 2012. *Invited chapter*. ■■
7. **S. Sra**. Fast projections onto mixed-norm balls with applications. *Data Mining and Knowledge Discovery (DMKD)*, Oct. 2011. *Invited journal article*. ■■□
8. **S. Sra**. Positive Definite Matrices and the Symmetric Stein Divergence. *Preprint: arXiv:1110.1773*, Oct. 2011. *Submitted journal article*. ■■□
9. **S. Sra** and **D. Karp**. The multivariate Watson distribution: Maximum-likelihood estimation and other aspects. *Preprint: arXiv:1104.4422*, Apr. 2011. *Submitted journal article*. ■

## Books and Monographs

10. S. Sra, S. Nowozin, and S. 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. ■■□

## Book Chapters and Journal Articles

11. D. Kim, S. Sra, and I. S. Dhillon. A non-monotonic method for large-scale non-negative least squares. *Optimization Methods and Software (OMS)*, Dec. 2011. (Accepted in Dec. 2011). ■□
12. M. Schmidt, D. Kim, and S. 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. ■■
13. M. Hirsch, S. Harmeling, S. Sra, and B. Schölkopf. Online multi-frame blind deconvolution with super-resolution and saturation correction. *Astronomy & Astrophysics*, Feb. 2011. □
14. S. Sra. A short note on parameter approximation for von Mises-Fisher distributions: and a fast implementation of  $I_s(x)$ . *Computational Statistics*, Jan. 2011. (accepted in Apr. 2009). ■
15. D. Kim, S. Sra, and I. 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. A. Banerjee, I. S. Dhillon, J. Ghosh, and S. Sra. *Text Mining: Theory, Applications, and Visualization A. Sriovastava and M. Sahami (eds.)*, chapter Text clustering with mixture of von Mises-Fisher distributions. Data Mining and Knowledge Discovery Series. Chapman & Hall / CRC Press, 2009. ■
17. J. Brickell, I. S. Dhillon, S. Sra, and J. A. Tropp. The Metric Nearness Problem. *SIAM J. Matrix Analysis and Appl.*, 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)**. ■■
18. D. Kim, S. Sra, and I. S. Dhillon. Fast Projection-Based Methods for the Least Squares Nonnegative Matrix Approximation Problem. *Statistical Analysis and Data Mining*, 1:38–51, 2007. **Invited Paper**. ■■
19. A. Banerjee, I. S. Dhillon, J. Ghosh, and S. Sra. Clustering on the Unit Hypersphere using von Mises-Fisher Distributions. *J. Mach. Learning Research (JMLR)*, 6:1345–1382, Sep 2005. ■

## Refereed Conference Publications

20. A. Cherian\*, S. 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. ■■
21. S. Sra and A. Cherian\*. Generalized Dictionary Learning for Symmetric Positive Definite Matrices with Application to Nearest Neighbor Retrieval. In *European Conf. Machine Learning (ECML)*, Sep. 2011. ■□
22. S. 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**. ■■□
23. Á. J. Barbero\* and S. Sra. Fast Newton-type Methods for Total-Variation with Applications. In *Proceedings of the International Conference on Machine Learning (ICML)*, Jun. 2011. ■■
24. A. Cherian\*, S. Sra, and N. Papanikolopoulos. Denoising sparse noise via online dictionary learning. In *Int. Conf. Acoustics, Speech, and Signal Processing (ICASSP)*, May 2011. ■□■
25. M. Hirsch, S. Sra, B. Schölkopf, and S. Harmeling. Efficient filter flow for space-variant multiframe blind deconvolution. In *IEEE Conf. Computer Vision & Pattern Recognition (CVPR)*, Jun. 2010. □
26. D. Kim, S. Sra, and I. S. Dhillon. A scalable trust-region algorithm with application to mixed-norm regression. In *Int. Conf. Machine Learning (ICML)*, 2010. ■■
27. S. Harmeling, S. Sra, M. Hirsch, and B. Schölkopf. Multiframe Blind Deconvolution, Super-Resolution, and Saturation Correction via Incremental EM. In *IEEE Int. Conf. Image Processing (ICIP)*, 2010. □

28. **S. Sra**, D. Kim, I. S. Dhillon, and B. Schölkopf. A new non-monotonic algorithm for PET image reconstruction. In *IEEE Nuclear Science Symposium / Medical Imaging Conf. (NSS/MIC)*, Oct. 2009. □
29. **S. Jegelka**, **S. Sra**, and A. Banerjee. Approximation Algorithms for Tensor clustering. In *Algorithmic Learning Theory (ALT)*, Jun. 2009. Extended version as arXiv preprint: cs.DS/0812.0389. ■
30. **B. Kulis**, **S. Sra**, and I. S. Dhillon. Scalable Semidefinite Programming using Convex Perturbations. 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. ■■
31. **S. Harmeling**, **M. Hirsch**, **S. Sra**, and B. Schölkopf. Online Blind Deconvolution for Astronomy. In *IEEE Int. Conf. on Computational Photography (ICCP)*, Apr. 2009. □
32. **S. Sra**. Block-Iterative Algorithms for Non-negative Matrix Approximation. In *IEEE Int. Conf. Data Mining (ICDM)*, pages 1037–1042, Dec. 2008. ■■
33. **J. V. Davis**, **B. Kulis**, **P. Jain**, S. Sra, and I. S. Dhillon. Information-theoretic Metric Learning. In *Int. Conf. Machine Learning (ICML)*, pages 633–640, Jun. 2007. **Best Student Paper**. ■
34. **D. Kim**, **S. Sra**, and I. S. Dhillon. Fast Newton-type Methods for the Least Squares Nonnegative Matrix Approximation Problem. In *SIAM Int. Conf. Data Mining (SDM)*, Apr. 2007. Recognized within **Best of SDM** papers. ■■
35. **A. Surendran** and **S. Sra**. Incremental Aspect Models for Mining Document Streams. In *Principles and Practice of Knowledge Discovery in Databases (PKDD)*, pages 633–640, Sep. 2006. ■
36. **S. Sra**. Efficient Large Scale Linear Programming Support Vector Machines. In *Euro. Conf. Machine Learning (ECML)*, pages 767–774, Sep. 2006. ■■
37. **S. Sra** and **J. A. Tropp**. Row-action Methods for Compressed Sensing. In *Int. Conf. on Acoustics, Speech, and Signal Processing (ICASSP)*. IEEE, May 2006. ■
38. I. S. Dhillon and **S. Sra**. Generalized Nonnegative Matrix Approximations with Bregman Divergences. In *Advances Neural Information Processing Systems (NIPS)*, Dec. 2005. ■□■
39. I. S. Dhillon, **S. Sra**, and J. A. Tropp. Triangle Fixing Algorithms for the Metric Nearness Problem. In *Advances in Neural Information Processing Systems (NIPS)*, Dec. 2004. ■
40. **H. Cho**, I. S. Dhillon, Y. Guan, and **S. Sra**. Minimum Sum Squared Residue based Co-clustering of Gene Expression data. In *SIAM Conf. on Data Mining (SDM)*, pages 114–125. SIAM, Apr. 2004. ■
41. **A. Banerjee**, I. S. Dhillon, J. Ghosh, and **S. Sra**. Generative Model-Based Clustering of Directional Data. In *ACM SIGKDD Int. Conf. on Knowledge Discovery and Data Mining (SIGKDD)*, Aug. 2003. ■

## Selected Abstracts

42. S. Sra. Large-scale nonnegative least squares. (*Abstract*) *Contributed to Householder Symposium XVIII*, Jun. 2011. ■□
43. D. Kim, S. Sra, and I. Dhillon. Sparse regression via a trust-region proximal method. (*Abstract*) *Contributed talk to EURO XXIV, 2010*, Jul. 2010. ■■
44. S. Sra, D. Kim, and I. Dhillon. Solving large-scale nonnegative least squares using an adaptive non-monotonic method. (*Abstract*) *Contributed talk to EURO XXIV, 2010*, Jul. 2010. ■
45. S. Sra. Solving large-scale nonnegative least squares. (*Abstract*) *Contributed talk to ILAS 2010*, Jun. 2010. Based on joint work with D. Kim and I. S. Dhillon. ■

## Miscellaneous Publications

46. **M. Langovoy** and **S. Sra**. Statistical estimation for optimization problems on graphs. In *NIPS Workshop on Discrete Optimization for Machine Learning*, Dec. 2011. *To appear*. ■
47. **S. Sra**. *Matrix Nearness Problems in Data Mining*. PhD thesis, Univ. of Texas at Austin, Aug. 2007. ■■□
48. **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. ■

## MAJOR INVITED TALKS AND LECTURES

1. Scalable methods for nonsmooth optimization. *Yahoo! Research*, CA. Mar. 9, 2012
2. A framework for scalable nonsmooth optimization. *LinkedIn*, CA. Mar. 6, 2012
3. Optimization and large-scale data analysis. *IBM Research*, NY. Aug. 25, 2011 (*Canceled by speaker*)
4. Positive definite matrices and the Symmetrized Stein Divergence:
  - *Microsoft Research, Redmond*. Aug. 29, 2011
  - *EE, CS, Math Seminar: University of Washington, Seattle*. Aug. 25, 2011
  - *EECS, IEOR, University of California, Berkeley*. Aug. 19, 2011 (*Canceled by speaker*)
  - *Yahoo Research, Santa Clara, California*. Aug. 18, 2011
  - *Toyota Technological Institute at Chicago*. Aug. 16, 2011
5. The metric nearness problem. *Statistics Colloquium, University of Chicago*. Aug. 15, 2011
6. Solving large-scale nonnegative least-squares. *Householder Symposium XVIII*. Jun. 12–17, 2011.
7. Scalable algorithms for nonsmooth composite convex minimization. *Informatik, ETH Zürich*. Apr. 2011.
8. Lecture on “Optimization in Machine Learning.” *CS Dept., Universidad Autónoma de Madrid*. Apr. 2011.
9. Large-scale Optimization for Machine Learning and Scientific Computing. *Computer Sciences, University of Buffalo*. Mar. 2011.
10. Multiframe blind deblurring. *Institute for Pure and Applied Mathematics (IPAM), UCLA*. Invited talk at the *Applications of Optimization in Science and Engineering* workshop, organized by: S. Boyd, Y. Eldar, Z.-Q. Luo, B. Schölkopf, L. Vandenberghe. Nov.–Dec., 2010.
11. Kernels for covariance matrices. *First I.S.T. Austria Symposium on CV and ML*. Oct. 2010.
12. Lecture on “Matrix Factorization and Approximation Problems.” *Invited short-course at the EU Regional School 2010, RWTH Aachen, Germany*. Apr. 2010.
13. New projected quasi-Newton methods with applications. *Microsoft Research, Redmond*. Dec. 2008.
14. Matrix nearness problems in data mining: nonnegative matrix approximation. *Google, CA*. Mar. 2007.
15. Matrix nearness problems in data mining. *Yahoo Inc., Sunnyvale, CA*. Mar. 2007.
16. Sparse matrix computations with SAGE. *SAGE Days 3, (at IPAM, UCLA)*. Feb. 2007.

## PROFESSIONAL SERVICE

### CONFERENCE AND WORKSHOP ORGANIZATION

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

**WORKSHOP CO-CHAIR:** OPT 2011, OPT 2010, OPT 2009, OPT 2008

A series of international workshops on: *Optimization for Machine Learning*  
(Held as a part of the *Neural Information Processing Systems (NIPS)* Conference)

### PROGRAM COMMITTEE MEMBER / REVIEWER / EXTERNAL REVIEWER

*Neural Information Processing Systems (NIPS)* (2005–2010)

*International Conference on Machine Learning (ICML)* (2006–2010)

*ACM SIGKDD Int. Conf. Knowledge Discovery and Data Mining (KDD)* (2003–2007, 2011)

*Artificial Intelligence and Statistics (AISTATS)* 2011

*Snowbird Abstracts* (2008–2011)  
*Uncertainty in Artificial Intelligence (UAI)* (2009)  
*IEEE Int. Conference on Semantic Computing (ICSC)* (2008)  
*Intelligent User Interfaces (IUI)* (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)  
*Conference on Learning Theory (COLT)* (2011)  
*IEEE Symposium on Foundations of Computer Science (FOCS)* (2009)

#### **REVIEWER FOR THE FOLLOWING JOURNALS**

*Journal of Machine Learning Research (JMLR)*  
*SIAM Review (SIREV)*  
*SIAM J. Control and Optimization (SICON)*  
*SIAM J. of Scientific Computing (SISC)*  
*SIAM J. Matrix Analysis and Applications (SIMAX)*  
*Linear Algebra and its Applications (LAA)*  
*Computational Statistics and Data Analysis (CSDA)*  
*Pattern Recognition (PR)*  
*Statistics and Computing (STCO)*  
*Optimization (Taylor & Francis)*  
*Signal Processing (Elsevier)*  
*Annals of Applied Statistics*  
*Information Sciences (Elsevier)*  
*IEEE Signal Processing Letters*  
*IEEE Transactions Knowledge and Data Engineering (TKDE)*  
*IEEE Transactions on Signal Processing (TSP)*  
*IEEE Transactions on Neural Networks (TNN)*  
*IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)*

#### **GRANT REVIEWER**

Have helped review NSF and NASA grant proposals

#### **ADMINISTRATIVE DUTIES**

Reviewing Postdoc, Ph.D., and Master's level applications at Max-Planck Institute  
Interviewing candidates at Max Planck Institute

#### **STUDENTS**

*Ph.D.* committee member for Álvaro Barbero (UAM Madrid; July 2011)  
*Interns:* Álvaro Barbero (UAM Madrid, 2010); Rashish Tandon (IIT Kanpur, 2010); Namhyoung Kim (POSTECH, Korea, 2010); Carlos María Gudín (UAM Madrid, 2011).

#### **PATENTS**

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### Combining spectral and probabilistic clustering

A. C. Surendran and S. Sra

United States Patent: US 7,809,704 B2

### Incrementally building aspect models

A. C. Surendran and S. Sra

United States Patent Application 20080005137, Filed in: Jun. 2006

## SOFTWARE WRITTEN

MYSDV, 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

Citizen of: India

Native proficiency in: English, Hindi, Punjabi

Fluent in: German (*self-taught*); Beginner+: in Italian (*self-taught*).

## REFERENCES

1. BERNHARD SCHÖLKOPF

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3. STEPHEN J. WRIGHT

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