Vita: Subhash Kak

June 11, 2007

Education

- Ph.D. in Electrical Engineering from Indian Institute of Technology Delhi, 1970; Dissertation title: "Studies in Signal Theory."

Professional Experience

Long-term appointments

- Louisiana State University, Baton Rouge, LA,
  Delaune Distinguished Professor (2003 - present);
  Professor (1983 - present);
  Visiting Associate Professor (August 1979 - August 1980); Associate Professor (August 1980 - August 1983)
- Indian Institute of Technology, Delhi, Assistant Professor (February 1974 - August 1979); Lecturer (February 1971 - February 1974).

Short-term appointments

- Visiting Professor, Indian Institute of Advanced Study, Shimla, 2004.
- Santa Fe Institute, Santa Fe, NM, Visitor, 1998 onwards.
- National Fellow, Indian Institute of Advanced Study, Shimla, 2001-2002.
- Harvard University, Cambridge, MA, Visiting Professor (January 1996 - May 1996): *Sabbatical Leave*
- Indian Institute of Technology, Delhi, Visiting Professor (Dec. 1985 - Jan. 1986)
- UNESCO Fellow, Fall, 1986 *Sabbatical Leave*
- Tata Institute of Fundamental Research, Bombay, December 1977.
- Bell Laboratories, Murray Hill, N.J., Guest Researcher, June 1976 - August 1976.
- Imperial College, University of London, London, U.K. Academic Visitor, November 1975 - June 1976.

Industry

- Chief Scientist, Total Clarity, Inc, Boston, 2002- onwards.
- Member of the Advisory Board, Redwood Investment Systems, Boston, 1999 -2000.

Student Supervision

- M.S. theses by Mohammed Riyazuddin (2006), Arvind Parthasarathy (2006), Adityan Rishiyur (2006), Kiranmayi Penumarthi (2005), Shaik A. Naveed (2005), Tarun Malik (2005), Navneet Mandhani (2004), Sameer Raina (2004), Pritam Rajagopal (2003), Radhika Vaddiraja (2003), Anuradha Penumarthy (2001), Ratnakar Malla (2001). Nanjappa Natarajan (2001), V.R. Admal (2001), Meenakshi Gnanaguruparan (2000), Sharath Kumar (2000), Savitha Pinnepalli (1999), Bo Shu (1998), Asheesh Mehta (1997), Sreenivas Tejomurtula (1997), Kun-Won Tang (1997), Ravi Jayanthi (1995), Lianjiang Chen (1994), Uday Devanagudy (1994), Praveen Raina (1994), Gireesh Subramanya (1994), Kedar Madineni (1994), Prathap Paragi (1993), Revathi Guddanti (1993), S. Joshi (1992), Raksha Gopal (1992), M. Khondker (1991), P. Merritt (1991), Ameya Palekar (1990), David Young (1989), K.W. Cheong (1986), Tse Sai-On (1984), Sweha (1982), Ibibia Dabipi (1981), George Economides (1980), Jolly (1978), Jain (1974).

  These theses are available at the LSU Library. *Recent theses*:

  Mohammed Riyazuddin, Information analysis of DNA sequences, 2006.

  Arvind Parthasarathy, Improved content based watermarking for images, 2006.

  Adityan Rishiyur, Instantaneously trained neural networks with complex and quaternion inputs, 2006.

  Kiranmayi Penumarthi, Augmented watermarking, 2005.

  Shaik A. Naveed, Improved watermarking scheme using decimal sequences, 2005.

  Tarun Anand Malik, Adaptive target tracking in wireless sensor networks, 2005.

  Navneet Mandhani, Watermarking using decimal sequences, 2004.

  Sameer Raina, Evolution of base substitution gradients in primate mitochondrial genomes, 2004.

  Radhika Vaddiraja, Generalized d-sequences and their applications to CDMA systems, 2003.

  Pritam Rajagopal, Instantaneously trained neural networks with complex inputs, 2003.

  Current M.S. Students: R. Adityan, Riyazuddin Mohammed, Arvind Parthasarathy

- Ph.D dissertations by

  Will Scott (2003), Block Level DCT Coefficients for Autonomic Image Recognition With Applications to Face Recognition [Scott is on the research staff at IBM, Austin]

  Kun-Won Tang (1999), Instantaneously trained neural networks [Tang is Director, General Microsystems, Malaysia]

  David Young (1997), A Theory of Cortical Neural Processing [Young is an instructor in the industrial engineering department of the Louisiana State University]

Parvin Hashemian (1996), Solving Classification Problems using Modular Approaches in Feedforward Neural Networks [Hashemian is an assistant professor of computer science at the University of Louisiana at Lafayette]

Sanjoy Das (1994), Second Order Neural Networks [Das is assistant professor at Kansas State University]

George Georgiou (1992, Tulane University, Special Examiner), Parallel Distributed Prorocessing in the Complex Domain [Georgiou is associate professor of computer science at California State University at San Bernardino]

Chung Youn (1989), New Control and Learning Algorithms for Neural Networks [Youn is associate professor of computer science in South Korea]

D.L. Prados (1989), The Capacity of Artificial Neural Networks Using the Delta Rule [Prados is a research computer scientist at the NASA Stennis Center]

M.C. Stinson (1988), Neural Networks with Asynchronous Control [Stinson is professor of computer science at Central Michigan Univ]

I. Dabipi (1987), Fail-safe Local Area Networking Using Channel redundancy [Dabipi is professor of electrical engineering at Univ of Maryland]

Administration

Graduate Coordinator, Electrical and Computer Engineering Department, Louisiana State University 1982 - 1986.

Professional Activities

- Keynote Speaker, RSA Data Security Conference, San Jose, 2006.
- Member Advisory Board, Lifeboat Foundation, 2005
- Co-Founder and Co-Chairman, Series of *International Conferences on Computational Intelligence and Neuroscience*, Sept 1995, Mar 1997, Oct 1998, North Carolina; March 2000, Atlantic City; March 2002, August 2003, Durham; August 2005, Salt Lake City.
- Member of the Board of Governors, *Association for Intelligent Machinery*, 1998 onwards.
- Member, Information Technology Master Planning Task Force, LSU, 1999-2001.
- Member, Intelligence Advisory Board, NIST, 2001 onwards.
- Core IT Search Committee, CAPITAL, LSU, 2002.
- Convener (Organizer), National Systems Conference, New Delhi, 1974; chairman of sessions at numerous international conferences.
- Reviewer of several IEEE and IEE publications as well as technical books by various University and other scholarly presses.
- UNDP Consultant, 1989-1990. Consulted with C-DAC (Centre for Development of Advanced Computing), Pune.
- Consultant, Fingerhut Corporation, Minneapolis, 1992-1994.

Editorships

- Guest Editor, *IEEE Computer*, Data Security in Computer Networks, February 1983.
- Guest Editor, 1993, Neural Networks and AI, *Information Sciences.*
- Co-Guest Editor, 1993, Networks for Neural Processing, *Circuits, Systems, and Signal Processing.*
- Associate Editor, *Information Sciences*, 1993-present.
- Member Editorial Board, *Journal of Combinatorics, Information, & System Science*, 1995-present.
- Advisory Editor, *Circuits, Systems, and Signal Processing*, 1998-present.
- Co-Guest Editor, Quantum Computing and Neural Information Processing, *Information Sciences*, 2000.
- Editorial Associate, Brain and Behavior Science (Cambridge University Press), 2000-present.
- Member, Editorial Board, Bulletin of the Allahabad Mathematical Society, 2006-present.

Patents

- Uniform permutation privacy system (with N.S. Jayant), US Patent No. 4,100,374, July 11, 1978.
- Neural networks and methods for training neural networks (with J. Pastor), U.S. Patent No. 5,426,721, June 20, 1995.
- Instantaneous training of neural networks, Invention disclosure, July 13, 1995.
- Improved corner-classification neural networks (with Kun-Won Tang), Invention disclosure, February 5, 1997.
- Anvish, a new metasearch engine for the internet (with Bo Shu), copyright filed August, 1998.

  Neural Technologies, Inc, Kansas City, has licensed the technology of the previous 4 items. This technology has been used for creation of several companies. One of these, www.solosearch.com, was purchased by another company (Pan International Gaming) for $15 million.
- Interpolating neural networks and their applications (with Savitha Pinnepalli and Sai Pinnepalli), Invention disclosure, July 27, 1999. A patent application is being filed.
- Polarization modulation for gigabit communication, Invention disclosure, April, 2000.
- WordWarp– A system for automatic classification of text, Invention disclosure, June, 2000.

Awards/Honors

- 2002. Distinguished Alumnus Award, Indian Institute of Technology, Delhi.
- 2001. National Fellow, Indian Institute of Advanced Study.
- 1998. Goyal Prize.
- 1989. IEEE-HKN(LSU) Favorite Professor of the Year.
- 1986. UNDP Tokten Fellow.
- 1982. Halliburton Award.
- 1977-78. Offered the Krantzberg Chair of Electronics by Technion, Israel Institute of Technology.
- 1977. Science Academy Medal of the Indian National Science Academy for contributions to science.
- 1977. Kothari Prize.
- British Council Fellow, 1975-1976.
- Designated Nominator, *Kyoto Prize*, the 50 million yen annual award given by the Inamori Foundation which is generally considered to be the Japanese equivalent of the Nobel Prize.

Community

- Invited lectures around the world; newspaper and magazine articles and interviews.
- Discovery Channel, History Channel and other TV companies in the US, Europe, and India have showcased research.
- Dutch Public TV has made two shows on my contributions to philosophy of science and technology, 2004, 2005.
- Member of the Advocate, Baton Rouge's 2000 Business Panel on Information Technology.

Publications

a) Books (Selected)

- The Architecture of Knowledge: Quantum Mechanics, Neuroscience, Computers, and Consciousness. CSC, New Delhi, 2004.
- Advances in Communications and Control, 2 volumes (edited with W.A. Porter). Baton Rouge, LSU, 1988.
- Advances in Communications and Signal Processing (edited with W. A. Porter). New York: Springer-Verlag, 1989.

- Advances in Computing and Control (edited with W.A. Porter & J.L. Aravena). New York: Springer-Verlag, 1989.
- The Proceedings of the National Systems Conference, editor, New Delhi: IIT Delhi, 1974.

b) Book Chapters (Selected)

- "Quantum mechanics and artificial intelligence" In *Intelligent Computing Everywhere,* edited by Alfons Schuster, Springer-Verlag, 2007.
- "Complex valued instantaneously trained neural networks" (with P. Rajagopal) In *Complex-valued Neural Networks: Theories and Applications,* edited by Akira Hirose, World Scientific Publishing, Singapore, 2003.
- "Data security in computer networks," in *Computers and Network Security,* edited by M.D. Abrams and H.J. Podell. Washington: IEEE Computer Society Press, 1986.
- "Multilayered array computing," and "The Paninian Approach to natural language processing," in *Pattern Directed Information Analysis*, Edited by D. Dutta Majumder. New Delhi: Wiley Eastern, 1987.
- "Shift Invariant Associative Memory," with D. Prados in *VLSI for Artificial Intelligence*, Edited by J. Delgado-Frias and W. Moore. Boston MA: Kluwer, 1989.
- "A new training algorithm for feedforward neural networks," In *Advances in Fuzzy Theory and Techniques*, P.P. Wang (editor), Durham NC: Bookwright Press, 1993.
- Quantum neural computing, In *Advances in Imaging and Electron Physics*, vol. 94, Peter Hawkes (Editor) Academic Press, 1995, pp. 259-313.
- "The three languages of the brain: quantum, reorganizational, and associative." In *Learning as Self-Organization*, Karl Pribram and Joseph King (editors). Lawrence Erlbaum Associates, Mahwah, NJ, 1996, pp. 185-219.
- "Reflections in Clouded Mirrors: Selfhood in Animals and Machines." In *Learning as Self-Organization*, Karl Pribram and Joseph King (editors). Lawrence Erlbaum Associates, Mahwah, NJ, 1996, pp. 511-534.

c) Refereed journal articles (Selected)

1. S. Kak, "A cubic public-key transformation." Circuits, Systems and Signal Processing, vol. 26, 2007.
2. A. Parthasarathy and S. Kak, "An improved method of content based image watermarking." IEEE Trans on Broadcasting, vol. 53, pp. 468-479, 2007.
3. S. Kak, "Quantum information and entropy." International Journal of Theoretical Physics, vol. 46, pp. 860-876, 2007.
4. S. Kak, "Moving observers in an isotropic universe." International Journal of Theoretical Physics, vol. 46, pp. 1424-1430, 2007.

5. A. Parakh and S. Kak, "How to enhance the security of electronic voting?"ACM Ubiquity, vol. 8, 2007.

6. S. Kak, "Information complexity of quantum gates." International Journal of Theoretical Physics, vol. 45, pp. 933-941, 2006.

7. S. Kak, "On the realizability of quantum computers." ACM Ubiquity, vol. 7 (11), pp. 1-9, 2006.

8. S. Kak, "A three-stage quantum cryptography protocol." Foundations of Physics Letters, vol. 19, pp. 293-296, 2006.

9. K. Penumarthi and S. Kak, "Augmented watermarking." Cryptologia, vol. 30, pp. 173-180, 2006.

10. S. Kak, "Golden mean and the physics of aesthetics." Foarm Magazine, 5, 73-81, 2006.

11. S. Kak, "Artificial and biological intelligence." ACM Ubiquity, vol. 6, issue 42, pp. 1-22, 2005.

12. N. Mandhani and S. Kak, "Watermarking using decimal sequences." Cryptologia, vol. 29, pp. 50-58, 2005.

13. S. Kak, "General qubit errors cannot be corrected." Information Sciences, vol. 152, pp. 195-202, 2003.

14. S. Kak, "A class of instantaneously trained neural networks." Information Sciences, vol. 148, pp. 97-102, 2002.

15. K.W. Tang and S. Kak, "Fast classification networks for signal processing." Circuits, Systems, Signal Processing, vol. 21, pp. 207-224, 2002.

16. M. Gnanaguruparan and S. Kak, "Recursive hiding of secrets in visual cryptography," Cryptologia, vol. 26, pp. 68-76, 2002.

17. S. Kak, "Statistical constraints in starting a quantum computation." Pramana, Journal of Physics, vol. 57, pp. 683-688, 2001.

18. D. Ventura and S.C. Kak, "Introduction to Quantum Computing and Neural Information Processing," Information Sciences, vol. 128, pp. 147-148, 2000.

19. S. Kak, "Rotating a qubit," Information Sciences, vol. 128, pp. 149-154, 2000.

20. S. Kak, "Active agents, intelligence, and quantum computing," Information Sciences, vol. 128, pp. 1-17, 2000.

21. S. Kak, "Quantum key distribution using three basis states," Pramana, Journal of Physics, vol. 47, pp. 709-713, 2000.

22. B. Shu and S. Kak, "A neural-network based intelligent metasearch engine," Information Sciences, vol. 120, pp. 1-11, 1999.

23. S. Kak, "Faster web search and prediction using instantaneously trained neural networks," IEEE Intelligent Systems, vol. 14, pp. 79-82, November/December 1999.

24. S. Kak, "The initialization problem in quantum computing," Foundations of Physics, vol. 29, pp. 267-279, 1999.

25. S. Tejomurtula and S. Kak, "Inverse kinematics in robotics using neural networks," Information Sciences, vol. 116, pp. 147-164, 1999.

26. S. Kak, "Quantum computing and artificial intelligence," IEEE Intelligent Systems, vol. 14, pp. 9-11, July/August 1999.

27. K.-W. Tang and S. Kak, "A new corner classification approach to neural network training," Circuits, Systems, and Signal Processing, vol. 17, pp. 459-469, 1998.

28. S. Kak, "On generalization by neural networks," Information Sciences, vol. 111, pp. 293-302, 1998.

29. S. Kak, "Quantum information in a distributed apparatus," Foundations of Physics, vol. 28, pp. 1005-1012, 1998.

30. S. Kak, "Knowledge of planets in the third millennium BC," Quarterly Journal of the Royal Astronomical Society, vol. 37, pp. 709-715, 1996

31. S. Kak, "Information, physics and computation," Foundations of Physics, vol. 26, pp. 127-137, 1996.

32. S. Kak, "Can we define levels of artificial intelligence?" Journal of Intelligent Systems, vol. 6, pp. 133-144, 1996.

33. S. Kak, "Speed of computation and simulation," Foundations of Physics, vol. 26, pp. 1375-1386, 1996.

34. S. Kak, "On the science of consciousness," Indian Journal of History of Science, vol. 32, pp. 105-120, 1997.

35. S. Kak, "Archaeoastronomy and literature," Current Science, vol. 73, pp. 624-627, 1997.

36. S. Kak, "An I-S signboard," Cryptologia, vol. 20, pp. 275-279, 1996.

37. S. Kak, "The astronomy of the age of geometric altars," Quarterly Journal of the Royal Astronomical Society, vol. 36, pp. 385-396, 1995.

38. S. Kak, "On quantum neural computing," Information Sciences, vol. 83, pp. 143-160, 1995.

39. S. Kak, "On van Nooten's paper on binary numbers," IEEE Annals of the History of Computing, vol. 17, p. 79, 1995.

40. S. Kak, "Quantum neural computing," Advances in Imaging and Electron Physics, vol. 94, pp. 259-313, 1995.

41. S. Kak, "New algorithms for training feedforward neural networks," Pattern Recognition Letters, vol. 15, pp. 295-298, 1994.

42. S. Kak, "Astronomy of the Vedic altars," Vistas in Astronomy, vol. 36, pp. 117-140, 1993.

43. S. Kak, "On training feedforward neural networks," Pramana, vol. 40, pp. 35-42, 1993.

44. W.A. Porter and S. Kak, "Networks for neural processing," Circuits, Systems, and Signal Processing, vol. 12, pp. 153-154, 1993.

45. S. Kak, "Feedback neural networks: new characteristics and a generalization," Circuits, Systems, and Signal Processing, vol. 12, pp. 263-278, 1993.

46. S. Kak, "Neural networks and artificial intelligence," Information Sciences, vol. 70, pp. 1-3, 1993.

47. S. Bhate and S. Kak, "Panini's grammar and computer science," Annals of the BORI vol 72, pp. 79-94, 1993.

48. S. Kak, "State generators and complex neural memories," Pramana, vol. 38, pp. 271-278, 1992.

49. S. Kak, "The Vararuchi cipher," Cryptologia, vol. 14, pp. 79-83, 1990.

50. S. Kak, "Indus and Brahmi - further connections," Cryptologia, vol. 14, pp. 169-183, 1990.

51. S. Kak, "Self-indexing of neural memories," Physics Letters A, vol. 143, pp. 293-296, 1990.

52. S. Kak, "The sign for zero," Mankind Quarterly, vol. 30, pp. 199-204, 1990.

53. S. Kak "Codes and ciphers," Indian Journal of History of Science, vol. 24, pp. 1-7, 1989.

54. S. Kak, "A new method for coin flipping by telephone," Cryptologia, vol. 13, pp. 73-78, 1989.

55. C.H. Youn and S. Kak, "Continuous unlearning in neural networks," Electronics Letters, vol. 25, pp. 202-203, 1989.

56. S. Kak and M.C. Stinson, "A bicameral neural network where information can be indexed," Electronics Letters, vol. 25, pp. 203-205, 1989.

57. D.L. Prados and S. Kak, "Neural network capacity using the delta rule," Electronics Letters, vol. 25, pp. 197-199, 1989.

58. S. Kak, "The Brahmagupta algorithm for square rooting," Ganita Bharati, vol. 11, pp. 27-29, 1989.

59. M.C. Stinson and S. Kak, "Bicameral neural computing," Lecture Notes in Computing and Control, vol. 130, pp. 85-96, 1989.

60. D. Prados and S. Kak, "Non-binary neural networks," Lecture Notes in Computing and Control, vol. 130, pp. 97-104, 1989.

61. C.H. Youn and S. Kak, "New learning and control algorithms for neural networks," Lecture Notes in Computing and Control, vol. 130, pp. 105-116, 1989.

62. S. Kak, "A two-layered mesh array for matrix multiplication," Parallel Computing, vol. 6, pp. 383-385, 1988.

63. S. Kak, "The Aryabhata cipher," Cryptologia, vol. 12, pp. 113-117, 1988.

64. S. Kak, "The use of determinatives in NLP," AI Magazine, vol. 9, pp. 10-12, Summmer 1988.

65. S. Kak, "A frequency analysis of the Indus script," Cryptologia, vol. 12, pp. 129-143, 1988.

66. S. Kak, "Multilayered array computing," Information Sciences, vol. 45, pp. 347-365, 1988.

67. M.C. Stinson and S. Kak, "A bicameral neural network that improves convergence," Neural Networks, vol. 1, p. 136, 1988.

68. S. Kak, "The Paninian approach to natural language processing," International Journal of Approximate Reasoning, vol. 1, pp. 117-130,1987.

69. S. Kak, "The study of the Indus script," Cryptologia, vol. 11, pp. 182-191, 1987.

70. S. Kak, "Generating d-sequences," Electronics Letters, vol. 23, pp. 202-203, 1987.

71. S. Kak, "A new result on d-sequences," Electronics Letters, vol. 23, p. 617, 1987.

72. S. Kak, "The Aryabhata algorithms for polynomials," Electronics Letters, vol. 23, pp. 838-839, 1987.

73. S. Kak, "Computational aspects of the Aryabhata algorithm," Indian Journal of History of Science, vol. 21, pp. 62-71, 1986.

74. S. Kak, "On secret hardware, public-key cryptography," Computers and Digital Technique (Proc. IEE - Part E), vol. 133, pp. 94-96, 1986.

75. S. Kak, "Encryption and error-correction using d-sequences," IEEE Trans. on Computers, vol. C-34, pp. 803-809, 1985.

76. S. Kak, "How to detect tampering of data," Information Processing Letters, vol. 20, 109-110, 1985.

77. S. Kak, "Linking the world together," Science Today, vol. 19, pp. 52-59, April 1985.

78. S. Kak, "Routing the packet," Science Today, vol. 19, pp. 44-46, May 1985.

79. S. Kak, "Threshold detection error bounds," Journal of the Inst. of Electronic and Telecomm. Engineers, vol. 30, pp. 29-35, 1984.

80. S. Kak, "On information associated with an object," Proceedings Indian National Science Academy, vol. 50, pp. 386-396, 1984.

81. S. Kak, "On the method of puzzles for key distribution," Int. Journal of Comp. and Inf. Sciences, vol. 13, 1984, pp. 103-109.

82. S. Kak, "Data security in computer networks - Guest Editor's Introduction," Computer, vol. 16, pp. 8-10, February 1983.

83. S. Kak, "Strings of first digits of powers of a number," Indian Journal of Pure and Applied Mathematics, vol. 14, pp. 896-907, July 1983.

84. S. Kak, "An overview of analog encryption," Proceedings IEE, vol. 130, Pt. F, pp. 399-404, August 1983.

85. S. Kak, "A structural redundancy in d-sequences," IEEE Transactions on Computers, vol. C-32, pp. 1069-1070, November 1983.

86. S. Kak, "Exponentiation modulo a polynomial for data security," Int. Journal of Computer and Inf. Science, vol. 12, pp. 337-346, 1983.

87. A.K. Raina and S. Kak, "Data security: a cryptographic approach," Proceedings Indian Academy of Sciences (Engineering Sciences), vol. 5, Part 1, pp. 65-83, March 1982.

88. S. Kak and A. Chatterjee, "On decimal sequences," IEEE Transactions on Information Theory, vol. IT-27, pp. 647-652, September 1981.

89. S. Kak, "Masking ciphers," Proceedings IEE, vol. 127, pp. 185-189, June 1980.

90. S. Kak, "On efficiency of chemical homeostasis," IEEE Trans. on Systems, Man & Cybernetics, vol. SMC-9, pp. 160-163, March 1979.

91. S. Kak, "Encryption of signals using data transpositions," Proceedings of the IEE, vol. 125, pp. 1327-1328, 1978.

92. S. Kak, "On quantum numbers and uncertainty II," Nuovo Cimento, vol. 41B, pp. 1-6, 1977.

93. S. Kak, "Sampling and redundancy," Journal Inst. of Elect. and Telecom. Engrs., vol. 23, pp. 336-340, 1977.

94. S. Kak and N.S. Jayant, "Speech encryption using waveform scrambling," Bell System Technical Journal, vol. 56, pp. 781-808, May-June 1977.

95. S. Kak, "The discrete finite Hilbert transform," Indian Journal Pure and Applied Maths., vol. 8, pp. 1385-1390, November 1977.

96. S. Kak, "On quantum numbers and uncertainty," Nuovo Cimento, vol. 33B, pp. 530-534, 1976.

97. H.F. Harmuth, and S. Kak, et al., "Walsh functions versus sinusoids," IEEE Trans. on EMC, vol. EMC-17, pp. 194-195, August 1975.

98. S. Kak, "Binary sequences and redundancy," IEEE Trans. on Systems, Man and Cybernetics, vol. SMC-4, pp. 399-401, July 1974.

99. S. Kak, "Reliability with an evolutionary failure rate," IEEE Trans. on Reliability, vol. R-22, pp. 239-240, October 1973.

100. S. Kak, "Hilbert transformation for discrete data," Int. Journal of Electronics, vol. 34, pp. 177-183, February 1973.

101. S. Kak, "Causality and limits on frequency functions," Int. Journal of Electronics, vol. 30, pp. 41-47, January 1971.

102. S. Kak, "Probability distribution to characterize clipped waves," Proc. IEEE , vol. 59, pp. 1534-1535, October 1971.

103. S. Kak, "On bicirculant matrices," Intl. Conf. on Combinational Maths., New Delhi, December 1972. Also in Proc. Indian National Science Academy, ser A., vol. 41, no. 3, 1975.

104. S. Kak, "A two-valued evolutionary process," Proc. IEEE, vol. 69, pp. 1005-1006, 1972.

105. S. Kak, "The discrete Hilbert transform," Proc. IEEE, vol. 58, pp. 585-586, April 1970.

106. S. Kak, "Sampling theorem in Walsh-Fourier analysis," Electronics Letters, vol. 6, pp. 447-448, July 1970.

107. S. Kak, "Spectrum estimation with regularly missed observations," Electronics Letters, vol. 6, pp. 671-672, October 1970.

108. S. Kak, "Baseband pulse shaping," Electronics Letters, vol. 6, October 1970.

109. S. Kak, "Classification of random binary sequences using Walsh-Fourier analysis," IEEE Trans. on EMC, vol. EMC-13, pp. 74-77, August 1970.

110. S. Kak, "Information transmission with continuous signals," Proc. IEEE, vol. 57, pp. 111-112, January 1969.

111. S. Kak, "Function approximation and Legendre polynomials," Journal Inst. Telecom. Engrs., vol. 15, pp. 827-830, December 1969.

112. S. Kak, "Zero-crossing information for signal reconstruction," Electronics Letters, vol. 5, December 1969, pp. 645-646.

113. S.C. Kak, "Fourier, Laplace and Hilbert transforms," Electronics Letters, vol. 4, pp. 396-397, September 1968.

114. S.C. Kak, "New criterion of realizability," Electronics Letters, vol. 4, pp. 537-538, November 1968.

Selected Conference Proceedings & Recent arXiv papers

1. S. Kak, "Information Complexity of Quantum Gates." Cornell Physics ArXiv, quant-ph/0506013, 2005.

2. S. Kak, "Aristotle and Gautama on Logic and Physics." Cornell Physics ArXiv, physics/0505172, 2005.

3. S. Kak, "A Three-Stage Quantum Cryptography Protocol." Cornell Physics ArXiv, quant-ph/0503027, 2005.

4. S. Kak, " The Golden Mean and the Physics of Aesthetics." Cornell Physics ArXiv, physics/0411195, 2004.

5. S. Kak, "Mendeleev and the Periodic Table of Elements." Cornell Physics ArXiv, physics/0411080, 2004.

6. S. Kak, "Three Interesting 15th and 16th Century Comet Sightings." Cornell Physics ArXiv, physics/0309113, 2003.

7. S. Kak, "Teleportation protocols requiring only one classical bit." Cornell Physics ArXiv, quant-ph/0305085, 2003.

8. S. Kak, "Instantaneously trained neural networks," Fifth International Conference on Computational Intelligence and Neuroscience, NC, March 2002.

9. S. Kak, "Rotating a qubit," Proceedings of the Fourth International Conference on Computational Intelligence and Neuroscience, NC, February 2000.

10. S.C. Kak, "Quantum computing and artificial intelligence," Plenary Lecture, Proceedings of the Fourth International Conference on Computational Intelligence and Neuroscience, NC, February 2000.

11. S. Kak, "The initialization problem in quantum computing," Proceedings of the Third International Conference on Computational Intelligence and Neuroscience, NC, October 1998.

12. G. de Souza and S.C. Kak, "Dynamic radius allocation in corner classification neural networks," Proceedings of the Third International Conference on Computational Intelligence and Neuroscience, NC, October 1998.

13. S.C. Kak, "On masks of mind," International Seminar on Mind, Man and Mask, New Delhi, Feb 24-28, 1998.

14. K.-W. Tang and S.C. Kak, "Corner classification neural networks where the output weights are learnt," Second International Conference on Computational Intelligence and Neuroscience, NC, March 1997.

15. S.C. Kak, "Does quantum mechanics have relevance in neuroscience?" Second International Conference on Computational Intelligence and Neuroscience, NC, March 1997.

16. S.C. Kak, "Why machines cannot be conscious," Towards a Science of Consciousness (Tucson II), April 1996.

17. S.C. Kak, "Neural nets, information, and intelligence," (Invited Paper) Second World Congress of Nonlinear Analysis, Athens, Greece, July 1996.

18. S.C. Kak, "The three languages of the brain," (Invited Paper) Fourth Appalachian Conference on Behavioral Neurodynamics, Radford, September 22-25, 1995.

19. S.C. Kak, "On generalization by neural networks," First International Conference on Computational Intelligence and Neuroscience, NC, October 1995.

20. S.C. Kak, "New directions in neural network research", Joint Conference on Information Sciences, NC, November 1994.

21. P. Raina, J. Christiansen, T. Clacko, S.C. Kak, "Financial data modeling using feedforward neural networks", Joint Conference on Information Sciences, NC, November 1994.

22. S.C. Kak, "Reflections in clouded mirrors: selfhood in animals and machines", Symposium on Aliens, Apes, and Artificial Intelligence, Univ of Alabama, February 13, 1993.

23. S.C. Kak, "An information view of the EPR experiment", Symposium on the Foundations of Modern Physics, Cologne, Germany, June 1-5, 1993.

24. S. Das and S.C. Kak, "The polynomial neural network", Second International Conference on Fuzzy Theory and Technology, Durham, NC, October 1993.

25. D. Young and S.C. Kak, "Feature based retrieval in neural networks", Proceedings IEEE Southeastcon, 1992.

26. S.C. Kak, "Learning and generalization in feedforward neural networks", First International Conference on Fuzzy Theory and Technology, Durham, NC, October 1992.

27. S.C. Kak and S. Das, "Storing pattern pairs in a bicameral neural network," Proceedings IEEE Southeastern Conference, New Orleans, April 1990.

28. S.C. Kak, "Symmetry breaking in neural memories," Proceedings International Symposium on Circuits and Systems, New Orleans, April 1990.

29. S.C. Kak, "Symmetry breaking in neural memories," Symposium on the Foundations of Modern Physics, Joensuu, Finland, August 1990.

30. S.C. Kak, "Neural computing with structured information," 2nd International Conference on Tools for Artificial Intelligence, Washington, D.C., November 1990.

31. S.C. Kak and A.O. Barbir, "The Brahmagupta algorithm for square rooting," Proceedings of the 21st Southeastern Symposium on System Theory, Tallahassee, March 1989.

32. M.C. Stinson, S.C. Kak, and D.G. Foster, "The bicameral neural network model: an application of conditional rule structure to speech perception," Proceedings of the Workshop on Natural Language Processing for Artificial Intelligence, Roorkee, Jan. 14-15, 1989.

33. S.C. Kak, "On Stochastic Computing," Proceedings of the 22nd Annual Conference on Information Sciences and Systems, Princeton, N.J., pp. 131-133, March 1988.

34. M.C. Stinson and S.C. Kak, "Techniques to improve convergence of neural networks," Proceedings of the 22nd Annual Conference on Information Sciences and Systems, Princeton, N.J., p. 275, March 1988.

35. M.C. Stinson and S.C. Kak, "Asynchronous controller to improve the convergence of neural nets," Proceedings of the 26th Annual ACM Conference of the Southeast Region, pp. 410-413, April 21-22, 1988.

36. D. Prados and S.C. Kak, "Shift invariant associative memory using VLSI," Proceedings of the International Workshop on VLSI for Artificial Intelligence , Oxford, U.K., 1988.

37. S.C. Kak, "Stochastic computing," IEEE International Symposium on Information Theory, Osaka, Japan, 1988.

38. M.C. Stinson and S.C. Kak, "On bicameral neural networks," 1st International Neural Networks Society (INNS) Conference, Boston, September 1988.

39. M.C. Stinson and S.C. Kak, "Bicameral Neural Computing," Proceedings ComCon 1988, (2nd International Conference on Advances in Communications and Controls), Baton Rouge, LA, Oct. 1988.

40. C.H. Youn and S.C. Kak, "New learning and control algorithms for neural networks," Proceedings ComCon 1988 (2nd International Conference on Advances in Communications and Controls), Baton Rouge, Oct. 1988.

41. D.L. Prados and S.C. Kak, "Nonbinary neural networks," Proceedings ComCon 1988 (2nd International Conference on Advances in Communications and Controls), Baton Rouge, Oct. 1988.

42. S.C. Kak, "The Paninian approach to natural language processing," Proceedings of the Second International Conference on Advances in Pattern Recognition and Digital Technique , Calcutta, Jan., 6-9, 1986.

43. D.P. Norton and S.C. Kak, "On Shuffling of 2-D Data," Proceedings of the 20th Annual Conference on Information Science and Systems, Princeton, N.J., pp. 552-556, March 19-21, 1986.

44. S.C. Kak, "Multilayered array computing," Proceedings of the 20th Annual Conference on Information Sciences and Systems, Princeton, N.J., pp. 436-441, March 19-21, 1986.

45. S.C. Kak, D.P. Norton and A. El-Amawy, "An efficient implementation of the Aryabhata algorithm," Proceedings of the 20th Annual Conference on Information Sciences and Systems, Princeton, N.J., pp. 790-792, 1986.

46. S.C. Kak, "Digital signatures in networks," Proceeding of the IEEE International Conference on Systems, Man and Cybernetics, India, pp. 968-971, December 1983-January 1984.

47. S.C. Kak, "Joint encryption and error-correction coding," IEEE symposium on Security and Privacy, Oakland, CA, pp. 55-60, April 1983.

48. S.C. Kak, "Information and complexity with applications to digital fault testing," Proceedings of the IEEE Southeastcon, pp. 62-65, April 1982.

49. S.C. Kak, "Information in a quantum description: an exploratory investigation," IEEE International Symposium on Information Theory, France, 1982.

50. S.C. Kak and A.K. Sood, "On a class of interconnection networks," Proceedings IEEE Southeastcon, pp. 232-236, 1981.

51. S.C. Kak, "Decimal sequences and their applications in communications," Proceedings International Conference in Communications, Denver, June 1981.

52. S.C. Kak, "Error bounds for a spread spectrum multiple access system," Proceedings of the National Telecommunications Conference, New Orleans, pp. G 3.4.1-G 3.4.4, 1981.

53. S.C. Kak, "Further results on maximum length decimal sequences," IEEE Intl. Symposium on Information Theory, Santa Monica, February 1981.

54. S.C. Kak, "Scrambling and randomization," IEEE Workshop on Communications Security (Crypto 81), University of California, Santa Barbara, pp. 59-63, August 1981.

55. S.C. Kak and A Chatterjee, "Theory and application of maximum length decimal sequences," Proceedings 14th Annual Conference on Information Sciences and Systems, Princeton, N.J., pp. 618-623, March 1980.

56. S.C. Kak & B. Sathiapalan, "An algorithmic information approach to cryptography," Proceedings 14th Annual Conference on Information Sciences and Systems, Princeton, N.J., March 1980.

57. S.C. Kak, "Real-time encryption of signals - a review," Proceedings 22nd Midwest Symposium on Circuits and Systems, Philadelphia, U.S., June 1979.

58. S.C. Kak, "Product formulas for Walsh functions," Proceedings Walsh Symposium at Washington, D.C., April 1973.

59. S.C. Kak, "On the Discrete Hilbert Transformation," Proceedings 5th Hawaii Conf. on System Science, January 1972.

60. S.C. Kak, "On matrices with Walsh vectors as the eigenvectors," Proc. Walsh Symp. at Washington, D.C., April 1972.

61. S.C. Kak, "On classification of binary sequences," Proceedings Walsh Symposium at Washington, D.C., April 1972.

Invited lectures (selected)

- Baton Rouge Astronomical Society, Lecture on "Quantum reality, multiple universes, information." September 11, 2006.
- Patanjali Lecture, University of Massachusetts at Dartmouth, May 2006.
- RSA Data Security Conference, San Jose, Keynote speech (Spring 2006)
- National Heritage Museum, Lexington, December 17, 2005.
- Harvard University Foundation Invited Lecture, December 16, 2005.
- Houston Museum of Fine Arts, Houston, November 2005.
- University of Connecticut Health Sciences Center, Hartford, Summer, 2005.
- Rochester Institute of Technology, Rochester (Spring 2005)
- Dutch Public TV OHM's National Convention, Keynote speech, Spring 2005.
- Pennsylvania State University, State College, Spring 2005.
- Washington University, St. Louis, Spring 2005.
- University of Minnesota, Minneapolis, Fall 2004.
- University of California, Berkeley (Fall 2004)
- University of Missouri, Columbia (Spring 2003)
- University of Minnesota, Minneapolis (Fall 2002)
- National Heritage Museum, Lexington, Massachusetts (Summer 2002)
- UCLA, Los Angeles (Spring 2002)
- University of Houston, Houston (Spring 2002)
- Duke University, Durham (Spring 2001)
- USF Medical School, Tampa (Fall 2000)

- University of Missouri, Kansas City (Fall 2000)
- University of Utah, Salt Lake City (Fall 2000)
- University of California, Irvine (Spring 2000)
- Stanford University (Spring 2000)
- University of California, Berkeley (Spring 2000)
- Georgia Tech (Fall 1999)
- Univ of Illinois at Urbana (Fall 1999)
- Univ of Wisconsin (Fall 1999)
- Concordia Univ, Montreal (Fall 1999)
- "The Hoopla about quantum computers," Indian Institute of Technology, Delhi, March 27, 1997.
- "Quantum computation: Will it revolutionize science?" Southern University, Baton Rouge, April 24, 1997.
- "The origins of science," Festival of India at Atlanta, August 17, 1997.
- "Early computing and cognitive sciences and their representation," Massachusetts Institute of Technology, Boston, September 27, 1997.
- "Birth of Indian science," Georgia Tech, Atlanta, January 18, 1998.
- "The frontiers of modern science," Univ of Miami, Miami, January 18, 1999.
- "Signal design using Walsh functions," International Symposium on Walsh functions, Warangal, India (1972).
- "Aspects of relativity theory," AIIMS, New Delhi (1979).
- "Decimal sequences," Bell Laboratories, 1980.
- "Data Security," Special Library Association Conference, New Orleans, 1983.
- "Computer security," Special Library Association Conference, New Orleans, 1983.
- "Coding and cryptography using D sequences," IBM TJ Watson Center, 1983.
- "The roots of science in India," India International Center, New Delhi, January 3, 1986. [Also published in IIC Quarterly, June 1986, pp. 181- 196].
- "Science in the next decade," India International Center, New Delhi, September 18, 1986.
- "Bicameral neural computing," Tulane University, New Orleans, April 6, 1989.
- "Neural computing with structured information," Cambridge University, Cambridge, U.K., December 20, 1989.

- "Self-indexing in neural computations," University of New Orleans, New Orleans, March 1991.
- "Science in ancient India," University of Michigan, Ann Arbor, February 7, 1992.
- "Ancient Science," George Washington University, Washington, D.C., April 12, 1992.
- "Challenges facing the modern university," Luncheon Speech at the inauguaration celebrations for Dr Lyons, the incoming president of Jackson State University, Jackson, Mississippi, March 18, 1993.
- "Neural networks, learning, and artificial intelligence," Duke Electrical Engineering Colloquium, Duke University, November 16, 1994.
- "Quantum neural computing," Physics Department, LSU, March 11, 1995.
- "The birth of science," IIT Delhi, August, 1995.
- "The views of Janus: looking behind and looking ahead at science," Philosophy Foundation, Boston, April 20, 1996.
- "Mathematics and astronomy in the Indus-Sarasvati age," International Conference on Revisiting the Indus-Sarasvati Age, Atlanta, October 5, 1996.
- "On the origins of science in India," Indira Gandhi National Centre for the Arts, Delhi, March 26, 1997.

Also seminars at ULL, NC State, IIT Delhi, IIT Bombay, Wayne State University, TIFR, Indian Telephone Industries (Bangalore), Regional Engineering College, Srinagar, Telecommunications Research Centre (New Delhi), Poona University, Southern University, Loyola University, SMU etc.