

Jin-Yi Cai

Curriculum Vitae

Computer Sciences Department
University of Wisconsin at Madison
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Twelve significant publications

<http://pages.cs.wisc.edu/~jyc/Twelve-Publications.pdf>

Positions Held

- 2014— Computer Sciences Department, University of Wisconsin at Madison.
Steenbock Professor in Mathematical Sciences
- 2000— Computer Sciences Department, University of Wisconsin at Madison.
Professor
- 2003— Mathematics Department, University of Wisconsin at Madison.
Professor (courtesy appointment)
- 2007—2008 Radcliffe Institute, Harvard University.
Radcliffe Fellow
- 2010—2013 Peking University.
Changjiang Chair Professor (visiting appointment)
- 2003—2006 Tsinghua University.
Visiting Chair Professor (visiting appointment)
- 1999 Department of Computer Science, University of Toronto.
Guggenheim Fellow & Visiting Professor
- 1996—2000 Department of Computer Science, State University of New York at Buffalo.
Professor
- 1995—2001 Department of Computer Science, Fudan University, Shanghai, China.
Guest Professor (visiting appointment)
- 1993—1996 Department of Computer Science, State University of New York at Buffalo.
Associate Professor
- 1989—1993 Department of Computer Science, Princeton University.
Assistant Professor
- 1986—1989 Department of Computer Science, Yale University.
Assistant Professor

Education

- Ph.D.** Computer Science, Cornell University, 1986.
Advisor: Juris Hartmanis
- Ph.D. Dissertation** *On Some Most Probable Separations of Complexity Classes.*

M.S. Computer Science, Cornell University, 1985.

M.A. Mathematics, Temple University, 1983.

Certificate Mathematics, Fudan University, 1981.

Awards and Honors

- Elected a Foreign Member of Academia Europaea, 2017.
- Steenbock Professorship, UW Madison. 2014.
- Kellett Mid-Career Award, UW Madison. 2012.
- Vilas Associate Award, UW Madison. 2008.
- Fellow of The American Association for the Advancement of Science. 2007.
- Radcliffe Fellowship, Harvard University. 2007.
- Morningside Silver Medal in Mathematics. 2004.
- ACM Fellow. 2001.
- Carolyn Rosner Excellent Educator Award, CS Dept. UW Madison. 2001 and 2005.
- Humboldt Research Award for Senior U. S. Scientists. 1999.
- John Simon Guggenheim Fellowship. 1998.
- Hao Wang Prize, 1997.
- Alfred P. Sloan Fellowship. 1994.
- Presidential Young Investigator Award, 1990.

Grants

- National Science Foundation: “Classification Program for Counting Problems”, \$450,000.00. 09/01/17–8/31/20.
- National Science Foundation: “Counting Problems, Holographic Algorithms and Dichotomy Theorems” \$479,987 with supplement \$79,997. September 1, 2012 — August 31, 2017.
- National Science Foundation: “Counting Problems and Dichotomy Theorems” \$397,326. September 1, 2009 — August 31, 2012.

- National Science Foundation, SCREMS: Scientific Computing Research Environments for the Mathematical Sciences. \$99,330. With Amir Assadi et al. August 15, 2009 — August 14, 2011. Co-PI.
- National Science Foundation research grant “Holographic Algorithms and Reductions” NSF CCF-0830488. Amount \$99,999. August 1, 2008 — July 31, 2011.
- National Science Foundation research grant “Some Problems in Complexity Theory”, NSF CCR-0511679. Amount \$200,000. July 1, 2005 — June 30, 2008.
- National Science Foundation research grant “Some Problems in Structural and Lattice Complexity”, NSF CCR-0208013. Amount \$294,103. September 1, 2002 — August 31, 2005.
- National Science Foundation research grant “Worst-case versus Average-Case Complexity and Applications to Secure Cryptography”, CCR9820806. Amount \$220,004. August 1, 2000 — July 31, 2003.
- National Science Foundation research grant “Realistic Uncheatable Benchmarks”, CCR-9634665. Amount \$242,237. Sept. 1996 — August 1999. co-PI: Min-You Wu.
- National Science Foundation SBE-INT Japan Program “US-Japan Cooperative Research: Complexity Theory for Strategic Goals”, Amount \$30,950. April 1, 1998 — March 31, 2001. co-PIs: Ken Regan, Alan Selman, Mitsunori Ogihara.
- Alfred P. Sloan Foundation Fellowship. \$30,000. 1994 — 1996.
- Presidential Young Investigator Award “A study of computational complexity theory”, CCR-9057486, Sept. 1990 — July. 1995. This award provides a five year grant of up to \$500,000 with matching funds.
- National Science Foundation research grant “Uncheatable Benchmarks”, CCR-9319393. Amount \$134,242. Sept. 1993 — Sept. 1996.
- National Science Foundation REU Grant for supervising research by undergraduate students. Amount \$6,500. 1991 — 1992.
- National Science Foundation research grant “Complexity Bounds in Parallel Computation”, CCR-8709818, Amount \$78,000. 1987 — 1989. co-PI: Michael J. Fischer and Merrick L. Furst.

Some Biographical Listings

- Listed in *Who's Who in America*, (2003) 57th edition.
- Listed in *Who's Who in Science and Engineering*, Premier Edition.

- Listed in *Who's Who in Science and Engineering*, (1996-1997) 3rd edition.
- Listed in *American Men and Women of Science*, 19th Edition.
- Listed in *Who's Who in the Media and Communications*, First Edition. (1998-1999)
- Listed in *Who's Who Among Asian Americans*, First Edition.
- Listed in *International Who's Who of Information Technology*, 1999 Edition.

Publications

BOOK

- *Complexity Dichotomies for Counting Problems vol. 1*
Jin-Yi Cai and Xi Chen. Cambridge University Press. In Press. ISBN: 9781107062375

BOOK EDITED

- *Advances in Computational Complexity Theory*.
Jin-Yi Cai, Editor. DIMACS Series Discrete Mathematics and Theoretical Computer Science, Volume 13. Published by the American Mathematical Society, 1993.

ARTICLES

1. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Dichotomy for Real Holant^c Problems. In submission. <https://arxiv.org/abs/1702.02693>
2. Jin-Yi Cai, Zhiguo Fu, Shuai Shao: A Complexity Trichotomy for the Six-Vertex Model. In submission.
3. Jin-Yi Cai, Zhiguo Fu: Complexity Classification of the Eight-Vertex Model. In submission. <https://arxiv.org/abs/1702.07938>
4. Jin-Yi Cai, Zhiguo Fu, Mingji Xia: Complexity Classification Of The Six-Vertex Model. To appear in *Information and Computation*. <https://arxiv.org/abs/1702.02863>
5. Jin-Yi Cai and Zhiguo Fu: Holographic Algorithm with Matchgates Is Universal for Planar #CSP Over Boolean Domain. In *Proc. of the 49th Annual ACM SIGACT Symposium on Theory of Computing (STOC) 2017*: 842-855. Full version available at <http://arxiv.org/abs/1603.07046> (94 pages).
6. Jin-Yi Cai, Xi Chen and Pinyan Lu: Complexity Dichotomies for Counting Graph Homomorphisms. *Encyclopedia of Algorithms 2016*: 366-369

7. Jin-Yi Cai, Heng Guo and Tyson Williams: Holant Problems. *Encyclopedia of Algorithms* 2016: 918-921
8. Jin-Yi Cai, Pinyan Lu and Mingji Xia: Holographic Algorithms. *Encyclopedia of Algorithms* 2016: 921-926
9. Michael Kowalczyk and Jin-Yi Cai: Holant Problems for 3-Regular Graphs with Complex Edge Functions. *Theory Comput. Syst.* 59(1): 133-158 (2016)
10. Jin-Yi Cai, Zhiguo Fu, Heng Guo and Tyson Williams: A Holant Dichotomy: Is the FKT Algorithm Universal? In *Proc. 56th IEEE Symposium on Foundations of Computer Science (FOCS)* 2015, pp. 1259–1276.
Full version available at <http://arxiv.org/abs/1505.02993> (128 pages).
11. Jin-Yi Cai, Heng Guo and Tyson Williams: The Complexity of Counting Edge Colorings and a Dichotomy for Some Higher Domain Holant Problems. In *Proc. 55th IEEE Symposium on Foundations of Computer Science (FOCS)* 2014. pp. 601–610.
Full version appeared in the Journal *Research in the Mathematical Sciences*, (2016) 3:18 DOI 10.1186/s40687-016-0067-8 (77 pages).
12. Jin-Yi Cai, Heng Guo and Tyson Williams: Holographic Algorithms Beyond Matchgates. *ICALP* (1) 2014. 271-282. Full version available at <http://arxiv.org/abs/1307.7430> (35 pages).
13. Jin-Yi Cai, Andreas Galanis, Leslie Ann Goldberg, Heng Guo, Mark Jerrum, Daniel Stefankovic and Eric Vigoda: #BIS-Hardness for 2-Spin Systems on Bipartite Bounded Degree Graphs in the Tree Nonuniqueness Region. *RANDOM* 2014. 582-595. *J. Comput. Syst. Sci.* 82(5): 690-711 (2016)
14. Jin-Yi Cai, Heng Guo and Tyson Williams: A Complete Dichotomy Rises from the Capture of Vanishing Signatures. *ACM Symposium on the Theory of Computing* (STOC) 2013, 635-644. *SIAM J. Comput.*, 45(5), 16711728. (58 pages) DOI:10.1137/15M1049798
15. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Dichotomy for Holant* Problems with a Function on Domain Size 3. In the Proc. *ACM-SIAM Symposium on Discrete Algorithms* (SODA) 2013. pp 1278–1295. Full version available at <http://arxiv.org/abs/1207.2354> (56 pages)
16. Jin-Yi Cai, Aaron Gorenstein: Matchgates Revisited. *Theory of Computing* (ToC) Volume 10 (2014) Article 868 pp. 401-430.
17. Jin-Yi Cai, Zhiguo Fu: A Collapse Theorem for Holographic Algorithms with Matchgates on Domain Size At Most 4. *Information and Computation*, 149-169 (2014)
18. Jin-Yi Cai: Complexity Dichotomy for Counting Problems. *LATA* 2013: 1-11.

19. Chen Zeng, Jin-Yi Cai, Pinyan Lu, Jeffrey F. Naughton: On optimal differentially private mechanisms for count-range queries. *ICDT 2013*: 261-271
20. Jin-Yi Cai, Xi Chen: Complexity of Counting CSP with Complex Weights. *ACM Symposium on the Theory of Computing (STOC) 2012*: 909-920
J. ACM 64(3): 19:1-19:39 (2017).
21. Jin-Yi Cai, Xi Chen, Heng Guo, Pinyan Lu: Inapproximability after Uniqueness Phase Transition in Two-Spin Systems. *Annual International Conference on Combinatorial Optimization and Applications (COCOA'12)*: 336-347
22. Zhiguo Fu, Jin-Yi Cai: Holographic Algorithms on Domain Size $k > 2$. *Theory and Applications of Models of Computation (TAMC) 2012*: 346-359.
23. Jin-Yi Cai, Michael Kowalczyk: Spin systems on k -regular graphs with complex edge functions. *Theoretical Computer Science* 461: 2-16 (2012). A preliminary version appeared as: Spin Systems on Graphs with Complex Edge Functions and Specified Degree Regularities. *Annual International Computing and Combinatorics Conference (COCOON) 2011*: 146-157.
24. Jin-Yi Cai, Michael Kowalczyk, Tyson Williams: Gadgets and Anti-gadgets Leading to a Complexity Dichotomy. *Proceedings of the 3rd Innovations in Theoretical Computer Science Conference (ITCS 2012)*, pp 452-467. CoRR abs/1108.3383: (2011).
25. Chen Zeng, Jeffrey F. Naughton, Jin-Yi Cai: On differentially private frequent itemset mining. *PVLDB* 6(1): 25-36 (2012)
26. Jin-Yi Cai: Progress in Complexity of Counting Problems. *FAW-AAIM 2011*: 1-3
27. Jin-Yi Cai, Xi Chen, Pinyan Lu: Non-negatively Weighted #CSP: An Effective Complexity Dichotomy. *IEEE Conference on Computational Complexity 2011*: 45-54
28. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Dichotomy for Holant* Problems of Boolean Domain. *ACM-SIAM Symposium on Discrete Algorithms (SODA) 2011*: 1714-1728.
29. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Holographic Algorithms with Matchgates Capture Precisely Tractable Planar #CSP. *Annual Symposium on Foundations of Computer Science (FOCS) 2010*: 427-436. *SIAM J. Comput.* 46(3): 853-889 (2017).
30. Jin-Yi Cai, Xi Chen: A Decidable Dichotomy Theorem on Directed Graph Homomorphisms with Non-negative Weights. *Annual Symposium on Foundations of Computer Science (FOCS) 2010*: 437-446.
31. Jin-Yi Cai, Michael Kowalczyk: Partition Functions on k -Regular Graphs with $\{0, 1\}$ -Vertex Assignments and Real Edge Functions. *Theor. Comput. Sci.* 494: 63-74 (2013).

A preliminary version appeared as: A Dichotomy for k -Regular Graphs with $\{0, 1\}$ -Vertex Assignments and Real Edge Functions. *Theory and Applications of Models of Computation* (TAMC) 2010: 328-339.

32. Jin-Yi Cai, Sangxia Huang, Pinyan Lu: From Holant to #CSP and Back: Dichotomy for Holant^c Problems. *Annual International Symposium on Algorithms and Computation* (ISAAC) 2010: 253-265. Best paper award. *Algorithmica* 64(3): 511-533 (2012)
33. Michael Kowalczyk, Jin-Yi Cai: Holant Problems for Regular Graphs with Complex Edge Functions CoRR abs/1001.0464: (2010) *International Symposium on Theoretical Aspects of Computer Science* (STACS) 2010: 525-536
34. Jin-Yi Cai, Xi Chen and Pinyan Lu. Graph Homomorphisms with Complex Values: A Dichotomy Theorem. Preliminary version in *International Colloquium on Automata, Languages and Programming* (ICALP) (1) 2010: 275-286. *SIAM J. Comput.* 42(3): 924-1029 (2013) (106 pages)
35. Jin-Yi Cai, Xi Chen, Richard J. Lipton, Pinyan Lu: On Tractable Exponential Sums. CoRR abs/1005.2632: (2010). In Proceedings of FAW 2010: 148-159. Best paper award.
36. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Computational Complexity of Holant Problems. *SIAM J. Comput.* 40(4): 1101-1132 (2011)
37. Jin-Yi Cai, Pinyan Lu and Mingji Xia. The Complexity of Complex Weighted Boolean # CSP. *Journal of Computer and System Sciences* 80 (1): 217-236 (2014).
38. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Holant problems and counting CSP. *ACM Symposium on the Theory of Computing* (STOC) 2009: 715-724.
39. Jin-Yi Cai, Pinyan Lu, Mingji Xia. Holographic Reduction, Interpolation and Hardness. *Computational Complexity* 21(4): 573-604 (2012)
40. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Holographic algorithms by Fibonacci gates. *Linear Algebra and its Applications* doi:10.1016/j.laa.2011.02.032
41. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Holographic Algorithms by Fibonacci Gates and Holographic Reductions for Hardness. *IEEE Symposium on Foundations of Computer Science* (FOCS) 2008: 644-653.
42. Jin-Yi Cai, Pinyan Lu, Mingji Xia: A Computational Proof of Complexity of Some Restricted Counting Problems. *Theory and Applications of Models of Computation* (TAMC) 2009: 138-149. *Theor. Comput. Sci.* 412(23): 2468-2485 (2011).

43. Peng Zhang, Jin-Yi Cai, Linqing Tang, Wenbo Zhao: Approximation and Hardness Results for Label Cut and Related Problems. Theory and Applications of Models of Computation (TAMC) 2009: 460-469. *Journal of Combinatorial Optimization* 21(2): 192-208 (2011).
44. Jin-Yi Cai, Xi Chen and Dong Li. A quadratic lower bound for the permanent and determinant problem over any characteristic $\neq 2$. *The 40th Annual ACM Symposium on the Theory of Computing* (STOC) 2008. 491-498. Quadratic Lower Bound for Permanent Vs. Determinant in any Characteristic. *Computational Complexity* 19(1): 37-56 (2010).
45. Jin-Yi Cai, Pinyan Lu, Mingji Xia: A Family of Counter Examples to an Approach to Graph Isomorphism. CoRR abs/0801.1766: (2008)
46. Jin-Yi Cai and Pinyan Lu. Signature Theory in Holographic Algorithms. The 19th International Symposium on Algorithms and Computation (ISAAC 2008), 568-579. *Algorithmica* 61(4): 779-816 (2011).
47. Jin-Yi Cai and Pinyan Lu: Erratum to: Signature Theory in Holographic Algorithms. *Algorithmica* 74(4): 1473-1476 (2016)
48. Jin-Yi Cai and Pinyan Lu. Holographic Algorithms With Unsymmetric Signatures. In proceedings of ACM-SIAM Symposium on Discrete Algorithms (SODA), 2008. 54-63.
49. Jin-Yi Cai. Matchgate Computations and Holographic Algorithms. In the Proceedings of ICCM 2007.
50. Jin-Yi Cai. Holographic Algorithms. In *Current Developments in Mathematics* (2007), pp. 111-150. Edited by S. T. Yau. International Press.
51. Jin-Yi Cai and Pinyan Lu. On Block-wise Symmetric Signatures for Matchgates. Fundamentals of Computation Theory, 16th International Symposium (FCT), Budapest, Hungary, 2007. Lecture Notes in Computer Science 4639, pp 187-198. Springer 2007. Special issue of *Theoretical Computer Science*, selected among best papers from FCT. 411(4-5): 739-750 (2010).
52. Jin-Yi Cai and Pinyan Lu. Holographic Algorithms: The Power of Dimensionality Resolved. The 34th International Colloquium on Automata, Languages and Programming (ICALP), Wroclaw, Poland, 2007. Lecture Notes in Computer Science 4596, pp. 631-642. Winner of the Best Paper Award. *Theor. Comput. Sci.* 410(18): 1618-1628 (2009).
53. Jin-Yi Cai, Pinyan Lu. Basis Collapse in Holographic Algorithms. *IEEE Conference on Computational Complexity (CCC)* 2007, pp 292-304. *Computational Complexity* 17(2): 254-281 (2008).

54. Jin-Yi Cai and Pinyan Lu. Holographic Algorithms: From Art to Science. *The 39th Annual ACM Symposium on the Theory of Computing (STOC) 2007*, 401–410. *J. Comput. Syst. Sci.* 77(1): 41-61 (2011).
55. Jin-Yi Cai and Pinyan Lu. On Symmetric Signatures in Holographic Algorithms. *The 24th Annual Symposium on Theoretical Aspects of Computer Science (STACS), 2007*, 429–440. Available at Electronic Colloquium on Computational Complexity (ECCC) TR06-135. *Theor. Comput. Sci.* 411(4-5): 739-750 (2010).
56. Byron J. Gao, Martin Ester, Hui Xiong, Jin-Yi Cai, Oliver Schulte: The Minimum Consistent Subset Cover Problem: A Minimization View of Data Mining. *IEEE Trans. Knowl. Data Eng.* 25(3): 690-703 (2013). A preliminary version appeared as: The minimum consistent subset cover problem and its applications in data mining. *Proceedings of the 13th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD) 2007*: 310-319.
57. Vinod Yegneswaran, Chris Alfeld, Paul Barford and Jin-Yi Cai. Camouflaging Honey-nets. In *Proceedings of IEEE Global Internet Symposium 2007*, Anchorage, AK, May, 2007.
58. Jin-Yi Cai and Osamu Watanabe. Stringent Relativization—A New Approach for Studying Complexity Classes. *SIGACT News Complexity Theory*, volume 37 number 4, December 2006, pp 47–55.
59. Jin-Yi Cai, Vinay Choudhary and Pinyan Lu. On the Theory of Matchgate Computations. *IEEE Conference on Computational Complexity (CCC) 2007*, 305–318. Available at Electronic Colloquium on Computational Complexity (ECCC)(018): (2006). *Theory of Computing Systems* 45(1): 108-132 (2009).
60. Jin-Yi Cai, Vinay Choudhary. Some Results on Matchgates and Holographic Algorithms. In *Proceedings of ICALP 2006, Part I. Lecture Notes in Computer Science* vol. 4051. pp 703-714. Springer. *International Journal of Software and Informatics*. p. 3-36. Volume 1, No.1, Dec. 2007.
61. Jin-Yi Cai, Vinay Choudhary. Valiant’s Holant Theorem and Matchgate Tensors. In *Proceedings of TAMC 2006. Lecture Notes in Computer Science* vol. 3959. pp 248-261. *Theoretical Computer Science* 384(1): 22-32 (2007).
62. Jin-Yi Cai, Vinod Yegneswaran, Chris Alfeld and Paul Barford. An Attacker-Defender Game for Honey-nets. *J. Comb. Optim.* 22(3): 305-324 (2011). *COCOON 2009*: 7-16.
63. Eric Bach and Jin-Yi Cai. A Novel Information Transmission Problem and its Optimal Solution. *Fundamentals of Computation Theory, 16th International Symposium (FCT), Budapest, Hungary, 2007. Lecture Notes in Computer Science* 4639, pp 64-75. Springer 2007. *Communications in Information & Systems* Volume 9, Number 2 (2009), 141-162.

64. Jin-Yi Cai and Hong Zhu. Progress in Computational Complexity Theory. *Journal of Computer Science and Technology*. Vol. 20, No. 6, Nov 2005, 735–750.
65. Jin-Yi Cai and Venkatesan T. Chakaravathy. A Note on Zero Error Algorithms Having Oracle Access to One NP Query. In Proceedings of COCOON 2005. Lecture Notes in Computer Science vol. 3595. pp 339-348. Journal version appeared as: On zero error algorithms having oracle access to one query. *J. Comb. Optim.* 11(2): 189-202 (2006)
66. Pinyan Lu, Jialin Zhang, Chung Keung Poon and Jin-Yi Cai. Simulating Undirected st-Connectivity Algorithms on Uniform JAGs and NNJAGs. In Proceedings of ISAAC 2005. Lecture Notes in Computer Science vol. 3827. pp 767-776.
67. Jin-Yi Cai and Robert Threlfall. A Note on Quadratic Residuosity and UP. *Information Processing Letters* 92(3): 127-131 (2004).
68. Zheng Huang, Lei Chen III, Jin-Yi Cai, Deborah S. Gross, David R. Musicant, Raghu Ramakrishnan, James J. Schauer and Stephen J. Wright. Mass Spectrum Labeling: Theory and Practice. ICDM 2004: 122-129.
69. Jin-Yi Cai and Osamu Watanabe. Random Access to Advice Strings and Collapsing Results. *The 15th International Symposium on Algorithms and Computation, (ISAAC) 2004*. Lecture Notes in Computer Science 3341, pp 209-220.
70. Jin-Yi Cai and Osamu Watanabe. On Proving Circuit Lower Bounds Against the Polynomial-Time Hierarchy. *SIAM J. Comput.* 33(4): 984-1009 (2004) A preliminary version: On Proving Circuit Lower Bounds Against the Polynomial-Time Hierarchy: Positive and Negative Results. Appeared in the *Proc. of COCOON 2003*, Springer-Verlag Lecture Notes in Computer Science, 2697. pp. 202-211.
71. Jin-Yi Cai and Osamu Watanabe. Relativized collapsing between BPP and PH under stringent oracle access. *Information Processing Letters* 90(3): 147-154 (2004)
72. Jin-Yi Cai, Venkat Chakaravathy and Dieter van Melkebeek. Time-Space Tradeoff In Derandomizing Probabilistic Logspace. In *The 21st Annual Symposium on Theoretical Aspects of Computer Science (STACS)*. Springer-Verlag Lecture Notes in Computer Science, Vol. 2996 (2004) 571–583. *Theory of Computing Systems* 39(1): 189-208 (2006).
73. Jin-Yi Cai and Osamu Watanabe. Stringent Relativization. Plenary invited talk. FSTTCS 2003: Foundations of Software Technology and Theoretical Computer Science, 23rd Conference, Mumbai, India, December 15-17, 2003. Proceedings, Lecture Notes in Computer Science 2914, pp. 408-419.

74. M. Adler, Jin-Yi Cai, J. K. Shapiro and D. Towsley. Estimation of Congestion Price Using Probabilistic Packet Marking.
In Proceedings of INFOCOM 2003, vol 3, Apr. 2003, pp 2068-2078. Full version in UMass Technical Report UM-CS-2002-023.
<ftp://ftp.cs.umass.edu/pub/techrept/techreport/2002/>
75. Jin-Yi Cai. On the Impossibility of Certain Ranking Functions.
International Mathematical Journal, **3**, No. 2, 119–128, (2003).
76. Jin-Yi Cai, Venkat Chakaravarthy, Lane Hemaspaandra, Mitsunori Ogihara. Competing Provers Yield Improved Karp-Lipton Collapse Results.
In the *Proc. of STACS 2003*, Springer-Verlag Lecture Notes in Computer Science. 535-546. *Information and Computation*, 198(1): 1-23 (2005)
77. Jin-Yi Cai and Hong Zhu. Progress in Computational Complexity Theory. *J. Comput. Sci. Technol.* 20(6): 735-750 (2005).
78. Yuan Wang, David DeWitt and Jin-Yi Cai. X-Diff: An Effective Change Detection Algorithm for XML Documents.
19th International Conference on Data Engineering (ICDE 2003), March 5 - March 8, 2003 - Bangalore, India.
79. Jin-Yi Cai and Osamu Watanabe. Relativized Collapsing Results under Stringent Oracle Access.
In Proc. 1st Forum on Information Technology (FIT2002), Sept. 25 - 28, 2002.
80. Jin-Yi Cai, Denis Charles, A. Pavan, Samik Sengupta. On Higher Arthur-Merlin Classes.
Int. J. Found. Comput. Sci. 15(1): 3-19 (2004). A preliminary version appeared in the *Proc. of COCOON 2002*, Springer-Verlag Lecture Notes in Computer Science. pp. 18-27.
81. Jin-Yi Cai. On the Minimum Volume of a Perturbed Unit Cube.
In the *Proc. of ISAAC 2002*, Springer-Verlag Lecture Notes in Computer Science Volume 2518. pp. 67-78.
82. Jin-Yi Cai. $S_2^p \subseteq ZPP^{NP}$.
In *Proc. 42nd IEEE Symposium on Foundations of Computer Science (FOCS)*, 2001, 620–628. *J. Comput. Syst. Sci.* 73(1): 25-35 (2007).
83. Jin-Yi Cai. On the Average-Case Hardness of CVP.
In *Proc. 42nd IEEE Symposium on Foundations of Computer Science (FOCS)*, 2001, 308–317.
84. Jin-Yi Cai and Eric Bach. On Testing for Zero Polynomials by a Set of Points with Bounded Precision.

In the Proceedings of COCOON 2001, Springer-Verlag Lecture Notes in Computer Science, Jie Wang (Ed.) Vol **2108** (2001) 473–482. *Theoretical Computer Science*, 296 (1): 15-25, 2003.

85. Jin-Yi Cai, Venkatesan T. Chakaravarthy, Raghav Kaushik and Jeffrey F. Naughton. On the Complexity of Join Predicates. In the Proceedings of the Symposium on Principles of Database Systems (PODS) 2001, 207–214.
86. Jin-Yi Cai. Essentially Every Unimodular Matrix Defines an Expander. *The 11th International Symposium on Algorithm and Computation (ISAAC) 2000*, Taipei, Taiwan. Plenary Talk. Springer-Verlag Lecture Notes in Computer Science, D. T. Lee and Shang-Hua Teng (Eds.) Vol **1969** (2000) 2–22. *Theory of Computing Systems* Vol. **36**, 105–135 (2003).
87. Jin-Yi Cai. The Complexity of Some Lattice Problems. *The 4th Algorithmic Number Theory Symposium (ANTS IV)*, Leiden, the Netherlands. Plenary Talk. Springer-Verlag Lecture Notes in Computer Science, Wieb Bosma (Ed.) Vol. **1838** (2000) 1–32.
88. Jin-Yi Cai, Richard J. Lipton, Yechezkel Zalcstein. The Complexity of the A B C Problem. *SIAM J. Comput.* 29(6): 1878-1888 (2000).
89. V. Kabanets and J. Cai. Circuit Minimization Problem. In the Proceedings of *The 32nd Annual ACM Symposium on the Theory of Computing (STOC)*, 2000, pp 73-79.
90. Jin-Yi Cai and Ajay Nerurkar. A note on the non-NP-hardness of approximate lattice problems under general Cook reductions. *Information Processing Letters*, 76(1-2): 61-66 (2000).
91. Jin-Yi Cai. A new transference theorem in the geometry of numbers and applications to Ajtai's connection factor. *Discrete Applied Mathematics* 126(1): 9-31 (2003).
92. Jin-Yi Cai. A New Transference Theorem in the Geometry of Numbers. *Fifth Annual International Computing and Combinatorics Conference (COCOON)*. Springer-Verlag Lecture Notes in Computer Science, T. Asano et. al.(Ed.) Vol. **1627** (1999) 113–122.
93. J.-Y. Cai, G. Havas, B. Mans, A. Nerurkar, J.-P. Seifert and I. Shparlinski. On Routing in Circulant Graphs. *Fifth Annual International Computing and Combinatorics Conference (COCOON)*. Springer-Verlag Lecture Notes in Computer Science, T. Asano et. al.(Ed.) Vol. **1627** (1999) 360–369.

94. Jin-Yi Cai, Ajay Nerurkar and D. Sivakumar. Hardness and Hierarchy Theorems for Probabilistic Quasi-polynomial Time.
In the Proceedings of *The 31st Annual ACM Symposium on the Theory of Computing (STOC)*, 726–735, 1999.
95. Jin-Yi Cai. Applications of a New Transference Theorem to Ajtai’s Connection Factor.
In the Proceedings of *The 14th Annual IEEE Conference on Computational Complexity*, 205–214, 1999.
96. Jin-Yi Cai. Some Recent Progress on the Complexity of Lattice Problems.
Plenary Talk. In the Proceedings of *The 14th Annual IEEE Conference on Computational Complexity*, 158–177, 1999.
97. J-Y. Cai, A. Pavan and D. Sivakumar. On the Hardness of Permanent.
In the Proceedings of *The 16th Annual Symposium on Theoretical Aspects of Computer Science (STACS)*. Springer-Verlag Lecture Notes in Computer Science, Ch. Meinel and S. Tison (Ed.), Vol. **1563** (1999) 90–99.
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In *Encyclopedia of Electrical and Electronics Engineering*. Published by John Wiley and Sons (John G. Webster, Editor), 1999. pp 415–426.
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100. J-Y. Cai and A. Nerurkar. Approximating the SVP to Within a Factor $\left(1 + \frac{1}{\dim^\epsilon}\right)$ is NP-hard under Randomized Reductions.
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101. Jin-Yi Cai and Tom Cusick. A Lattice-Based Public-Key Cryptosystem.
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102. Jin-Yi Cai, Ajay Nerurkar and Min-You Wu. The Design of Uncheatable Benchmarks using Complexity Theory.
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106. Jin-Yi Cai, D. Sivakumar and Martin Strauss. Constant Depth Circuits and the Lutz Hypothesis. In *Proc. 38th IEEE Symposium on Foundations of Computer Science (FOCS)*, 1997, 595–604.
107. Jin-Yi Cai. A Relation of Primal-Dual Lattices and the Complexity of Shortest Lattice Vector Problem. *Theoretical Computer Science* (207), 1998, pp 105–116.
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132. Jin-Yi Cai, Anne Condon and Richard Lipton. On Bounded Round Multi-Prover Interactive Proof Systems.
 In the Proceedings of *The Structure in Complexity Theory Conference*, (1990) 45–54.
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 Appeared in *Complexity Theory—Current Research*, 101–146, edited by Klaus Ambos-Spies, Steve Homer and Uwe Schöning, Cambridge University Press, 1993. A preliminary version appeared in *The 17th Symposium on Mathematical Foundations of Computer Science* (1992), 162–171. Springer-Verlag *Lecture Notes in Computer Science* Vol. **629**.
139. Jin-Yi Cai. Computations Over Infinite Groups.
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152. Jin-Yi Cai. Probability One Separation of the Boolean Hierarchy. In the Proceedings of *The 4th Annual Symposium on Theoretical Aspects of Computer Science*, Springer-Verlag Lecture Notes in Computer Science, F. J. Brandenburg, G. Vidal-Naquet and M. Wirsing (Ed.), Vol. **247**, (1987)148-158.
153. Jin-Yi Cai and Lane Hemachandra. The Boolean Hierarchy: Hardware over NP, In the Proceedings of *The Structure in Complexity Theory Conference*, (1986) 105–124.
154. Jin-Yi Cai and Gabriele Meyer. Graph Minimal Uncolorability is D^P -complete. *SIAM Journal on Computing*, Vol. **16** No. 2 (1987) 259–277. Published by SIAM. A preliminary version appeared as:
On the Complexity of Graph Critical Uncolorability.
In the Proceedings of *The 14th International Colloquium on Automata, Languages and Programming (ICALP)*, Springer-Verlag Lecture Notes in Computer Science, Thomas Ottmann (Ed.) Vol. **267** (1987) 394–403.
155. Jin-Yi Cai and Tom Coleman. The Cyclic Coloring Problem and Estimation of Sparse Hessian Matrices. *SIAM Journal on Discrete and Algebraic Methods*, Vol. **7** No. 2 (1986) 221-235. Published by SIAM.

Professional Activities

- Editor of JOURNAL OF COMPUTER AND SYSTEM SCIENCES.
- Editor of INTERNATIONAL JOURNAL OF FOUNDATIONS OF COMPUTER SCIENCE.
- Associate Editor of JOURNAL OF COMPLEXITY.
- Associate Editor of JOURNAL OF COMPUTATIONAL COMPLEXITY.
- Area Editor of INTERNATIONAL JOURNAL OF SOFTWARE AND INFORMATICS (IJSI).

- Member of the Editorial Board of THE CHICAGO JOURNAL OF THEORETICAL COMPUTER SCIENCE.
- Former Member of the Scientific Board for ELECTRONIC COLLOQUIUM ON COMPUTATIONAL COMPLEXITY.
- Former Associate Editor of JOURNAL OF COMPUTER SCIENCE AND TECHNOLOGY.
- Special issue editor for THE JOURNAL OF COMPUTER AND SYSTEM SCIENCES.
- Special issue editor for ALGORITHMICA.
- A founder of the conference series Theory and Applications of Models of Computation (TAMC).
- Program committee member for *The Structure in Complexity Theory Conference*, 1993, San Diego, California.
- Chair of the program committee for *The Annual Conference on Computational Complexity (Formerly The Structure in Complexity Theory Conference)*, 1996, Philadelphia, Pennsylvania.
- Co-chair of the program committee for *The Annual International Computing and Combinatorics Conference*, 1996, Hong Kong.
- Program committee member for *The 28th Annual ACM Symposium on Theory of Computing (STOC)*, 1996.
- Program committee member for *The 18th International Conference on Foundations of Software Technology & Theoretical Computer Science (FST&TCS)*, 1998, Chennai, India.
- Program committee member for *International Workshop on Cryptographic Techniques and E-Commerce (CrypTEC '99)*, 1999, Hong Kong, China.
- Program committee member for *The Tenth Annual International Computing and Combinatorics Conference*, 2004.
- Program committee member for *The Second Annual Conference on Computation and Logic*, 2005.
- Program committee member for *The 37th Annual ACM Symposium on Theory of Computing (STOC)*, 2005.
- Conference co-organizer for the Third International Conference of Theory and Applications of Models of Computation (TAMC), 2006.
- Program Committee Chair for the Fourth International Conference of Theory and Applications of Models of Computation (TAMC), 2007.

- Program Committee member for Algorithms and Computation, 16th International Symposium, ISAAC 2007.
- Conference committee member for *The Annual Conference on Computational Complexity*, 1996–2001.
- Organizer for DIMACS workshops in the complexity special year 1990–91.
- Panel member for various NSF review panels, starting with NSF Research Initiation Award in 1993–1994.
- Referee for the National Science Foundation grant proposals.
- Referee for various professional journals and publishers: *Journal of ACM*, *SIAM Journal of Computing*, *Journal of Computer and Systems Science*, *International Journal of Foundations of Computer Science*, *Theoretical Computer Science*, *Mathematical Systems Theory*, *Information and Computation* and formerly *Information and Control*, *Journal of Complexity*, Princeton University Press, *Information Processing Letters*, *The IEEE Transactions on Computers*, and *Journal of Parallel and Distributed Computing*, etc.
- Referee for various conferences: *The IEEE Annual Symposium on Foundations of Computer Science* (FOCS), *The ACM Annual Symposium on the Theory of Computing* (STOC), *The Structure in Complexity Theory Conference*, *The Annual International Computing and Combinatorics Conference* (Cocoon), etc.

Invited, Plenary Speaker at Major Conferences or Named Lectures

- ShanghaiTech Symposium on Information Science and Technology (SSIST) 2016.
- The 7th International Conference on Language and Automata Theory and Applications, LATA 2013, Bilbao, Spain.
- Distinguished Lecture, 2013, Temple University.
- FAW-AAIM 2011 Invited Speaker, Jinhua, China.
- Asian Association for Algorithms and Computation (AAAC), 2010, Pohang, Korea.
- Robert Stewart Distinguished Lecture, 2008, Iowa State University.
- CST 10th Anniversary Celebration Lecture, 2008, Temple University.
- Distinguished Lecture, 2007, Texas A&M University.
- *The 11th International Symposium on Algorithm and Computation* (ISAAC) 2000, Taipei, Taiwan.

- *Algorithmic Number Theory*, the 4th International Symposium, (ANTS-IV) 2000, Leiden, The Netherlands.
- *IEEE Annual Conference on Computational Complexity* 1999 at FCRC, Atlanta, GA.
- *University of Maryland Theory Day* 1993.
- *Fundamentals of Computation Theory (FCT)* 1991, Berlin, Germany.

Colloquia Seminar Talks

University of California, Los Angeles; University of California, Berkeley MSRI; Cornell University; Columbia University; Yale University; IBM Thomas J. Watson Research Center, Yorktown Heights; Princeton University; Brown University; Stanford University; University of California, Davis; University of Oregon, Eugene; University of Washington, Seattle; Carnegie Mellon University; The Johns Hopkins University; Washington University in St. Louis; University of Texas, Austin; University of Texas, San Antonio; Texas A&M University; Universität Würzburg; University of Maryland, College Park; Rutgers University; State University of New York at Buffalo, Mathematics Department; State University of New York at Buffalo, Computer Science Department; University of Delaware; McMaster University; Rensselaer Polytechnic Institute; University of Toronto; University of Waterloo; The Chinese Academy of Sciences, Software Institute; The Chinese Academy of Sciences, Mathematics Institute; Fudan University; The Science Foundation, Shanghai, China; The Weizmann Institute of Science, Israel; University of Southern California; DIMACS at Rutgers University; Bell Communications Research (Bellcore); The Chinese Academy of Sciences, Applied Mathematics Institute; Invited Speaker at the AMS meeting—Special Session on Complexity Theory, Greensboro, North Carolina; University of Minnesota, Minneapolis; University of Illinois, Urbana-Champaign; University of Wisconsin, Mathematics Department, Madison; University of Wisconsin, Computer Sciences Department, Madison; International Computer Science Institute (ICSI) at Berkeley; University of Würzburg; University of Ulm; Aachen, Bonn, Berlin, Wrocław, Budapest, Venice, Grenoble, Leiden, Schloss Dagstuhl, National University of Singapore; University of Malaysia; DIMACS Workshop at Princeton University; University of Kentucky; Massachusetts Institute of Technology; NEC Research; Fields Institute, University of Toronto; Invited Speaker at the Canadian Mathematics Society annual meeting, Kingston; IBM Research - Almaden; Isaac Newton Institute for Mathematical Sciences; Tsinghua University; Beijing University, Mathematics Department; Renmin University; Shandong University; Fudan University, Mathematics Institute; City University of Hong Kong; Shanghai Jiaotong University; University of Szeged; Microsoft Research Asia; University of Massachusetts; California Institute of Technology; University of Rochester; Harvard University, Yau Seminar; Harvard University, Computer Science Colloquium and Theory Seminar; Boston University; Tufts University; Radcliff Institute; MIT; University of Montreal; University of Illinois at Chicago; Iowa State University; Indiana University-Purdue University Indianapolis; University of Notre Dame; Pennsylvania State University, University Park; Georgia Institute of Technology; Univer-

sity of Chicago; Northwestern University; University of Michigan, Ann Arbor; Institute for Advanced Study, School of Mathematics.

Courses Taught

- Discrete Mathematics
- Introduction to Theoretical Computer Science
- Data Structures
- Data Structures and Algorithms
- Design and Analysis of Algorithms
- Topics in Complexity Theory
- Mathematical Foundations of Computer Science
- Introduction to the Theory of Computation
- Concrete Mathematics
- Automata Theory

Departmental and University Committees

- Award Committee (2015–)
- University Committee on Honorary Degrees (2013–2016)
- Undergraduate Advising Committee (2013-2014)
- Physical Sciences Divisional Committee (2011–2014)
- Graduate School Research Committee (2010-2011)
- Award Committee Chair (2008–2009)
- Award Committee (2006–2007)
- Recruiting Committee (2004-2005)
- Award Committee Chair (2004-2005)
- Recruiting Committee (2003-2004)
- Award Committee Chair (2003-2004)

- Rosser Lecture Chair (2002-2004)
- Colloquium Committee Chair (2002-2003)
- Recruiting Committee (2000–2001)
- Ad Hoc Committee Chair for Tenure of Cluster Hiring Candidate (2000)
- College of Arts and Sciences Tenure and Promotion Committee (1998–2000)
- Faculty of Natural Science and Math Tenure and Promotion Committee (1997–1998)
- Director of Graduate Studies (1996–1998)
- Faculty Senator (1996–1997)
- Departmental Tenure and Personnel Committee (1993–2000)
- Internship Chair (1994–96)
- Recruitment Committee (1994–96)
- Graduate Studies Committee (1993–1994)
- Colloquium Committee Chair (1993–1994)
- Ad Hoc Infrastructure Committee (1993–1994)
- Advisory Council for FNSM Science Alumni Association (1995–1998)
- Graduate Admissions Affairs (1989–1993)
- Graduate Qualifying Exam Affairs (1989–1993)
- United Way Campaign Coordinator (1991–1992 and 1992–1993)

Student Supervision

- Thesis Advisor for Sigal Ar. Ph. D. from Princeton University, 1993. Thesis title: “Trustworthy Computations”.
- Thesis Advisor for Ajay Nerurkar. Ph. D. from SUNY Buffalo, 1999. Thesis title: “Average-Case versus Worst-Case Complexity of Computation”.
- Thesis Advisor for Venkatesan Chakaravarthy. Ph. D. from University of Wisconsin, Madison, 2004. Thesis title: “On Some Computational Problems in Randomization, Interaction and Inapproximability”.

- External Thesis Advisor for Pinyan Lu, Ph. D. from Tsinghua University, Beijing, 2008. Thesis title: “The Complexity of Counting Problems and Holographic Algorithms”.
- Thesis Advisor for Michael Kowalczyk. Ph. D. from University of Wisconsin, Madison, 2010. Thesis title: “Dichotomy Theorems for Holant Problems”.
- External Thesis Advisor for Liang Li, Ph. D. from Beijing University, Beijing, 2013. Thesis title: “Approximate Counting via Correlation Decay”.
- Thesis Advisor for Heng Guo. Ph. D. from University of Wisconsin, Madison, 2015. Thesis title: “Complexity Classification of Exact and Approximate Counting Problems.” **Winner** of the Distinguished Dissertation Award 2016 from European Association for Theoretical Computer Science (EATCS).
- Thesis Advisor for Tyson Williams. Ph. D. from University of Wisconsin, Madison, 2015. Thesis title: “Advances in the Computational Complexity of Holant Problems.”
- Currently supervising Ph. D. students: Artem Govorov, Tianyu Liu and Shuai Shao.
- Post-doc supervisor for Zhiguo Fu.
- Post-doc supervisor for Mingji Xia.
- Post-doc supervisor for Yitong Yin.
- Post-doc supervisor for Juying Zhou.
- Post-doc supervisor for Gabor Ivanyos.
- Project advisor for Tibor Beke at Princeton University, funded by an NSF REU grant.
- Project advisor for Mike Rubinstein at Princeton University, funded by an NSF REU grant.