

# 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

- 2000—        Computer Sciences Department, University of Wisconsin at Madison.  
                 Professor
- 2025—        Juris Hartmanis Professor in Computer Science (WARF)
- 2024—        Rajiv & Ritu Batra Chair in Computer Science.
- 2014—2024   University of Wisconsin at Madison.  
                 Steenbock Professor in Mathematical Sciences
- 2003—        Mathematics Department, University of Wisconsin at Madison.  
                 Professor (0-time 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

- Juris Hartmanis Professor in Computer Science (WARF), 2025.
- Rajiv & Ritu Batra Chair in Computer Science, 2024.
- Simons Fellowship, 2022.
- CCF Award for Overseas Outstanding Contribution, 2022.
- American Mathematical Society (AMS) Fellow, 2022.
- Fulkerson Prize in Discrete Mathematics, 2021.
- Gödel Prize in Theoretical Computer Science, 2021.
- Elected a Foreign Member of Academia Europaea, 2017.
- University House Instructor Award in 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

- WARF Professorship. \$100,000. 07/01/25–06/30/30.
- Simons: Complexity Dichotomy for Counting Problems MSN258175 Award Number: 920610 \$132,000.00. 09/01/22–8/31/23.
- National Science Foundation REU, \$8,000.00. 07/01/20–06/30/21.
- National Science Foundation: “Classification Program for Counting Problems”, \$450,000.00. 09/01/17–8/31/21.
- 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. November 2017. 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 and Ashwin Maran. Polynomial and analytic methods for classifying complexity of planar graph homomorphisms. (118 pages.) In submission.  
<https://arxiv.org/pdf/2412.17122>
2. Jin-Yi Cai and Ben Young: Quantum Algorithms for Discrete Log Require Precise Rotations. *ACM Transactions on Quantum Computing*. To appear.
3. Yin Liu, Austen Z. Fan, Jin-Yi Cai: Restricted holant dichotomy on domain sizes 3 and 4. *Theor. Comput. Sci.* 1023: 114931 (2025)
4. Jin-Yi Cai and Jin Soo Ihm: Holant\* Dichotomy on Domain Size 3: A Geometric Perspective. *ICALP 2025*: 148:1-148:18
5. Jin-Yi Cai: Shor's Algorithm Does Not Factor Large Integers in the Presence of Noise. *SCIENCE CHINA Information Sciences* (2024) <https://doi.org/10.1007/s11432-023-3961-3>
6. Jin-Yi Cai, Jacob Kruse, Kenneth Mayer, Daniel P. Szabo: A Uniformly Random Solution to Algorithmic Redistricting. *CoRR* abs/2402.13868 (2024)
7. Yin Liu, Austen Z. Fan, Jin-Yi Cai: Restricted Holant Dichotomy on Domains 3 and 4. *Theoretical Computer Science* <https://doi.org/10.1016/j.tcs.2024.114931> Volume 1023, 1 January 2025, 114931
8. Niclas Boehmer, Jin-Yi Cai, Piotr Faliszewski, Austen Z. Fan, Lukasz Janeczko, Andrzej Kaczmarczyk, Tomasz Was: Properties of Position Matrices and Their Elections. *Proceedings of the AAAI Conference on Artificial Intelligence*, 37(5), 5507-5514. <https://doi.org/10.1609/aaai.v37i5.25684>
9. Jin-Yi Cai and Ashwin Maran: The Complexity of Counting Planar Graph Homomorphisms of Domain Size 3. *STOC 2023: Proceedings of the 55th Annual ACM Symposium on Theory of Computing*. June 2023. Pages 1285–1297.
10. Jin-Yi Cai and Ben Young: Planar #CSP Equality Corresponds to Quantum Isomorphism - A Holant Viewpoint. *50th International Colloquium on Automata, Languages, and Programming (ICALP 2023)* : 33:1-33:17.  
*ACM Transactions on Computation Theory* 16(3): 18:1-18:41 (2024)
11. Jin-Yi Cai, Zhiguo Fu: Complexity Classification of the Eight-Vertex Model. *Inf. Comput.* 293: 105064 (2023)
12. Jin-Yi Cai, Austen Z. Fan, Yin Liu: Bipartite 3-regular counting problems with mixed signs. *J. Comput. Syst. Sci.* 135: 15-31 (2023)

13. Austen Z. Fan, Jin-Yi Cai: Dichotomy result on 3-regular bipartite non-negative functions. *Theor. Comput. Sci.* 949: 113745 (2023)
14. Zhiguo Fu, Jin-Yi Cai: Holographic Algorithms on Domains of General Size. *Theory Comput. Syst.* 67(3): 417-436 (2023)
15. Jin-Yi Cai, Zhiguo Fu, Heng Guo and Tyson Williams: FKT is Not Universal — A Planar Holant Dichotomy for Symmetric Constraints. *Theory Comput. Syst.* 66(1): 143-308 (2022) (**165** pages)
16. Jin-Yi Cai, Ashwin Maran: Counting Cycles on Planar Graphs in Subexponential Time. COCOON 2022: 268-279 *Algorithmica* 86(2): 656-693 (2024)
17. Jin-Yi Cai, Daniel P. Szabo: Bounded Degree Nonnegative Counting CSP. *ACM Transactions on Computation Theory*, Volume 16 Issue 2 [doi.acm.org?doi=3632184](https://doi.org/10.1145/3632184)
18. Jin-Yi Cai, Tianyu Liu: An FPTAS for the square lattice six-vertex and eight-vertex models at low temperatures. *Proceedings of the 2021 ACM-SIAM Symposium on Discrete Algorithms (SODA) 2021*: 1520-1534  
<https://doi.org/10.1137/1.9781611976465.92>
19. Jin-Yi Cai, Zhiguo Fu, Shuai Shao: New Planar P-time Computable Six-Vertex Models and a Complete Complexity Classification. *Proceedings of the 2021 ACM-SIAM Symposium on Discrete Algorithms (SODA) 2021*: 1535-1547  
<https://doi.org/10.1137/1.9781611976465.93>
20. Jin-Yi Cai, Artem Govorov: The complexity of counting edge colorings for simple graphs. *Theor. Comput. Sci.* 889: 14-24 (2021)
21. Jin-Yi Cai, Artem Govorov: Dichotomy for Graph Homomorphisms with Complex Values on Bounded Degree Graphs.  
<https://arxiv.org/pdf/2004.06620.pdf> (99 pages).  
In the *Proceedings of the 61st Annual IEEE Symposium on Foundations of Computer Science (FOCS) 2020*: 1103-1111.
22. Shuai Shao, Jin-Yi Cai: A Dichotomy for Real Boolean Holant Problems.  
<https://arxiv.org/pdf/2005.07906.pdf> (92 pages).  
In the *Proceedings of the 61st Annual IEEE Symposium on Foundations of Computer Science (FOCS) 2020*: 1091-1102.
23. Jin-Yi Cai, Zhiguo Fu, Shuai Shao: From Holant to Quantum Entanglement and Back. <https://arxiv.org/abs/2004.05706>.  
*International Colloquium on Automata, Languages and Programming (ICALP) 2020*: 22:1-22:16.

24. Artem Govorov, Jin-Yi Cai, Martin Dyer: A Dichotomy for Bounded Degree Graph Homomorphisms with Nonnegative Weights. International Colloquium on Automata, Languages and Programming (ICALP) 2020: 66:1-66:18. *J. Comput. Syst. Sci.* 132: 1-15 (2023)
25. Jin-Yi Cai, Tianyu Liu: Counting perfect matchings and the eight-vertex model. International Colloquium on Automata, Languages and Programming (ICALP) 2020: 23:1-23:18.
26. Jin-Yi Cai, Artem Govorov: On a Theorem of Lovász that  $\text{hom}(\cdot, H)$  Determines the Isomorphism Type of  $H$ . Innovations in Theoretical Computer Science (ITCS) 2020: 17:1-17:15. *ACM Trans. Comput. Theory* 13(2): 11:1-11:25 (2021)
27. Jin-Yi Cai, Zhiguo Fu, Shuai Shao: Beyond #CSP: A Dichotomy for Counting Weighted Eulerian Orientations with ARS. *Information and Computation* volume 275: (2020) <https://doi.org/10.1016/j.ic.2020.104589>
28. Jin-Yi Cai, Tianyu Liu, Pinyan Lu, Jing Yu: Approximability of the Eight-vertex Model. *Computational Complexity Conference* 2020: 4:1-4:18.
29. Jin-Yi Cai, Artem Govorov: Perfect Matchings, Rank of Connection Tensors and Graph Homomorphisms. Symposium on Discrete Algorithms (SODA) 2019: 476-495. *Combinatorics, Probability and Computing*, 31(2): 268-303 (2022) Cambridge University Press.
30. Jin-Yi Cai, Tianyu Liu, Pinyan Lu: Approximability of the Six-vertex Model. Symposium on Discrete Algorithms (SODA) 2019: 2248-2261
31. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Dichotomy for Real Holant<sup>c</sup> Problems. *ACM-SIAM Symposium on Discrete Algorithms* (SODA) 2018: 1802-1821
32. Jin-Yi Cai, Zhiguo Fu, Kurt Girstmair, Michael Kowalczyk: A Complexity Trichotomy for  $k$ -Regular Asymmetric Spin Systems Using Number Theory. *Innovations in Theoretical Computer Science* (ITCS) 2018: 2:1-2:22 *Comput. Complex.* 32(1): 4 (2023).
33. Jin-Yi Cai, Heng Guo, Tyson Williams: Clifford gates in the Holant framework. *Theor. Comput. Sci.* 745: 163-171 (2018)
34. Jin-Yi Cai, Zhiguo Fu, Mingji Xia: Complexity Classification of The Six-Vertex Model. *Inf. Comput.* 259: 130-141 (2018)
35. 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. *SIAM J. Comput.* special issue for selected papers of STOC. <https://doi.org/10.1137/17M1131672> (102 pages)

36. Jin-Yi Cai, Xi Chen and Pinyan Lu: Complexity Dichotomies for Counting Graph Homomorphisms. *Encyclopedia of Algorithms 2016*: 366-369
37. Jin-Yi Cai, Heng Guo and Tyson Williams: Holant Problems. *Encyclopedia of Algorithms 2016*: 918-921
38. Jin-Yi Cai, Pinyan Lu and Mingji Xia: Holographic Algorithms. *Encyclopedia of Algorithms 2016*: 921-926
39. Michael Kowalczyk and Jin-Yi Cai: Holant Problems for 3-Regular Graphs with Complex Edge Functions. *Theory Comput. Syst.* 59(1): 133-158 (2016)
40. 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.
41. 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).
42. Jin-Yi Cai, Heng Guo and Tyson Williams: Holographic Algorithms Beyond Matchgates. *ICALP (1) 2014*. 271-282. *Inf. Comput.* 259(1): 102-129 (2018)
43. 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)
44. 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), 1671-1728. 2016. (58 pages) DOI:10.1137/15M1049798
45. 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)  
To appear in *Information & Computation*.
46. Jin-Yi Cai, Aaron Gorenstein: Matchgates Revisited. *Theory of Computing (ToC) Volume 10 (2014) Article 868* pp. 401-430.
47. 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)

48. Jin-Yi Cai: Complexity Dichotomy for Counting Problems. *LATA 2013*: 1-11.
49. Chen Zeng, Jin-Yi Cai, Pinyan Lu, Jeffrey F. Naughton: On optimal differentially private mechanisms for count-range queries. *ICDT 2013*: 261-271
50. 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).
51. 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
52. Zhiguo Fu, Jin-Yi Cai: Holographic Algorithms on Domain Size  $k > 2$ . *Theory and Applications of Models of Computation (TAMC) 2012*: 346-359.
53. 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.
54. 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). *ACM Transactions on Computation Theory (TOCT)* 11(2): 7:1-7:26 (2019)
55. Chen Zeng, Jeffrey F. Naughton, Jin-Yi Cai: On differentially private frequent itemset mining. *PVLDB* 6(1): 25-36 (2012)
56. Jin-Yi Cai: Progress in Complexity of Counting Problems. *FAW-AAIM 2011*: 1-3
57. Jin-Yi Cai, Xi Chen, Pinyan Lu: Non-negatively Weighted #CSP: An Effective Complexity Dichotomy. *IEEE Conference on Computational Complexity* 2011: 45-54
58. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Dichotomy for Holant\* Problems of Boolean Domain. *ACM-SIAM Symposium on Discrete Algorithms (SODA) 2011*: 1714-1728. *Theory Comput. Syst.* 64(8): 1362-1391 (2020)
59. 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).
60. 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. *Computational Complexity* 28(3): 345-408 (2019)

61. 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.
62. Jin-Yi Cai, Sangxia Huang, Pinyan Lu: From Holant to  $\#$ CSP and Back: Dichotomy for Holant<sup>c</sup> Problems. *Annual International Symposium on Algorithms and Computation (ISAAC)* 2010: 253-265. Best paper award. *Algorithmica* 64(3): 511-533 (2012)
63. 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
64. 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)
65. 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.
66. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Computational Complexity of Holant Problems. *SIAM J. Comput.* 40(4): 1101-1132 (2011)
67. 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).
68. Jin-Yi Cai, Pinyan Lu, Mingji Xia: Holant problems and counting CSP. *ACM Symposium on the Theory of Computing (STOC)* 2009: 715-724.
69. Jin-Yi Cai, Pinyan Lu, Mingji Xia. Holographic Reduction, Interpolation and Hardness. *Computational Complexity* 21(4): 573-604 (2012)
70. 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
71. 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.
72. 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).

73. 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).
74. 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).
75. Jin-Yi Cai, Pinyan Lu, Mingji Xia: A Family of Counter Examples to an Approach to Graph Isomorphism. CoRR abs/0801.1766: (2008)
76. 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).
77. Jin-Yi Cai and Pinyan Lu: Erratum to: Signature Theory in Holographic Algorithms. *Algorithmica* 74(4): 1473-1476 (2016)
78. Jin-Yi Cai and Pinyan Lu. Holographic Algorithms With Unsymmetric Signatures. In proceedings of ACM-SIAM Symposium on Discrete Algorithms (SODA), 2008. 54-63.
79. Jin-Yi Cai. Matchgate Computations and Holographic Algorithms. In the Proceedings of ICCM 2007.
80. Jin-Yi Cai. Holographic Algorithms. In *Current Developments in Mathematics* (2007), pp. 111-150. Edited by S. T. Yau. International Press.
81. 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).
82. 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).
83. 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).

84. 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).
85. 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).
86. 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.
87. 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.
88. 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.
89. 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).
90. 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.
91. 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).
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## Professional Activities

- Committee Chair for Test of Time Awards of FOCS (Foundations of Computer Science).
- Editor of JOURNAL OF COMPUTER AND SYSTEM SCIENCES.
- Former Editor of INTERNATIONAL JOURNAL OF FOUNDATIONS OF COMPUTER SCIENCE.
- Associate Editor of JOURNAL OF COMPLEXITY.

- Associate Editor of JOURNAL OF COMPUTATIONAL COMPLEXITY.
- Associate Editor of JOURNAL OF INFORMATION AND COMPUTATION.
- Former 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**

- The 65th IEEE Symposium on Foundations of Computer Science (FOCS) 2024, Ex-troverted Theory <https://sites.google.com/view/teng-fest>
- International Joint Conference on Theoretical Computer Science (IJTCS) 2020.
- CSE 50th Anniversary Celebration, SUNY Buffalo, 2017.
- 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; University 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
- Introduction to Algorithms
- 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.”
- Thesis Advisor for Tianyu Liu. Ph. D. from University of Wisconsin, Madison, 2020-21. Thesis title: “Approximate Complexity in Statistical Mechanics: Counting and Sampling in the Six- and Eight-Vertex Models.”
- Thesis Advisor for Shuai Shao. Ph. D. from University of Wisconsin, Madison, 2020-21. Thesis title: “Complexity Classification of Counting Problems on Boolean Variables.”
- Thesis Advisor for Artem Govorov. Ph. D. from University of Wisconsin, Madison, 2020-21. Thesis title: “Complexity and Expressibility of Counting Graph Homomorphism Problems”.

- Thesis Advisor for Hugh Liu. Ph. D. from University of Wisconsin, Madison, 2023. Thesis title: “A Journey Through Some Computational Problems.”
- Currently supervising Ph. D. students: Ashwin Maran, Ben Young, Jin Soo Ihm, Zhuxiao Tang, and Austen Fan (co-advisor Paris Koutris)
- 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.
- Project advisor for Dani Szabo at UW-Madison, funded by an NSF REU grant.