Bala KALYANASUNDARAM

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Education

B.Sc., Applied Sciences, India, 1979.
B.E., Electronics and Communication, Indian Institute of Science, 1982.
M.S., Computer Science, Indian Institute of Technology, 1987.
Ph. D., Computer Science, Pennsylvania State University, 1988.

Research Interests:

Computational Science
Algorithms
Computational Structures

University Positions

Georgetown University : (2004-2007)
Chair of Computer Science Department
Georgetown University : (2001-)
Craves Endowed Professor in Computer Science Department
Georgetown University : (2000-2001)
Associate Professor in Computer Science Department
University of Pittsburgh: (1994-2000)
Associate Professor in Computer Science Department
University of Pittsburgh: (1988-1994)
Assistant Professor in Computer Science Department

Web Tools

sequerome.georgetown.edu

instaseq.georgetown.edu

Funding

1. National Science Foundation. Topics in Space-Bounded Computations, CCR-9009318; $ 31,483; Aug 1990- Jul 1993.
2. National Science Foundation (with R. Daley). Research in Multi-Agent Learning Algorithms, CCR-9202158; $ 90,117; Aug 1992- Feb 1995.
3. National Science Foundation (with K. Pruhs). Scheduling Protocols for Networked Multi-Media Applications, CCR-9734927; $ 201,141; Jun 1998- Jan 2001.
4. Air Force Office of Scientific Research (with K. Pruhs). Dynamic Spectrum Allocation Algorithms, AFOSR; $ 199,996; Dec 1999- Nov 2001.
5. National Science Foundation (with K. Pruhs). Research Experience for Undergraduates, $ 5,000; Sep 1999- Aug 2000.
6. National Science Foundation. Collaborative Research: Algorithmic Problems in Next Generation Networks, CCR-0098271; $142,750; Jun 2001- May 2004.
7. Air Force Office of Scientific Research Dynamic Spectrum Allocation Algorithms, AFOSR-F49620-02-1-0100; $68,874; Jan 2002- Dec 2002.

Patents:

Methods and Apparatus for Allocating Resources in a Communicating System (with Mahe Velauthapillai and John Waclawsky), US Patent 7433311, Oct 2008.

Methods and Apparatus for Dynamic Bandwidth Adjustment, (with Mahe Velauthapillai and John Waclawsky), US patent 7116682, 2006.

Professional Activities

Editorship :

Deputy Editor for Computer Languages, Structures and Systems
Guest Editor for Journal of Scheduling

Panelist for:

NSF proposals in Theoretical Computer Science
NSF Infrastructure proposals

Reviewer for:

Information Processing Letters
SIAM Journal on Computing
IEEE Transactions on Computers
Journal of Computer and System Sciences
Information and Computation
NSF proposals in Theoretical Computer Science
ESA, FOCS, FST&TCS, STOC, SODA conferences

Journal Publications

$\star$ indicates that the paper has been invited for normal refereeing process for *journal* publication.

1. Rounds versus Time for the Two Person Pebble Game, (with G. Schnitger), **Information and Computation, 88(1), 1-17, 1990**. A preliminary version of this paper has appeared in the *Symposium on Theoretical Aspects of Computer Science* (STACS), 517-529, 1989.

2. $\star$ On the Power of White Pebbles, (with G. Schnitger), **Combinatorica, 11(2), 157-171, 1991**. A preliminary version of this paper has appeared in the *Symposium of the Theory of Computing* (STOC), 258-266, 1988.

3. The Probabilistic Communication Complexity of Set-Intersection, (with G. Schnitger), **SIAM Journal on Discrete Mathematics, 5(4), 545-557, 1992**. A preliminary version of this paper has appeared in the *Conference on Structure in Complexity Theory*, 41-49, 1987.

4. On-line Weighted Matching, (with K. Pruhs), **Journal of Algorithms, 14, 478-488, 1993**. A preliminary version of this paper has appeared in the *Symposium on Discrete Algorithms* (SODA), 234-240, 1991.

5. A Competitive Analysis of Algorithms for Searching Unknown Scenes, (with K. Pruhs), **Computational Geometry: Theory and Applications, 3, 139-155, 1993**. Preliminary versions of this paper have appeared in the *Symposium in Theoretical Aspects of Computer Science* (STACS), 147-157, 1992, and in *DIMACS workshop on On-line Algorithms*, 157-162, 1991, under the title "Visual Searching and Mapping".

6. Not All Insertion Methods Yield Constant Approximate Tours in the Euclidean Plane, (with K. Pruhs and V. Bafna), **Theoretical Computer Science, 125, 345-353, 1994**.

7. $\star$ Constructing Competitive Tours from Local Information, (with K. Pruhs), **Theoretical Computer Science, 130, 125-138, 1994.** A preliminary version of this paper has appeared in the *International Colloquium on Automata, Languages and Programming* (ICALP), 102-113, 1993.

8. $\star$ Probabilistic PFIN-type learning, (with R. Daley and M. Velauthapillai), **Journal on Experimental and Theoretical Artificial Intelligence, 6, 41-62, 1994**. A preliminary version of this paper has appeared in the Workshop on Analogical and Inductive Inference (AII), 151-169, 1992.

9. $\star$ Breaking the probability $\frac{1}{2}$ barrier in FIN-type learning, (with R. Daley and M. Velauthapillai) **Journal of Computer and System Sciences, 50(3), 574-599, 1995**. A preliminary version of this paper has appeared in *Computational Learning Theory* (COLT), 203-217, 1992.

10. On-line Load Balancing of Temporary Tasks, (with Y. Azar, S. Plotkin, K. Pruhs, and O. Waarts), **Journal of Algorithms, 22, 93-110, 1997**. A preliminary version of this paper has appeared in the *Workshop on Algorithms and Data Structures* (WADS), 119-130, 1993.

11. The Online Transportation Problem, (with K. Pruhs), accepted for publication in **SIAM Journal on Discrete Mathematics, 1999.** A preliminary version of this paper has appeared in the *European Symposium on Algorithms* (ESA), 484-493, 1995.

12. An Optimal Deterministic Algorithm for Online b-Matching, (with K. Pruhs), appeared in **Theoretical Computer Science, 233, 319-325, 2000**. A preliminary version of this paper has appeared in the *16th Conference on Foundations of Software Technology and Theoretical Computer Science*, 193-199, 1996.

13. ⋆ Fault-Tolerant Real-Time Scheduling, (with K. Pruhs), accepted for publication in **Algorithmica, Vol. 28, No. 1, pp. 125–144, 2000**. A preliminary version of this paper has appeared in the *European Symposium on Algorithms* (ESA), 296-307, 1997.

14. Speed is as Powerful as Clairvoyance, (with K. Pruhs), accepted for publication in **Journal of the ACM, 2000.** A preliminary version of this paper has appeared in the *36th Annual Symposium on Foundations of Computer Science* (FOCS), 214-221, 1995.

15. ⋆ Maximizing Job Completions Online, (with K. Pruhs), accepted for publication in **Journal of Algorithms.** A preliminary version of this paper has appeared in the *European Symposium on Algorithms* (ESA), 235-246, 1998.

16. ⋆ Eliminating Migration in Multi-Processor Scheduling, (with K. Pruhs), appeared in **Journal of Algorithms, 38, 2-24, 2001.** A preliminary version of this paper has appeared in the *Symposium on Discrete Algorithms* (SODA), 499-506, 1999.

17. ⋆ The Communication Complexity of Enumeration, Elimination and Selection (with A. Ambainis, H. Buhrman, W. Gasarch, and L. Torenvliet) appeared in **Journal of Computer and System Sciences, 63, 148-185, 2001.** A preliminary version of the paper has appeared in the conference *Structures 2000.*

18. Caching for Web Searching (with J. Noga, K. Pruhs, and G. Woeginger) appeared in a special issue of **Algorithmica** on Internet Algorithmics **33, 353-370, 2002.** A preliminary version has appeared in *7th Scandinavian Workshop on Algorithm Theory, 2000.*

19. ⋆ Scheduling Broadcasts in Wireless Network (with Kirk Pruhs and Mahe Velauthapillai) appeared in **Joural of Scheduling, 4, 339-354, 2001**. A preliminary version has appeared in *European Symposium on Algorithms, 2000.*

20. Dynamic Spectrum Allocation: the Impotency of Duration Notification (with K. Pruhs), appeared in **Journal of Scheduling, 3, 289-295, 2000.** A preliminary version of this paper has appeared in the *20th Conference on Foundations of Software Technology and Theoretical Computer Science*, 2000.

21. Errata: A New Algorithm for Scheduling Periodic, Real-Time Tasks (with Kirk Pruhs and Eric. Torng), appeared in **Algorithmica, Vol. 28, No. 3, pp. 269-270, 2000.**

22. Minimizing Flow-Time Nonclairvoyantly, (with K. Pruhs), accepted for publication in **Journal of the ACM, 2004.** A preliminary version of this paper has appeared in the *38th Annual Symposium on Foundations of Computer Science* (FOCS), 345-352, 1997.

23. ⋆ Unlocking the Advantage of Dynamic Service Selection and Pricing (with Mahe Velauthapillai and, John Waclawsky), accepted for publication in **ACM Transactions on Theory of Comput. Systems** Vol. 38 No. 4 pp. 393-410, (2005).

24. Fault-Tolerant Scheduling, (with K. Pruhs), appeared in **SIAM Journal on Computing, Vol. 34, No. 3, pp. 697-719, 2005.** A preliminary version of this paper has appeared in the *Symposium on the Theory of Computing* (STOC), 115-124, 1994.

25. Web-based interface facilitating sequence-to-structure analysis of BLAST alignment reports, (with N. Ganesan, N. F. Bennett, M. Velauthapillai, N. Pattabiraman, and R. Squier), appeared in **BioTechniques, Vol. 39, No. 2, pp. 186-188, 2005.**

26. A Bigger BLAST, (with N. Ganesan, N. F. Bennett, M. Velauthapillai, N. Pattabiraman, and R. Squier), appeared in **Science,** Vol 309, 2005.

27. Capabilities of Thoughtful Machines, (with M. Velauthapillai), accepted for publication in **Fundamenta Informaticae, 2006.**

28. Taming Teams with Mind Changes, (with M. Velauthapillai), accepted for publication in a special issue of **Journal on Computer and System Sciences, 2008.** A preliminary version of this paper has appeared in the *Algorithmic Learning Theory* (ALT), 1995.

Book Chapters

1. Communication Complexity and Lower Bounds in Sequential Computation (with G. Schnitger), *invited technical paper,* **Teubner-Texte zur Informatik, Band 1, Edited by J. Buchmann, H. Ganzinger and W.J. Paul, 1992**. A preliminary version of this paper has appeared in the Annual Allerton Conference on Communication, Control and Computation, 749-757, 1986, under the title "On the Power of One-Tape Turing Machines".

2. Algorithms, **Handbook of Statistics Volume 9: Computational Statistics, 1-16, 1993**.

3. Towards Reduction Arguments for FINite Learning, (with R. Daley), **GOSLER final report: Algorithmic Learning for Knowledge Based Systems, Lecture Notes in Artificial Intelligence 961, 63-75, 1995**.

4. Online Network Optimization Problems, (with K. Pruhs), **Online Algorithms, The State of the Art, Lecture Notes in Computer Science 1442, 268-280, 1998**.

Conference Proceedings (Refereed)

These are **additional** conference publications. The journal version is being reviewed or under preparation.

1. Probabilistic vs. Pluralistic Learning with Mind Change (with R. Daley), *Mathematical Foundations of Computer Science* (MFCS), 218-226, 1992.

2. Capabilities of Probabilistic Learners with Bounded Mind Changes, (with R. Daley), *Computational Learning Theory* (COLT), 182-191, 1993.

3. Capabilities of Fallible FINite Learning, (with R. Daley and M. Velauthapillai), *Computational Learning Theory* (COLT), 199-208, 1993.

4. Use of Reduction Arguments in Determining Popperian FIN-Type Learning Capabilities, (with R. Daley), *Algorithmic Learning Theory* (ALT), 173-186, 1993.

5. FINite Learning Capabilities and Their Limits, (with R. Daley), *Computational Learning Theory* (COLT) 1997.

6. Fairness to All While Downsizing (with Mahe Velauthapillai) *In the Proceedings of 31st International Colloquium on Automata, Languages and Programming, Turku, Finland July 2004.*

7. Bioinformatics Data Profiling Tools: A Prelude to Metabolic Profiling, *Pacific Symposium on Biocomputing 2007, 127-132, 2007.*

Invited Talks

1. Dealing with Mobility, Dynamic Service Selection and Pricing in Wireless Network, *Workshop on On-line Algorithms*, Dagstuhl, Germany, 2002.

2. Dealing with Mobility, Dynamic Service Selection and Pricing in Wireless Network, *Business School*, University of Pittsburgh, 2002.

3. Dynamic Pricing and Renegotiation for Network Management, *Capital Area Theory Seminar*, University of Maryland, 2000.

4. Computational Clairvoyance, *Capital Area Theory Seminar*, University of Maryland, 1999.

5. Computational Clairvoyance, Georgetown University, 1999.

6. Caching for Web Searching, Georgetown University, 1999.

7. Online Network Optimization Problems, *Workshop on On-line Algorithms*, Dagstuhl, Germany, 1996.

8. Constructing Competitive Tours from Local Information (or Learning/Exploring an Unknown Weighted Planar Graph), *Capital Area Theory Seminar*, Georgetown University, 1992.

9. Visual Searching and Mapping, *DIMACS Workshop on On-line Algorithms*, 1991.

10. On-line Algorithms, *Pennsylvania State University*, 1991.

Other Technical Publications

1. Detection of Bi-Symmetric Functions, (with R. Owens), TR-CS-86-05, Penn. State University.
2. On the Separation of Various Complexity Classes in Communication Complexity, TR-CS-87-16, Penn. State University.
3. From SMILES to Activity and Property of Molecules, (with M. Velauthapillai).
4. A Systematic Discovery of Vowels in Written Natural Languages (with Anfal ALGharabally, Ganesan Natarajan, Solomon Sara and Mahe Velauthapillai).

Teaching

Courses Taught: ($\star$) indicates a new course designed and introduced by me.

1. ($\star$) COSC 012 Introduction to Media Computing
2. COSC 071 Computer Science I.
3. COSC 173 Data Structures
4. COSC 330 Algorithms
5. COSC 385 Theoretical Computer Science.
6. ($\star$) COSC 393 Wireless Networks.
7. Graduate Courses, Cryptography: taught at University of Pittsburgh.

Undergraduate Research Experience

Georgi Dinkov, Daniel Fimiarz, Marcia Elyseu (Georgetown), Wireless Network, 2002.
Adrien Treuille (Georgetown), Online Algorithm, 2000-2001.
Eric W Wiewiora (Univ. of Pittsburgh), Dynamic Spectrum Allocation, 2000-2001.

Master's Project

Sushma Banthia, Project, Efficient On-line Range Searching in Computational Geometry, University of Pittsburgh, April 1991.

Thesis Committee Member

1. Hakan Aydin (Computer Science, Ph. D 2001), Enhancing Performance and Fault Tolerance in Reward-based Scheduling.
2. Claude-Nicolas Fiechter (Computer Science, Ph. D., 1997), Design and Analysis of Efficient Reinforcement Learning Algorithms.
3. Shaocen Han (Mathematics, Ph. D., 1995), Toughness of Graphs.
4. Hans Ros (Computer Science, Ph. D., 1992), Learning Boolean Functions with Genetic Algorithms.
5. Zhibo Chen (Mathematics, Ph. D., 1991), On Polynomial Representations of Functions over Integer Residue Class Rings and over Finite Fields.
6. Evelyn Duesterwald (Computer Science, M.S., 1990), Static Concurrency Analysis in the Presence of Procedures.