

Jaikumar Radhakrishnan

Professor
School of Technology and Computer Science
Tata Institute of Fundamental Research
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Personal Information Date of birth: 30 May 1964.
Nationality: Indian.

Education

- Ph.D. (Computer Science), Rutgers University, NJ, USA, October 1991.
Dissertation: *Graph Entropy and formula complexity*.
Advisor: Prof. Endre Szemerédi.
- B.Tech. (Computer Science and Engineering), Indian Institute of Technology, Kharagpur, India, 1985.

Research Interests Randomness and Computation, Combinatorial and Algebraic Methods in Complexity Theory, Information Theory, Quantum Computing.

PhD Students

1. K V Subrahmanyam. Dissertation: Problems in monotone contact networks, TIFR Mumbai, 1994.
2. S Venkatesh. Dissertation: Combinatorial problems in data structures, TIFR Mumbai, 2000.
3. Pranab Sen. Dissertation: Algebraic problems in computational complexity, TIFR Mumbai, 2001.
4. Sivaramakrishnan Sivasubramaniam. Dissertation: Algorithms for hard problems, TIFR Mumbai, 2005.
5. Rahul Jain. Thesis: Information theoretic problems in computational complexity, TIFR Mumbai, 2005.
6. Chinmoy Dutta. Thesis: Lower bounds for noisy computations, TIFR Mumbai, 2009.
7. Saswata Shannigrahi. Thesis: Coloring, embedding, compression and data structure problems on uniform hypergraphs, TIFR Mumbai, 2011.

Work Experience

1. Professor. School of Technology and Computer Science, Tata Institute of Fundamental Research, since Feb. 2007.
2. Visiting Professor. Toyota Technological Institute at Chicago, since Oct. 2004–Sep. 2006.
3. Associate Professor. School of Technology and Computer Science, Tata Institute of Fundamental Research, since Aug. 2000–Feb. 2007.
4. Reader. School of Technology and Computer Science, Tata Institute of Fundamental Research, Feb. 97 to Aug. 2000.
5. Postdoctoral visitor. Computer Science Department, The Hebrew University of Jerusalem, Oct. 96 to Oct. 97 (on leave from TIFR).
6. Fellow, Theoretical Computer Science Group, Tata Institute of Fundamental Research, Feb. 92 to Feb. 97.
7. Visiting Associate Professor, School of Information Science. Japan Advanced Institute of Science and Technology, Hokuriku, Japan, Oct. 92 to Sept. 93 (on leave from TIFR).
8. Visiting Fellow, Theoretical Computer Science Group, Tata Institute of Fundamental Research, Sept. 91 to Jan. 92.
9. Associate Systems Engineer, CMC Ltd., Calcutta, June 85 to June 86.

Recognition

- Machtey Award for the best student paper by the FOCS 91 program committee for the paper “Better bounds for threshold formulas” (jointly with two other papers).
- Associate of the Indian Academy of Sciences for the period 1994–99.
- Fellow of the Indian Academy of Sciences, since 2007.
- Shanti Swarup Bhatnagar Prize for Science and Technology in the area of Mathematical Sciences, 2008

Conference Papers

- C1 “Better bounds for threshold formulas.” 32nd FOCS, 1991, 314–323.
- C2 “On the complexity of parallel prefix problems on small domains.” 33rd FOCS, 1992, 638–647. (With Shiva Chaudhuri.)
- C3 “Directed vs. undirected monotone contact networks for threshold functions.” 34th FOCS, 1993, 604–613. (With Magnús M. Halldórsson and K. V. Subrahmanyam.)
- C4 “On some communication complexity problems related to threshold functions.” 13th FST&TCS, LNCS 761, December 1993, pp. 248–259. (With Magnús M. Halldórsson and K. V. Subrahmanyam.)
- C5 “Greed is good: approximating independent sets in sparse and bounded degree graphs.” 26th STOC, 1994, 439–448. (With Magnús Halldórsson.)
- C6 “Improved approximations of independent sets in bounded-degree graphs.” 4th SWAT, LNCS 824, 1994, 195–206. (With Magnús Halldórsson.)
- C7 “Deterministic restrictions in circuit complexity.” 28th STOC, 1996, 30–36. (With Shiva Chaudhuri.)
- C8 “The randomized complexity of maintaining the minimum.” SWAT, 1996, pp. 337–351. (With Shiva Chaudhuri and Gerth Brodal.)
- C9 “Tight bounds for depth-two superconcentrators.” 38th FOCS, 1997, 585–594. (With Amnon Ta-Shma.)
- C10 “Improved bounds and algorithms for hypergraph two-coloring.” 19th FOCS, 1998, 684–693. (With Aravind Srinivasan.)
- C11 “Robust asynchronous protocols are finite-state.” 5th ICALP, LNCS 1443, 1998, 188–199. (With M. Mukund, K. Narayan Kumar, and Milind Sohoni.)
- C12 “Towards a Characterisation of Finite-State Message-Passing Systems.” ASIAN, LNCS 1538, 1998, 282–299. (With M. Mukund, K. Narayan Kumar, and Milind Sohoni.)
- C13 “The complexity of pointer chasing: applications of entropy and sampling.” 31st STOC, 1999, 602–611. (With S. Venkatesh and S. Ponzio.)
- C14 “Are bitvectors optimal?” 32nd STOC, 2000, 449–458. (With H. Buhrman, P B Miltersen, and S. Venkatesh.)
- C15 “The quantum complexity of set membership.” 21st FOCS, 2000, 554–562. (With Pranab Sen and S. Venkatesh.)
- C16 “Depth-3 arithmetic circuits for $S_n^2(X)$ and extensions of the Graham-Pollack theorem.” FST&TCS, 2000, 176–187. (With Pranab Sen and Sundar Vishwanathan.)
- C17 “Explicit deterministic constructions for membership in the bitprobe model.” ESA, 2001, 290–299. (With Venkatesh Raman and S. Srinivasa Rao.)

- C18 “Better lower bounds for locally decodable codes.” *Computational Complexity*, 2002, 184-193. (With Amit Deshpande, Rahul Jain, T. Kavitha, and Satyanarayana V. Lokam.)
- C19 “Privacy and interaction in quantum communication complexity and a theorem about the relative entropy of quantum states.” *FOCS 2002*, 429–438. (With Pranab Sen and Rahul Jain.)
- C20 “The quantum communication complexity of the pointer chasing problem: the bit version.” *FST&TCS 2002*, 218–229. (With Pranab Sen and Rahul Jain.)
- C21 “On the hardness of approximating minimum monopoly problems.” *FST&TCS 2002*, 277–288. (With Sounaka Misra and S. Krishnan.)
- C22 “Fast distributed algorithms for (weakly) connected dominating sets and linear-size skeletons.” *SODA 2003*, 717–724. (With Alessandro Panconesi, Alessandro Mei, Devdatt Dubhashi, and Aravind Srinivasan.)
- C23 “On converting CNF to DNF.” *MFCSS 2003*, 612–621. (With P B Miltersen and I Wegener.)
- C24 “A direct sum theorem in communication complexity via message compression.” *ICALP 2003*, 300-315. (With Pranab Sen and Rahul Jain.)
- C25 “A lower bound for the bounded round quantum communication complexity of set disjointness.” *FOCS 2003*, 220-229. (With Pranab Sen, and Rahul Jain.)
- C26 Expansion properties of (secure) wireless networks. *Proceedings of the ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)*, **16**, 281–285 (2004). (With A. Panconesi.)
- C27 Connectivity properties of secure sensor networks. *Proceedings of the 2004 ACM Workshop on Security of Ad Hoc and Sensor Networks (SASN)*, 53–58 (2004). (With R. Di Pietro, L. Mancini, A. Mei, A. Panconesi .)
- C28 Complete Partitions of Graphs. *Symposium on Discrete Algorithms (SODA)*, **16**, 860–869 (2005). (With G. Kortsarz and S. Sivasubramanian, TIFR.)
- C29 Prior entanglement, message compression and privacy in quantum communication. To appear in the proceedings of *IEEE Conference on Computational Complexity (CCC)*, June 2005. (With Rahul Jain, and Pranab Sen.)
- C30 On the Power of Random Bases in Fourier Sampling: Hidden Subgroup Problem in the Heisenberg Group. To appear in the proceedings of *International Colloquium on Automata, Languages and Programming (ICALP)*, July 2005, 1399-1411. (With Martin Roetteler and Pranab Sen.)
- C31 Is partial quantum search of a database any easier? *ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)*, July 2005. (With Lov Grover.)
- C32 Bounds for Error Reduction with Few Quantum Queries. *APPROX-RANDOM 2005*: 245-256. (With S. Chakraborty and N. Raghunathan.)

- C33 Tradeoffs in Depth-Two Superconcentrators. STCS 2006: 372-383. (With Chinmoy Dutta.)
- C34 Sensor networks that are provably resilient. SECURECOMM 2006. (With Roberto Di Pietro, Luigi V. Mancini, Alessandro Mei, Alessandro Panconesi.)
- C35 Gap Amplification in PCPs Using Lazy Random Walks. ICALP(1) 2006: 96–107. (With Madhu Sudan.)
- C36 Zero Error List-Decoding Capacity of the $q/(q-1)$ Channel. FSTTCS 2006: 129-138. (With S. Chakraborty, N. Raghunathan, P. Sasatte.)
- C37 Subspace Polynomials and List Decoding of Reed-Solomon Codes FOCS 2006: 207-216. (With E. Ben-Sasson S. Kopparty)
- C38 The Communication Complexity of Correlation. CCC 2007: 10–23. (With P. Harsha, R. Jain, D. McAllester)
- C39 A tight lower bound for parity in noisy communication networks. SODA 2008: 1056-1065 (With C. Dutta, Y. Kanoria, D. Manjunath.)
- C40 Minimizing average latency in oblivious networks. SODA 2008: 200–207. (With P. Harsha, T.P. Hayes, H. Narayanan, H. Raecke.)
- C41 Lower Bounds for Noisy Wireless Networks using Sampling Algorithms. FOCS 2008: 394-402. (With C. Dutta.)
- C42 Finding duplicates in a data stream. SODA 2009: 402-411. (With P. Gopalan.)
- C43 Online set packing and competitive scheduling of multi-part tasks. PODC 2010: 440-449. (With Yuval Emek, Magns M. Halldrsson, Yishay Mansour, Boaz Patt-Shamir, Dror Rawitz.)
- C44 Data Structures for Storing Small Sets in the Bitprobe Model. ESA (2) 2010: 159-170. (With Smit Shah and Saswata Shannigrahi.)
- C45 Streaming Algorithms for 2-Coloring Uniform Hypergraphs. WADS 2011: 667-678. (With Saswata Shannigrahi.)
- C46 Split and Join: Strong Partitions and Universal Steiner Trees for Graphs. FOCS 2012: 81-90. (With Costas Busch, Chinmoy Dutta, Rajmohan Rajaraman, Srinivasagopalan Srivathsan.)
- C47 More on a Problem of Zarankiewicz. ISAAC 2012: 257–266. (With Chinmoy Dutta.)
- C48 Topology matters in communication. FOCS 2014. (With Arkadev Chattopadhyay and Atri Rudra).
- C49 Set membership with a few bit probes. SODA 2015 (to appear). (With Mohit Garg).
- C50 One-shot Marton inner bound for classical-quantum broadcast channel. QIP 2015 (to appear as poster). (With Pranab Sen and Naqeeb Warsi).

Journal Papers / Book articles

- J1 “Improved bounds for covering complete uniform hypergraphs.” *Information Processing Letters*, 41, 1992, 203–207.
- J2 “ $\Sigma\Pi\Sigma$ threshold formulas.” *Combinatorica*, 14(3), 1994, 345–374.
- J3 “Directed monotone contact networks for threshold functions.” *Information Processing Letters*, 50, 1994, 199–203. (With K. V. Subrahmanyam.)
- J4 “Improved approximations of independent sets in bounded-degree graphs via subgraph removal.” *Nordic Journal of Computing*, 1, 1994, 475–492. (With Magnús Halldórsson.)
- J5 “On the number of negations needed to compute parity functions.” *IEICE Transactions on Inf. and Syst.*, E78-D(1), 1995, 90–91. (With Tetsuro Nishino.)
- J6 “Better lower bounds for monotone threshold formulas.” *Journal of Computer and System Sciences*. 54(2) 1997, 221–226.
- J7 “The complexity of parallel prefix problems on small domains.” *Information and Computation*. 138(1) 1997, 1–22. (With Shiva Chaudhuri.)
- J8 “Greed is good: Approximating independent sets in sparse and bounded-degree graphs.” *Algorithmica*. 18 1997, 145–163. (With Magnús Halldórsson.)
- J9 “Pi-Sigma-Pi Threshold Formulas”, *Mathematical Systems Theory*, 29 1996, 357–374.
- J10 “The randomized complexity of maintaining the minimum.” *Nordic Journal of Computing*, 3(4), 1996. 337–351. (With Gerth Brodal, and Shiva Chaudhuri.)
- J11 “An entropy proof of Brégman’s theorem.” *Journal of Combinatorial Theory A*. 77, 1997, 161–164.
- J12 “Improved bounds and algorithms for hypergraph 2-coloring.” *Random Structures and Algorithms*. 16, 2000, 4–32. (With Aravind Srinivasan.)
- J13 “Bounds for dispersers, extractors and depth-2 superconcentrators.” *SIAM Journal of Discrete Mathematics*, 13 (1), 2000, 2–24. (With Amnon Ta-Shma.)
- J14 “The communication complexity of pointer chasing.” To appear in the Special Issue of the *Journal of Computer and System Sciences*, 62(2), 2000, 323–355. (With S. Venkatesh and Stephen Ponzio.)
- J15 “A tradeoff between search and update in dictionaries.” *Information Processing Letters*, 80(5), 2001, 243–247. (With Venkatesh Raman.)
- J16 “The quantum complexity of set membership.” *Algorithmica*, 34(4), 2002, 462–479. (with Pranab Sen and S. Venkatesh.)
- J17 “Are bit-vectors optimal?” *SIAM journal of computing* 31(6), 2002, 1723–1744. (With H. Buhrman, P.B. Miltersen, S. Venkatesh.)

- J18 “A note on scrambling permutation.” *Random Structures and Algorithms*, 22(4), 2003, 435–439.
- J19 “Entropy and counting.” In the book *Computational Mathematics, Modelling and Algorithms* (Ed. J.C. Misra). Narosa Publishers, New Delhi.
- J20 “Essential covers of the cube by hyperplanes.” *J. Comb. Theory, Ser. A* 109(2): 331-338 (2005). (With N. Linial.)
- J21 “Lower bounds for adaptive locally decodable codes.” *Random Structures and Algorithms. Random Struct. Algorithms* 27(3): 358-378 (2005). (With A. Deshpande, R. Jain, T. Kavitha, Satya Lokam.)
- J22 “Fast distributed algorithms for (weakly) connected dominating sets and linear-size skeletons.” *J. Comput. Syst. Sci.* 71(4): 467-479 (2005) (With Devdatt Dubhashi, Alessandro Mei, Alessandro Panconesi, and Aravind Srinivasan.)
- J23 “Complete partitions of graphs.” *Combinatorica*, 2007. (With M. Halldórsson, G. Kortsarz, S. Sivasubramanian.)
- J24 “On Dinur’s proof of the PCP theorem.” *Bull. Amer. Math. Soc.* 44 (2007), 19-61. (With Madhu Sudan.)
- J25 “Redoubtable sensor networks.” *ACM Trans. Inf. Syst. Secur.* 11(3): (2008) (With R. Pietro, L.V. Mancini, A. Mei, A. Panconesi.)
- J26 “A property of quantum relative entropy with an application to privacy in quantum communication.” *J. ACM* 56(6): (2009) (With Rahul Jain and Pranab Sen.)
- J27 “Subspace polynomials and limits to list decoding of Reed-Solomon codes.” *IEEE Transactions on Information Theory* 56(1): 113-120 (2010). (With E. Ben-Sasson, S. Kopparty.)
- J28 “The communication complexity of correlation.” *IEEE Transactions on Information Theory* 56(1): 438-449 (2010) (With Prahladh Harsha, Rahul Jain, David A. McAllester.)
- J29 “Online set packing. *SIAM J. Computing* 41(4), 728-746 (2012).” (With Yuval Emek, Magnús M. Halldórsson, Yishay Mansour, Boaz Patt-Shamir, Dror Rawitz.)
- J30 “Expansion properties of (secure) wireless networks.” *ACM Transactions on Algorithms* 8(3): Article 21, 9 pages (2012) (With Alessandro Panconesi.)
- J31 “Streaming algorithms for language recognition problems.” *Theoretical Computer Science* (2013): available online 2 Jan 2013, DOI information: 10.1016/j.tcs.2012.12.028. (With Ajesh Babu, Nutan Limaye and Girish Varma.)
- J32 “An entropy-based proof for the Moore bound for irregular graphs.” In *Perspectives in Computational Complexity: The Somenath Biswas Anniversary Volume, Progress in Computer Science and Applied Logic* (vol 26) (M. Agrawal and V. Arvind, Eds), Birkhäuser, 173–182 (2114). (With Ajesh Babu.)

Others

- M1 News from India: Primes is in P. BULLETIN OF THE EATCS 78, October 2002. (Jointly with V. Vinay, IISc. Bangalore and T. Kavitha, IISc Bangalore; edited by Madhavan Mukund, Chennai.)
- M2 Fields medals and the Nevanlinna Prizes: 2002. (A summary of Madhu Sudan's contributions). Current Science, 83 (9), November 2002, 1088–1096. (Joinly with CS Rajan and Nitin Nitsure; edited by SG Dani.)
- M3 Linear time, almost linear time, and almost always linear time: Snippets from the work of Robert Endre Tarjan. In Math Unlimited, Essays in Mathematics. R Sujatha, HN Ramaswamy, CS Yogananda (Eds.). Science Publishers, 225-234 (2012).
- M4 The one-shot quantum capacity of a quantum channel. (Under preparation, jointly with Pranab Sen and Naqeeb Warsi).