

Rodney M. Goodman
Curriculum Vitae
November 4, 2014

Personal Data:

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Website: www.rod.goodman.name
Phone (626) 376 6293
Citizenship: Dual USA/UK Citizen.
Education: B.Sc., Honors, Electrical. Engineering, University of Leeds, U.K., 1968.
Ph.D., Electronics, University of Kent at Canterbury, U.K., 1976, Advisor: Prof. P.G. Farrell.
Professional: C.Eng., FIET, FIEEE.



Career:

2002- CEO Gaea Corporation.
1994-2001 Professor of Electrical Engineering, California Institute of Technology.
1994-1996 Director, Center for Neuromorphic Systems Engineering, National Science Foundation Engineering Research Center, California Institute of Technology.
1989-2001 Faculty, Computation and Neural Systems Program.
1985-1993 Associate Professor of Electrical Engineering with tenure, California Institute of Technology, Pasadena, California.
1982-1985 Senior Lecturer (Associate Professor), Dept. of Electronic Engineering, University of Hull, U.K.
1975-1982 Lecturer (Assistant Professor, tenure 1978), Dept. of Electronic Engineering, University of Hull, U.K.
1972-1975 Lecturer (Assistant Professor), Department of Electrical Engineering, Kingston-upon-Thames Polytechnic, U.K.
1971-1972 Tutorial Fellow, Electronics Laboratories, University of Kent at Canterbury, U.K.

Research Interests:

Intelligent information processing systems: Neural networks, machine learning, pattern recognition, data mining, neuromorphic and biologically inspired processing systems, VLSI and MEMS, microprocessors and embedded systems, AI methodologies, robotics, collective robotics, swarm intelligence, machine consciousness, machine vision and distributed computation, biomedical applications.

Communications systems: Information theory, error control coding, data compression, distributed and mobile networks, Ultra Wideband Wireless, Ad Hoc Networks, RFID, RTLS.

Teaching Interests:

I have taught communications and computation courses that appear in most EE/CS undergraduate, masters, and Ph.D. programs including digital systems, microprocessors, analog electronics, circuit theory, linear systems theory, signals and systems, computer architecture, software engineering, introduction to programming languages, communications, and VLSI. Have always implemented significant practical laboratory components into these courses, including lab experiments, simulation design, and hardware design projects. I have supervised senior projects lab and senior experimental and theoretical theses. Graduate level courses include: information theory and coding, cryptography, digital communications and networks, neural networks and pattern recognition, machine learning, signal and image processing, robotics, computation and neural systems, swarm intelligence and collective robotics.

Industrial Interests:

Startup formation, industrial/university/government labs liaison, research parks, incubators. Knowledge of startup funding sources such as venture capital, SBIRs, and state/federal/private foundation entrepreneurial programs. Knowledge of technology company formation and operations.

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Professional Memberships and Activities:

- Chartered Electrical Engineer and Fellow of the Institution of Engineering and Technology (IET, U.K.), Fellow of the Institution of Electrical and Electronic Engineers. (IEEE).
- Reviewer for IEEE (U.S.A.), and IEE and IERE (U.K.) journals including: IEEE Transactions on Information Theory, Computers, Neural Networks, Pattern Analysis and Machine Intelligence, Proceedings of the IEEE, Proceedings of the IEE, Electronics Letters, Neural Computation.
- Reviewer for proposals to NSF, ARO, AFOSR, ONR, DARPA.
- Have served as North American editor of *Neural Computing and Applications*, Springer International.
- Have served on various organizing and program committees for: IEEE International Information Theory Symposium, Neural Information Processing Systems (NIPS), NIPS Foundation, International Joint Conference on Neural Networks (IJCNN), Neural Networks for Computing/Machines that Learn (Snowbird), IFIP International Symposium on Integrated Network Management (ISINM), International Symposium of Circuits and Systems (ISCAS), International Workshop on Applications in Neural Networks in Telecommunications (IWANNT), Frontiers in Distributed Information Systems (FDIS), International workshop on “Can a Machine be Conscious” – Cold Spring Harbor.
- Ph.D. Students: Have advised a total of 25 Ph.D. graduate students, and six Post-doctoral students.
- Publications: A total of over 150 publications in journals and conference proceedings.
- Patents: 16 issued patents
- Research Grants: Have attracted over \$7M in research grants since 1985 to support the Goodman research lab at Caltech.
- Was the responsible Principal Investigator for winning a National Science Foundation (NSF), Engineering Research Center (ERC) for Caltech. Was responsible for administering this award of \$11M over 5 years, and served as the center Director for its first two years of operation, and director of industrial liaison thereafter. These are national centers of excellence, and the Caltech Center for Neuromorphic Systems Engineering, together with its educational component, the Computation and Neural Systems graduate degree program is at the forefront of this field. The mission of this Center is to develop the technologies necessary for endowing the machines with the human-like senses of vision, audition, touch, and smell (chemical sensing), and applying these to autonomous robots.
- Have acted as technical consultant for a variety of government and commercial organizations in both the UK and the USA.
- Startup Companies: Have been responsible for founding six technology startup companies in the UK and the USA. Have been responsible for attracting private, government, and venture capital startup funds for these companies and have served on their boards of directors. Have also acted as technical consultant to these companies.

Honors and Awards:

- Undergraduate Class of 1968 project prize, Institution of Electrical Engineers of Great Britain, 1968.
- Member of the Institution of Electrical Engineers of Great Britain and Chartered Engineer, 1979.
- Paper Prize: The Marconi Premium of the Institution of Electrical Engineers of Great Britain, 1980.
- NATO Senior Scientist Awards, 1981 and 1983.
- Research Fellow of the Royal Society of Great Britain, Microcomputer Synthesis of Speech and Music, 1982-84.
- Research Fellow of the Leverhulme Trust of Great Britain, Knowledge-Based Personal Information Systems, 1984.
- NASA Tech Brief Awards: 1990, 1991.
- Fellow of the Institution of Engineering and Technology of Great Britain, 2002.
- Fellow of the Institution of Electrical and Electronic Engineers, 2004.
- Carnegie Trust Centenary Professorship 2008.

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Five Selected Publications:

- O. Holland, and R. Goodman, “ Robots with Internal Models: A Route to Machine Consciousness? ,” *Journal of Consciousness Studies*, Special Issue on Machine Consciousness, Vol. 10, No. 4-5, pp. 77-109, April/May 2003.
- A.T. Hayes, A. Martinoli, and R.M.Goodman, “Distributed Odor Source Localization,” *IEEE Sensors Journal*, Special Issue on Electronic Nose Technologies, Vol. 2, No. 3, pp. 260-217, June 2002.
- J. A. Dickson, R. M. Goodman, “Integrated Chemical Sensors based on Carbon Black and Polymer Films using a Standard CMOS Process and Post-processing,” *Proceedings of the IEEE International Symposium on Circuits and Systems (ISCAS'2000)*, May 2000, Geneva, Switzerland, pp. 341-344.
- B. Gupta, R. Goodman, F. Jiang, Y-C. Tai, S. Tung, C-M, Ho, “Analog VLSI System for Active Drag Reduction,” *IEEE Micro*, Vol. 16, No. 5, pp. 53-59, October 1996.
- Z. Zeng, R.M. Goodman P. Smyth, “Discrete Recurrent Neural Networks for Grammatical Inference,” *IEEE Transactions on Neural Networks*, Special Issue on Dynamic Recurrent Neural Networks: Theory and Applications, Vol. 5, No. 2, pp. 320-330, March 1994.

Referees:

On request.

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Ph.D. Students Advised:

Hull University UK-

W.H. Ng	EE PhD, 1978	Optimization of Decoding Procedures for Convolutional Codes.
K.A. Salloum	EE PhD, 1983	Error Control Coding for a Multi-Level HF Data Transmission Modem.
A.F.T Winfield	EE PhD, 1984	Maximum-Likelihood Sequential Decoding of Convolutional Error Correcting Codes.
A.J. McAuley	EE PhD, 1985	Public Key Cryptosystems – Theory, Application, and Implementation.

Caltech-

Padhraic Smyth	EE PhD, 1988	The Application of Information Theory To Problems in Decision Tree Design and Rule-Based Expert Systems.
Tsi-Dar Chiueh	EE PhD, 1989	Pattern Classification and Associative Recall by Neural Networks.
Sean Coffey	EE PhD, 1989	On Complexity and Efficiency in Encoding and Decoding Error Correcting Codes.
Kathleen Kramer	EE PhD, 1991	Large Operand Division and an Asynchronous Approach to Fault Detection.
John W. Miller	EE PhD, 1992	Building Probabilistic Models from Databases.
Masahiro Sayano	EE PhD, 1992	Analyses of Coding and Compression Strategies for Data Storage and Transmission.
Andrew J. Moore	CNS PhD, 1992	Spatial Filtering in Tone Reproduction and Vision.
Charles Higgins	EE PhD, 1993	Classification and Approximation with Rule-based Networks.
Hayit Greenspan	EE PhD, 1993	Multi-resolution Image Processing and Learning for Texture Recognition and Image Enhancement.
Gamze Erten Salam	EE PhD, 1993	An Analog VLSI Architecture for Stereo Correspondence.
Zheng Zeng	EE PhD, 1994	Recurrent Neural Networks for Grammatical Inference.
Barry Ambrose	EE PhD, 1995	Dynamic Routing of Telephone Traffic Using Network Management Tools.
John Cortese	EE PhD, 1995	Stochastic Computation.
Bhusan Gupta	EE PhD, 1997	Analog VSLI for Active Drag Reduction.
Jeff Dickson	EE PhD, 1999	Adaptive Systems in CMOS Analog VLSI.
David Babcock	EE PhD, 1999	Intelligent Control Using Generalizing Case-Based Reasoning with Neural Networks.
Randy Spangler	EE PhD, 1999	Rule-Based Analysis and Composition of Music.
Cindy Daniell	EE PhD, 2000	Object Recognition in Compressed Imagery.
Sanza T. Kazadi	CNS PhD, 2000	Swarm Engineering.
Samuel Tang	EE PhD, 2001	Neuromorphic VLSI Circuits for an Electronic Nose Chip.
Vincent Koosh	EE PhD, 2001	Analog Computation and Learning in VLSI.
John Lindal	EE PhD, 2001	An Investigation of Classification Algorithms for an Autonomous Software Agent for Locating Information on the World Wide Web.
Adam Hayes	CNS PhD, 2002	Self-Organized Robotic System Design and Autonomous Odor Localization.
William Agassounon.	EE PhD, 2003	Modeling Artificial, Mobile Swarm Systems.

Post-Docs Advised:

Tony McAuley	1985-1988	VLSI processors and asynchronous logic.
Dawei Dong	1995-96	Neural networks for automotive drivetrain applications.
Alcherio Martinoli	1999-2001	Collective robotics.
Jeff Dickson	1999-2001	Nose chips.
Vincent Koosh	2001-2001	Analog VLSI.
Ian Kelly	2001-2001	Robot hardware systems.

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Academic Research Grants:

1978	S.E.R.C. (U.K.)	£8,500	Minimum Distance Decoding of Long Convolutional Codes.
1979	S.E.R.C. (U.K.)	£7,700	Error Correction Coding for Large Semiconductor Memories.
1981	NATO	£5,000	Error Control Coding.
1981	S.E.R.C. (U.K.)	£10,000	Maximum Likelihood Decoding of Long Convolutional Codes.
1982	Nuffield Found (U.K.)	£5,000	VLSI Education Using Computer Assisted Learning.
1982	Royal Society	£10,000	Microcomputer Speech and Music.
1983	GEC	£71,000	(at GEC Hirst Research Center), VLSI RSA Public Key Cryptosystem.
1983	NATO	£5,000	Coding for VLSI Memories.
1984	Leverhulme Trust (U.K.)	£5,000	Development of a Knowledge Based Personal Information System.
1984	S.E.R.C. (U.K.)	£22,000	VLSI Implementation of Convolutional Error Control Decoders.
1985	Caltech	\$80,000	Microsystems Lab startup funds.
1985-87	PAT	\$71,729	Program in Advanced Technologies sponsored by Aerojet, General Motors, and TRW: On Chip Error correction Coding for VLSI RAMs and Wafer Scale Integration.
1986	Tektronix	\$29,600	Equipment Donation: Logic Analyzers.
1986	IBM	\$48,000	Discretionary funds: Image processing equipment purchase.
1986	Fluke Mfg. Co.	\$15,000	Equipment Donation: Lab instrumentation.
1986-87	JPL	\$10,000	Efficient Error Correcting Spacecraft Memory.
1986-87	JPL	\$45,340	JPL Director's Discretionary Fund: Maximum Likelihood Decoding of Long Constraint Length Convolutional Codes.
1987-88	Pacific Bell	\$42,000	Expert Systems for Real Time Network Management.
1987-89	PAT	\$73,700	Program in Advanced Technology sponsored by Aerojet, General Motors, and TRW: Information Theoretic Approach to Expert Systems.
1987-89	NSF	\$90,000	Undergraduate creativity award Expert Systems in VLSI Design.
1988	Hewlett-Packard	\$26,430	Equipment donation: Communications instrumentation.
1988	Xerox	\$10,000	Discretionary funds: Computer Vision System purchase.
1988	Fluke Mfg. Co.	\$3,620	Equipment Donation: Lab multimeters.
1988-89	Pacific Bell	\$90,000	Expert Systems for Real Time Network Management.
1988-90	NSF	\$142,328	Architectures for Error Control in VLSI Random Access Memory Systems.
1989-90	JPL	\$71,400	JPL Directors Discretionary Fund: Source Coding using Neural Vector Quantizers.
1989-91	ARO	\$200,000	An Information Theoretic Approach to Rule Based Expert Systems.
1990	Apple Computer	\$32,603	Equipment donation: Macintosh computers and peripherals.
1990	Silicon Compiler Sys.	\$120,000	Equipment donation: GDT automated VLSI design software.
1990	Pacific Bell	\$85,400	Discretionary funds: Purchase of Sun Computers.
1990	Caltech	\$120,000	Discretionary funds: Resdesign of EE14 Electronics Teaching Laboratory.
1990-91	Pacific Bell	\$100,000	Expert Systems for Real Time Network Management
1990-92	DARPA	\$394,118	Neural Networks Initiative: An Information Theoretic Approach to Distributed Inference and Learning.
1991-92	ARO	\$50,000	Development of ITRULE algorithms.
1992-93	Pacific Bell	\$50,000	Expert Systems for Real Time Network Management.
1992-95	AFOSR	\$146,899	Real Time Adaptive VLSI Neural Classifiers.
1993-94	NYNEX	\$40,000	Automatic Methods of Knowledge Acquisition.
1993-95	ONR-ASSERT	\$157,532	Hybrid Neural/Fuzzy Reasoning System.
1993-98	AFOSR	\$3,872,461	University Research Initiative (URI): Integrated Microtransducer and Neural Network Systems for Distributed Control. Goodman lab amount: \$760,000 over 4 years.

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1994-96	ONR	\$1,169,300	Hybrid Neural Vision System for Image Classification and Recognition.
1994-99	NSF	\$11,000,000	Center for Neuromorphic Systems Engineering, Engineering Research Center. Goodman lab award \$1,250,000 over 5 years.
1994	State of California	\$250,000	Engineering Research Center. Matching funds.
1994	Caltech	\$80,000	Engineering Research Center. Matching funds.
1994	Intel	\$60,000	Neural computing.
1995	AGL	\$40,000	Expert Systems in Telecommunications.
1995	Intel	\$20,000	Neural computing.
1996	Honeywell	\$40,000	Neural networks.
1997	Nortel	\$60,000	Neural networks for communications networks applications.
1997	Honeywell	\$40,000	Neural networks for condition monitoring.
1997	General Motors	\$33,000	Neural networks for automotive applications.
1997-98	DURIP	\$173,754	Instrumentation for Testing of Low Power Electronics.
1997-00	ONR/AASERT	\$183,478	A Hybrid Neural Vision System for Image Classification and Recognition.
1997-00	ARO/DARPA	\$4,647,795	A Conducting Polymer-Based Electronic Nose for Landmine Detection. (Goodman lab: \$897,949).
1998-00	ONR/DARPA	\$500,000	Chemical Plume Tracing via Collective Autonomous Robotics
1998-00	ARO/DARPA	\$400,000	Distributed Robotics.
1998	Nortel	\$40,000	Intelligent Network Management.
1998-01	ARO	\$2,600,093	MURI: Understanding Olfaction from Detection to Classification. (Goodman lab: \$363,351)
1998	Honeywell	\$40,000	Neural networks.
1999-00	AFOSR	\$111,040	Distributed Turbulent Flow Control by MEMS and Neural Networks.
1999	Nortel	\$40,000	Intelligent Network Management for Cable Modem Networks.
2000-02	IMLS	\$461,011	American Archive Digitization Project.
2000	Nortel	\$40,000	Ant-based routing Algorithms for Network Traffic Flow.
2000	TRW Foundation	\$20,000	Optimal Task Allocation in Collective Robotics.
2000	TRW	\$25,000	Swarm Sensing.
2000	Delphi-Delco	\$65,000	Integrated Safety Systems through Swarm Intelligence.
2001	Florence Gould Found.	\$20,000	Handwriting Recognition.
2001	Delmas Foundation	\$30,000	Cursive Handwriting Recognition.

Startup Companies:

- 1980. Electronic Automation Ltd. Hull, UK. Founder and Board Member. Automated visual inspection hardware and software.
- 1982 APD Ltd Hull UK. Founder and Board Member. (Now part of Lynx Group PLC). Integrated communications/IT networks for public safety, public transport, and logistics.
- 1995 AGL Inc. Pasadena, CA, USA. Founder and Board Member. (Now part of Nortel Networks) Intelligent network management software.
- 1997 Cyrano Sciences Inc. Pasadena, CA, Founder and Board Member. USA. (Now part of Smiths Detection) Electronic nose technology.
- 2004 InfinID Technologies Inc., Founder and Board Member. RFID, RTLS.
- 2008 TixTrack Inc., Founder and Board Member. Ticket Analytics, Dynamic Pricing for Ticket Sales.

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Consulting:

- 1975-1978 Royal Arthritis Society, Canada:
Telemetry systems for Electrogoniometers.
- 1978-1983 Hull Royal Infirmary and Yorkshire Regional Health Area, U.K.:
Telemetry systems for prosthetic hip joints. Nationwide on-line nephrology computer record system.
Kidney donor regional computer network.
- 1976-1985 Sea Fish Industry Association of Great Britain, Edinburgh, U.K.:
Computerized fish auction sales via datatext networks. Electric fishing techniques.
Computer controlled echo sounders.
Automated fish detection using expert systems.
- 1980-1985 Electronic Automation Ltd., Hull, U.K., Founder, Board Member, and Consultant:
Robot vision system for Unimation Inc. Puma robots. Computerized teachable routing machines.
Microprocessor tachographs.
- 1983-1985 Advanced Processor Design Ltd., Hull, U.K., Founder, Board Member and Consultant:
High speed stack based computer architectures. Functional language and AI computer systems.
Network management for on-line computer systems.
- 1983-1985 Cairntech Ltd., Edinburgh, Scotland:
Public key cryptosystems for speech scramblers.
- 1983-1985 British Telecom, Martlesham Research Laboratories, U.K.:
Consultant on CCITT V32 modem and error correction proposals.
Design of high speed data transmission modems and equalizers.
- 1985-1986 Jet Propulsion Laboratory, Pasadena:
Error control coding for deep space communications.
- 1986-1988 Pacific Bell, San Ramon, California:
Network switch software.
- 1989-1992 Jet Propulsion Laboratory, Pasadena:
Network management automation for the JPL ILAN.
Expert systems for monitoring and control of the GPS range datalink system.
Deep Space Network review panel.
- 1992 U.S. Army Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD:
Hybrid neural network and expert system software in support of the spectroscopy 6.1 program.
- 1992-1994 Communications Manufacturing Company, Los Angeles:
Calling Number Delivery (CND) test systems.
Mobile spread spectrum links for test equipment.
- 1995-1997 AGL Inc. Founder and Board Member:
Intelligent network management software.
- 1995-1996 ALCOA:
Visual inspection using neural network techniques.
- 1997-2000 Nortel Networks:
Intelligent network systems.
- 1997- Cyrano Sciences, Founder, Board Member, and Consultant:
Electronic nose technology.
- 2001-2003 IdeaLab!, Consultant:
Autonomous robot technology.
- 2001-2004 StereoVision Inc, Consultant and Advisory Board Member.
3D vision systems.
- 2002-2003 Calhoun Vision:
MEMS applications to contact lens technology.
- 2004-2013 InfinID Technologies Inc. Founder and Board Member.
RadioFrequency ID and location Systems. (RFID, RTLS)
- 2008- TixTrack Inc. Founder and Board Member.
Ticket Analytics, Dynamic Pricing for Ticket Sales.

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Publications

Journal Papers

46. O. Holland, and R. Goodman, "Robots with Internal Models: A Route to Machine Consciousness Studies, Special Issue on Machine Consciousness, Vol. 10, No. 4-5, pp. 77-1
45. C. Daniell, A. Mahalanobis, and R. Goodman, "Object Recognition in Subband Transform Compressed Images Using Correlation Filters," *Applied Optics-Information Processing*, Vol. 42, Issue 32, November 2003.
44. A.T. Hayes, A. Martinoli, and R.M. Goodman, "Swarm Robotic Odor Localization: Off-Line Optimization and Validation with Real Robots," *Robotica*, Special issue on Biological Robotics, Vol. 21, No. 4, pp. 427-441, August 2003.
43. A.T. Hayes, A. Martinoli, and R.M. Goodman, "Distributed Odor Source Localization," *IEEE Sensors Journal*, Special Issue on Electronic Nose Technologies, Vol. 2, No. 3, pp. 260-217, June 2002.
42. V. F. Koosh, and R.M. Goodman, "Analog VLSI Neural Network with Digital Perturbative Learning," *IEEE Transactions on Circuits and Systems II*, Vol. 49, No. 5, pp. 359-368, May 2002.
41. S. Kazadi, A. Abdul-Khaliq, R. Goodman, "On the Convergence of Puck Clustering Systems," *Robotics and Autonomous Systems*, 38 (2), pp. 93-117, 2002.
40. S. Kazadi, R. Goodman, D. Tsikata, and H. Lin, "An Autonomous Water Vapor Plume Tracking Robot Using Passive Resistive Polymer Sensors." *Autonomous Robots*, Vol. 9, No. 2, pp. 175-188, 2000.
39. Lee, C., Kim, J., Babcock, D., and Goodman, R. "Application of Neural Network to Turbulence Control for Drag Reduction", *Phys. Fluids*, Vol.9, pp. 1740-1747, 1997.
38. B. Gupta, R. Goodman, F. Jiang, Y-C. Tai, S. Tung, C-M, Ho, "Analog VLSI System for Active Drag Reduction," *IEEE Micro*, Vol. 16, No. 5, pp. 53-59, October 1996.
37. B.E. Ambrose and R.M. Goodman, "Neural Networks Applied to Traffic Management in Telephone Networks," *Proceedings of the IEEE*, Vol. 84, No. 10, pp. 1421-1430, October 1996.
36. G. Erten and R.M. Goodman, "Analog VLSI Implementation for Stereo Correspondence Between 2-D Images," *IEEE Transactions on Neural Networks*, Vol. 7, No. 2, pp. 266-277, March 1996
35. R.M. Goodman and B.E. Ambrose, "Stability of Traffic Patterns in Broadband Networks," *Journal of Network and Systems Management*, Special Issue on Routing in Broadband Networks, Vol. 3, No. 4, pp. 371-380, December 1995.
34. Z. Zeng, R.M. Goodman P. Smyth, "Discrete Recurrent Neural Networks for Grammatical Inference," *IEEE Transactions on Neural Networks*, Special Issue on Dynamic Recurrent Neural Networks: Theory and Applications, Vol. 5, No. 2, pp. 320-330, March 1994.
33. C.M. Higgins and R.M. Goodman, "Fuzzy Rule-Based Networks for Control," *IEEE Transactions on Fuzzy Systems*, Vol. 2, No. 1, pp. 82-88, February 1994.
32. H. Greenspan and R.M. Goodman, R. Chillappa, C. Anderson, "Learning Texture Discrimination Rules in a Multiresolution System," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Special Issue on Learning in Computer Vision, Vol. 16, No. 9, pp. 894-901, September 1994.
31. Z. Zeng, R.M. Goodman and P. Smyth, "Learning Finite State Machines with Self-Clustering Recurrent Networks," *Neural Computation*, Vol. 5, No.6, pp. 976-990, November 1993.
30. J. W. Miller, R.M. Goodman and P. Smyth, "On Loss Functions which Minimize to Conditional Expected Values and Posterior Probabilities," *IEEE Transactions on Information Theory*, Vol. 39, No. 4, pp. 1404-1408, July 1993.
29. R. M. Goodman and P. Smyth, "Automated Induction of Rule-Based Neural Networks from Databases," *International Journal of Intelligent Systems in Accounting, Finance and Management*, Special Issue on Neural Networks, Vol. 2, No. 1, pp. 41-54, 1993.

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28. R.M. Goodman, R.J. McEliece and M. Sayano, "Phased Burst Error Correcting Array Codes," *IEEE Transactions on Information Theory*, Vol. 39, No. 2, pp. 684-693, March 1993.
27. R.M. Goodman, P. Smyth, C.M. Higgins & J. Miller, "Rule-Based Neural Networks for Classification and Probability Estimation," *Neural Computation*, Vol. 4, No. 6, pp. 781-804, November 1992.
26. P. Smyth and R.M. Goodman, "An Information Theoretic Approach to Rule Induction from Databases," *IEEE Transactions on Knowledge and Data Engineering*, Vol. 4, No. 4, pp. 301-316, August 1992.
25. R.M. Goodman and M. Sayano, "The Reliability of Semiconductor RAM Memories with On-Chip Error Correction Coding," *IEEE Transactions on Information Theory*, Special Issue on Coding for Storage Devices, Vol. 37, No. 3, pp. 884-896, May 1991.
24. A. Moore, J. Allman and R. Goodman, "A Real-time Neural System for Color Constancy," *IEEE Transactions on Neural Networks*, Vol. 2, No. 2, pp. 237-247, March 1991.
23. T. Chiueh and R.M. Goodman, "Recurrent Correlation Associative Memories," *IEEE Transactions on Neural Networks*, Vol. 2, No. 2, pp. 275-284, March 1991.
22. T. Chiueh, R.M. Goodman and M. Sayano, "A Static RAM Chip with On-Chip Error Correction," *IEEE Journal of Solid-State Circuits*, Vol. 25, No. 5, pp. 1290-1294, October 1990.
21. R.M. Goodman and M. Sayano, "Size Limits on Phased Burst Error Correcting Array Codes," *Electronics Letters*, Vol. 26, No. 1, pp. 55-56, January 1990.
20. J.T. Coffey, R.M. Goodman, and P.G. Farrell, "New Approaches to Reduced-Complexity Decoding," *Discrete Applied Mathematics*, Vol. 33, pp. 43-60, 1991.
19. R.M. Goodman and P. Smyth, "Decision Tree Design Using Information Theory," *Knowledge Acquisition*, Vol. 4, No. 1, pp. 1-26, 1990.
18. J.T. Coffey and R.M.F. Goodman, "The Complexity of Information Set Decoding," *IEEE Transactions on Information Theory*, Vol. 36, No. 5, pp. 1031-1037, September 1990.
17. J.T. Coffey and R.M.F. Goodman, "Any Code of Which we Cannot Think is Good," *IEEE Transactions on Information Theory*, Vol. 36, No. 6, pp. 1453-1461, November 1990.
16. R.M. Goodman, P. Smyth, and Hayes Latin, "Real Time Autonomous Expert Systems in Network Management," *Office: Technology & People*, Vol. 5, No. 3, pp. 205-228, 1989.
15. R.M. Goodman and A.J. McAuley, "An Arithmetic-Stack Processor for High Level Language Execution," *Journal of Forth Applications & Research*, Vol. 5, No. 4, pp. 469-492, 1989.
14. R.M.F. Goodman and P. Smyth, "Decision Tree Design from a Communication Theory Standpoint," *IEEE Transactions on Information Theory*, Vol. 34, No. 5, pp. 979-994, September 1988.
13. M. Blaum, R.M.F. Goodman and R.J. McEliece, "The Reliability of Single-Error Protected Computer Memories," *IEEE Transactions on Computers*, Vol. 37, No. 1, pp. 114-119, January 1988.
12. T. Fuja, C. Heegard and R.M. Goodman, "Linear Sum Codes for Random Access Memories" *IEEE Transactions on Computers*, Vol. 37, No. 9, pp. 1030-1042, September 1988.
11. R.M.F. Goodman and A.J. McAuley, "New Trapdoor-Knapsack Public-Key Cryptosystem," *Proceedings of the IEE*, Vol. 132, Pt. E, No. 6, pp. 289-292, November 1985.
10. R.M.F. Goodman and R.J. McEliece, "Lifetime Analyses of Error-Control Coded Semiconductor RAM Systems," *Proceedings of the IEE*, Vol. 129, Pt. E, No. 3, pp. 81-85, May 1982.
9. R.M.F. Goodman, G.E. Taylor, and A.F.T. Winfield, "An Advanced Electronics Teaching Laboratory," *International Journal on Electrical Engineering Education*, Vol. 19, pp. 357-366, 1982.
8. M. Kilvington and R.M.F. Goodman, "In Vivo Hip Joint Forces Recorded on a Strain Gauged "English" Prosthesis using an Implanted Transmitter," *Engineering in Medicine*, Vol. 10, No. 4, pp. 175-187, 1981.
7. R.M.F. Goodman, C. Eng and A.F.T. Winfield, "Soft-Decision Minimum Distance Sequential Decoding Algorithm for Convolutional Codes," *Proceedings of the IEE*, Vol. 128, Pt. F, No. 3, pp. 179-186, June 1981.
6. P.G. Farrell and R.M.F. Goodman, "Soft-Decision Error Control Coding for HF Data Transmission," *Proceedings of the IEE*, Vol. 127, Pt. F, No. 5, pp. 389-399, October 1980.
5. R.M.F. Goodman, "Soft-Decision Decoding of the Teletext Character Code," *Electronics Letters*, Vol. 15, No. 4, pp. 108-109, February 1979.

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4. W.H. Ng and R.M.F. Goodman, "Analysis of the Computational and Storage Requirements for the Minimum-Distance Decoding of Convolutional Codes," *Proceedings of the IEE*, Vol. 126, No. 1, pp. 29-34, January 1979.
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