Sushant Sachdeva

Research Scientist, Google

CONTACT INFORMATION

sachdevasushant@gmail.com
https://sachdevasushant.github.io/

RESEARCH INTERESTS

Algorithms, and its connections to learning, optimization, and statistics

My recent research has focused on the design of fast algorithms, using techniques from convex optimization, numerical linear algebra, and approximation theory.

APPOINTMENTS

Google — Mountain View, CA

Research Scientist — Aug 2016 – Present

Yale University — New Haven, CT

Postdoctoral Associate, Department of Computer Science — Jan 2014 – July 2016
Supervisor: Prof. Daniel Spielman

Lecturer, Department of Computer Science — Jan 2015 – May 2015

UC Berkeley, Simons Institute for the Theory of Computing — Berkeley, CA

Simons Research Fellow — Aug 2013 – Dec 2013
Program: Real Analysis in Computer Science

EDUCATION

Princeton University — Princeton, NJ

Ph.D., Department of Computer Science — Sep 2008 - Sep 2013
Thesis: New Results in the Theory of Approximation — Fast Graph Algorithms and Inapproximability
Adviser: Prof. Sanjeev Arora
Area of study: Theoretical Computer Science

M.A., Department of Computer Science — Sep 2008 – Jun 2010
GPA: 4.0/4.0

Indian Institute of Technology Bombay — Mumbai, India

B.Tech., Department of Computer Science and Engineering — Jul 2004 – Aug 2008
Adviser: Sundar Vishwanathan
CPI: 9.97/10.00

HONORS AND AWARDS

Awarded **President of India Gold Medal** for topping the class of 2008 (of 500+ students)

Ranked **1st all over India** in IIT Entrance Examination 2004 (among 170,000+ students)

Bronze Medalist at 36^{th} International Chemistry Olympiad (IChO) 2004, Kiel, Germany

Represented IIT Bombay at **ACM ICPC World Finals, Tokyo 2007**

Scored a perfect SPI of 10.0 in 7 semesters out of 8 at IIT Bombay

Awarded a grade of AP for outstanding performance in ten courses at IIT Bombay

Awarded Jayanti Deshmukh Memorial Gold Medal for being the most outstanding B.Tech. student in the computer science class of 2008 (out of 35 students)

Awarded Aditya Birla Scholarship 2004–08, covering my undergraduate studies. It is awarded to only 10 engineering students each year.

Awarded Dhirubai Ambani Scholarship 2004–08 for being among the top 10 students of Maharashtra state in AISSCE 2004.

Awarded Kishore Vaigyanik Protsahan Yojana (KVPY) fellowship 2002–04. Awarded to

around 50 students each year; aimed at promoting research careers in the sciences.

Monographs

Faster Algorithms via Approximation Theory
S. Sachdeva, N. K. Vishnoi
In Foundations and Trends in Theoretical Computer Science 9.2 (FTTCS) 2014, pp. 125-210

Refereed Journal Publications

The mixing time of the Dikin walk in a polytope – A simple proof
S. Sachdeva, N. Vishnoi
In Operations Research Letters, 44.5 (September 2016), pp. 630–634

An Arithmetic Analogue of Fox's Triangle Removal Argument
P. Hatami, S. Sachdeva, M. Tulsiani
In Online Journal of Analytic Combinatorics 11 (OJAC) 2016

Provable ICA with Unknown Gaussian Noise, and Implications for Gaussian Mixtures and Autoencoders
S. Arora, R. Ge, A. Moitra, S. Sachdeva
In Algorithmica 72.1 (May 2015), pp. 215–236

Inapproximability of Minimum Vertex Cover on k-Uniform k-Partite Hypergraphs
V. Guruswami, S. Sachdeva, R. Saket
In SIAM Journal on Discrete Mathematics 29.1 (SIDMA) 2015, pp. 36–58

Greedy Geometric Algorithms for Collection of Balls, with Applications to Geometric Approximation and Molecular Coarse-Graining
F. Cazals, T. Dreyfus, S. Sachdeva, N. Shah
In Computer Graphics Forum 33–6, 2014

On the Characterization and Selection of Diverse Conformational Ensembles with Applications to Flexible Docking
S. Loriot, S. Sachdeva, K. Bastard, C. Prevost, F. Cazals
In Computational Biology and Bioinformatics, IEEE/ACM Transactions on 8.2 (TCBB) 2011, pp. 487–498

Refereed Conference / Workshop Publications

A framework for analyzing resparsification algorithms
R.Kyng, J. Pachocki, R. Peng, S. Sachdeva
To appear in 26$^{\text{th}}$ ACM-SIAM Symposium on Discrete Algorithms 2017

Approximate Gaussian Elimination for Laplacians: Fast, Sparse, and Simple
R. Kyng, S. Sachdeva
In 57$^{\text{th}}$ IEEE Symposium on Foundations of Computer Science (FOCS) 2016

Sparsified Cholesky and Multigrid Solvers for Connection Laplacians
R. Kyng, Y. T. Lee, R. Peng, S. Sachdeva, and D. A. Spielman
In 48$^{\text{th}}$ ACM Symposium on Theory of Computing (STOC) 2016

Fast, Provable Algorithms for Isotonic Regression in all ℓ_p-norms
R. Kyng, A. Rao, S. Sachdeva
In 29$^{\text{th}}$ Advances in Neural Information Processing Systems (NIPS) 2015

Algorithms for Lipschitz Learning on Graphs
R. Kyng, A. Rao, S. Sachdeva, D. A. Spielman
In 28$^{\text{th}}$ Conference on Learning Theory (COLT) 2015

Simultaneous Approximation of Constraint Satisfaction Problems
A. Bhangale, S. Kopparty, S. Sachdeva
In 42$^{\text{nd}}$ International Colloquium on Automata, Languages, and Programming (ICALP) 2015

Optimal Inapproximability for Scheduling Problems via Structural Hardness for Hypergraph Vertex Cover
S. Sachdeva, R. Saket
In 28^{th} IEEE Conference on Computational Complexity (CCC) 2013

Approximating the Exponential, the Lanczos Method and an $\tilde{O}(m)$-Time Spectral Algorithm for Balanced Separator
L. Orecchia, S. Sachdeva, N. K. Vishnoi
In 44^{th} ACM Symposium on Theory of Computing (STOC) 2012

Provable ICA with Unknown Gaussian Noise, and Implications for Gaussian Mixtures and Autoencoders
S. Arora, R. Ge, A. Moitra, S. Sachdeva
In 26^{th} Advances in Neural Information Processing Systems (NIPS) 2012

Finding Overlapping Communities in Social Networks: Towards a Rigorous Approach
S. Arora, R. Ge, S. Sachdeva, G. Schoenebeck
In 13^{th} ACM Conference on Electronic Commerce (EC) 2012

Testing Permanent Oracles — Revisited
S. Arora, A. Bhattacharyya, R. Manokaran, S. Sachdeva
In 16^{th} International Workshop on Randomization and Computation (RANDOM) 2012

Nearly Optimal NP-Hardness of Vertex Cover on k-Uniform k-Partite Hypergraphs
S. Sachdeva, R. Saket
In 14^{th} International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX) 2011

Select Manuscripts

Cuts in Cartesian Products of Graphs
S. Sachdeva, M. Tulsiani

Theses

New Results in the Theory of Approximation: Fast Graph Algorithms and Inapproximability
Ph.D. Thesis, Princeton University, 2013. Advised by Sanjeev Arora

On the Hardness of Approximating Vertex Cover
B.Tech. Thesis, IIT Bombay, 2008. Advised by Sundar Vishwanathan

Talks

Fast Approximate Gaussian Elimination for Laplacians
TOCA-SV, Stanford, Nov 2016
TCS Plus Seminar, Sept 2016
Theory of Computation Seminar, Harvard University, Sept 2016
Theory Lunch, Boston University, Sept 2016

Fast Algorithms for Optimization and Learning on Graphs
Google, New York, May 2016
Computer Science Colloquium, Purdue University, Apr 2016
Department of Computer Science Lecture, University of Toronto, Canada, Mar 2016
Computer Science Seminar, University of Colorado Boulder, Mar 2016

Regression on Graphs – Lipschitz and Isotonic
Simons Seminar, University of Texas Austin, May 2016
University of Chicago, Scientific and statistical computing seminar, Nov 2015

Lipschitz Learning on Graphs
IIT Bombay, CS department seminar, Jul 2015
EPFL (École Polytechnique Fédérale de Lausanne) INF department seminar, Jul 2015
Conference on Learning Theory (COLT), Paris, Jul 2015
UC San Diego, CS department theory seminar, May 2015
Yale University, Statistics department seminar, Apr 2015

Triangle Removal in Groups
Simons Institute, UC Berkeley, Real analysis seminar, Nov 2013
Institute for Advanced Study (IAS) Computer science/discrete mathematics seminar, Apr 2013

Generalizations of KKL Theorem and Friedgut's Junta Theorem
Simons Institute, UC Berkeley, Real analysis workshop, Aug 2013

Hardness for Scheduling Problems
Conference on Computational Complexity (CCC), Palo Alto, Jun 2013

Near-linear Time Algorithms for Balanced Separator
Rutgers University, DIMACS/CS theoretical computer science seminar, Mar 2013
University of Washington, ETP theory connections, Aug 2012
Symposium on Theory of Computing (STOC), New York, May 2012
Institute for Advanced Study (IAS) Computer science/discrete mathematics seminar, Apr 2012

Testing Permanent Oracles
International Workshop on Randomization and Computation (RANDOM), Boston, Aug 2012

Professional Service

Reviewer: SODA 2016, STOC 2015, SODA 2015, SIDMA, QIC, Random 2014, FOCS 2014, STOC 2014, FSTTCS 2013, SODA 2014, Approx 2013, TOC, Algorithmica, ITCS 2013, SODA 2013, ICALP 2012, LATIN 2012, SODA 2012, FSTTCS 2011

Teaching Experience

Lecturer, Yale University

Lecturer for CPSC 665 : An Algorithmist's toolkit Spring 2015
Designed and taught a full course on advanced algorithms (2 lectures a week)
55% of students rated the course excellent (highest rating)

Teaching Assistant, Princeton University

Assistant in Instruction for COS 433: Cryptography Spring 2010
Taught weekly precepts, organized weekly question hours, graded assignments and exams

Assistant in Instruction for COS 340: Reasoning About Computation Fall 2009
Taught weekly precepts, organized weekly question hours, graded assignments and exams
Taught one 1.5-hr lecture

Professional Experience

Toyota Technological Institute Chicago, IL

Research Intern, Summer 2012
Supervisor: Yury Makarychev
Lower bounds for Vertex Sparsifiers.

Microsoft Research India Bangalore, India

Research Intern, Summer 2011
Supervisor: Nisheeth K. Vishnoi
Fast algorithms for Balanced Separator.

INRIA Sophia-Antipolis, France

Research Intern, Summer 2007
Supervisor: Frederic Cazals (Research Director, Geometrica group).
Selecting a representative set of protein conformers.

ETH Zurich, Switzerland

Research Intern, Summer 2006
Supervisor: Riko Jacob (Algorithms, Data Structures, and Applications group).
Cache efficiency of shortest path algorithms with preprocessing.

References

Prof. Daniel Spielman (spielman@cs.yale.edu)
Henry Ford II Professor of Computer Science, Mathematics, and Applied Mathematics

Yale University

Prof. Sanjeev Arora (arora@cs.princeton.edu)
Charles C. Fitzmorris Professor of Computer Science
Princeton University
(Please contact admin. assistant Mitra Kelly at mkelly@cs.princeton.edu)

Prof. Nisheeth K. Vishnoi (nisheeth.vishnoi@epfl.ch)
Associate Professor of Computer Science
EPFL (École Polytechnique Fédérale de Lausanne)

Prof. John Lafferty (lafferty@galton.uchicago.edu)
Louis Block Professor at Departments of Statistics, Computer Science, and the College
University of Chicago

Prof. Jonathan Kelner (kelner@mit.edu)
Mark Hyman, Jr. Career Development Associate Professor of Applied Mathematics
MIT (Massachusetts Institute of Technology)