



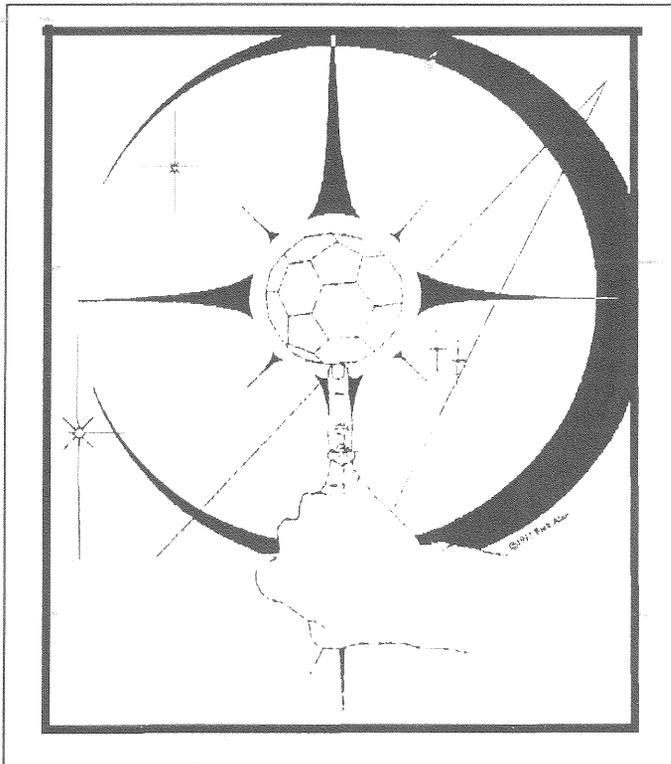
Connections

The Newsletter of the IEEE Neural Networks Council

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Whence Cybernetics?

Interesting things and people show up on the electronics bulletin boards. Neuron Digest, moderated by Peter Marvit of the University of Pennsylvania, (email: neuron-request@psych.upenn.edu) recently ran a discussion "Whence Cybernetics". Contributors included (in order of posting, Jacob Galley, Melvin Rader, William Dwinnell, Marvin Minsky, and Dick Cavonius. The opinions expressed are solely those of the writers.

Jacob Galley, a student at the University of Chicago, began the discussion

I have been studying linguistics and cognitive science type stuff for about two years in college, and I am just now becoming aware of the long line of cybernetic thought which runs parallel to "good old-fashioned" symbolic AI. Why is this work now (and apparently always since the schism) more obscure than work done in symbolic, serial cognitive modelling?

[Gulley quoted two paragraphs from Foundations of Neural Networks by Tarun Khanna (Addison-Wesley 1990), which compare the cyberneticians and the AI community. He states that Khanna goes on to portray connectionism as a new hybrid between the two traditions.]

I am amazed that this alternative to symbolic AI is so obscure. Why are (symbolic) artificial intelligence classes, theories and opinions so easy to find, but cybernetic thought has faded away, become esoteric?

There are lots of reasons I can think of which seem reasonable, but I don't know enough of the history to be sure:

- Cybernetic theory is more abstract, difficult, vague. (No idea yet if this is even true.)
- The "Chomskyan Revolution" in linguistics and/or the "Cognitive Revolution" in psychology tipped the scales in the symbolic AI tradition's favor. (No idea what the causal relationships are between the three symbolic schools, if any can be clearly attributed.)
- The foundations of serial programming caught on before the foundations of parallel programming (which we are still hammering out today), so applications of symbolic AI were more successful, more glamorous, sooner.

Does anyone have any thoughts on this?

What's so interdisciplinary about studying lower levels of thought process?

Melvin Rader, a student at Evergreen State College responded:

By cybernetics, I take you to mean the study of neural networks and connectionist models of artificial intelligence. By no means is it dead, or even all that obscure. As an undergraduate at the Evergreen State College in Olympia, WA this year I took four credits of 'Connectionism' and another four of programming of neural networks. I believe there's a newsgroup devoted to neural networks as well.

Seymour Papert has written a whimsical account of the history of network vs. symbolic approaches to artificial intelligence.

[Papert's fairy tale, which Rader quoted, casts cybernetics and AI in the role of jealous sisters competing for the attention and overflowing coffers of Lord DARPA. He portrays himself and Marvin Minsky as the followers of the AI sister who used their mighty weapon, the pen, to create a book—Perceptrons—with which they slew the Cybernetics sister.]

Minsky and Papert's book did effectively kill further research into neural networks for about two decades. The thrust of the book was that with the learning algorithms that had been developed then, neural networks could only learn linearly separable problems, which are always simple (this was proved mathematically). Networks existed which could solve more complicated problems, but they had to be "hard wired" - the person setting up the network had to set it up in such a way that the network already "knew" everything that it was going to be tested on; there was no way for such a network to learn.

(The book also raised some other, more philosophical concerns.) Since learning was basically the only advantage neural network models had over symbolic models (aside from an aesthetic appeal due to their resemblance to natural models), research into neural networks died out. (Also, NN research is associated philosophically with behaviorism - NNs solve through association. When behaviorism died, it also helped bring down the NN field.)

However, in the late 70's (I think) the "backpropagation training algorithm" was developed. Backpropagation

allows the training of neural networks which are powerful enough to solve non-linearly separable problems, although it has no natural equivalent. With the development of backpropagation, and with the association of several big names with the field, research into network models of artificial intelligence revived.

I understand the term "Connectionism" to apply to a field which draws from neural network research and research into the brain. In contrast to whatever book you were quoting from, I understand connectionist thought to be at odds with the symbolic approach to artificial intelligence. A good book to read on the subject is *Connectionism and the Mind* by Bechtel and Abrahamsen. It is a good introduction to connectionism and goes into the philosophy behind it all, although some of the math is off.

William B. Dwinnell, University of Pittsburgh, then added a bit more history:

The passage you posted concerning cybernetics is somewhat misleading. The term "cybernetics" was coined by Norbert Wiener in the 1940's, defining it as "the entire field of control and communication theory, whether in the machine or in the animal." In its narrowest sense, as Wiener wrote about it,

CYBERNETICS

CIRCULAR CAUSAL AND FEEDBACK MECHANISMS IN BIOLOGICAL AND SOCIAL SYSTEMS

TRANSACTIONS OF THE NINTH CONFERENCE
MARCH 20 and 21, 1952

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Looking back: In addition to the editors, the 25 participants in this 1952 interdisciplinary workshop included Walter Pitts, Warren McCulloch, Ross Ashby.

cybernetics might be thought of as a precursor to modern information theory (he mentions Shannon, by the way, in his book *Cybernetics* [1948, John Wiley & Sons, New York]), control theory (including what we now call robotics), and, to some degree, prediction.

In the most general sense, "cybernetics" may be construed as covering all of computer science, and more. It is common today for people to present cybernetics in light of AI or robotics, but there is no reason to put this special slant on cybernetics. Probably the most accurate short definition of "cybernetics", using contemporary terminology would be a proto-science concerning information theory and communication theory.

Next to enter the discussion was Prof. Marvin Minsky of MIT, who vehemently objected to Rader's understanding of Perceptrons:

You'd better give those credits back. The book explained (1) some theory of which geometric problems were linearly separable (and the results were

not notably simple), (2) derived lower bounds on how the size of networks and coefficients grow with the size of certain problems, and (3) these results have nothing whatever to do with the learning algorithms involved, because they only discuss the existence of suitable networks. There was not so much research in neural networks between 1969, when the book was published, and around 1980 or so. This may have been partly because we showed that feedforward nets are impractical for various kinds of invariant recognitions on large retinas, but they are useful for many other kinds of problems. The problem was that too many people propagated absurdly wrong summaries of what the book said—as in the above account. There were some gloomy remarks near the end of the book about the unavailability of convergence guarantees for multilayer nets (as compared with the simple perceptron procedure, which always converges for separable patterns), and this might have discouraged some theorists. There still are no such guarantees for learning algo-

rithms of practical size -- but for many practical purposes, no one cares much about that.

The final comment, but not necessarily the last word, came from Dick Cavonius, University of Dortmund, in the August 27 issue of *Neuron Digest*:

I suspect that a large part of the answer to Galley's question on what happened to cybernetics is that time plays a role: it's unfortunate, but in this field—to a greater extent than in science in general—activity is dictated by what happens to be fashionable at any given moment. Cybernetics was all the rage in the late 40s and 50s. Too much enthusiasm was generated, and when it failed to achieve everything that was expected of it was renounced in favor of AI. To a certain extent the same is now happening to AI, although AI will be harder to kill off because our investment in it is much larger than the investment in cybernetics was.

From the Editor's Desk

The fascinating conversation above has prompted me to break my usual editorial silence and write a "from the editor" letter.

First, a message to my colleagues in Neural Networks Education: When you teach a course in Neural Nets, do NOT teach the history at the beginning of the course! Teach it at the end. The typical student cannot put the significance of the history into context until you have covered the technical stuff. He won't know a backpropagation from a backprojection until the end of class.

And with that introduction, let me address some of the questions that arose in the discussion above:

The word "cybernetics" comes from the Greek *kybernetes* meaning the helmsman on a ship, the one who steers, the one who controls. Yes, cybernetics was the predecessor of modern control theory. And by the way, those who seek to use concepts of control theory to model biological systems are to be commended, but the history actually went the other way. (Biological) systems which adapt their behavior to comply with external stimuli, to keep certain parameters within bounds (what we would call a stable controller)

are referred to possessing *homeostasis*, a word used extensively in early cybernetics literature. This property was observed and described in biological systems a very long time ago.

I did my own MS thesis under one of the grand old men of cybernetics, Ross Ashby. Look for his books *Design for a Brain* (Chapman and Hall, London, 1952) and *Introduction to Cybernetics* (Chapman and Hall, 1956) for some great reading. I worked with Ashby and Heinz von Förster in the Biological Computing Laboratory at the University of Illinois. (Did you get that? **Biological Computing Laboratory**. In 1969!)

At that time, research in cybernetics was a mixed bag of heavy mathematics, the firming up (and splitting off) of control theory as an independent discipline, and attempts to resolve what biology seemed to be telling us about computing with what computing seemed to be telling us about biology.

I did my MS thesis on internal communications in systems (the concept was that the more communication/interaction the elements within a system had among themselves, the less likely the system was to be stable--some profound implications

to modern government and the mass media). Unfortunately, I could only test the theory on linear systems. I was all set to go into cybernetics for the Ph.D. Then came *Perceptrons*.

As Prof. Minsky mentioned above, the book was carefully written. It explained the perceptron quite well, and was really quite limited in its "shooting down" of the field. Basically, it said that there were certain problems that a perceptron (a "diameter-limited" perceptron to be precise) could not solve. "So what?" we might say today. "Gödel also showed that there were certain problems no machine could solve." But that doesn't seem to stop us from using computers. Anyway, for reasons unexplainable (but easily theorized) neural network/cybernetics funding dried up.

Did Minsky and Papert write their book deliberately, for personal reasons, knowing what it would do, as rumor sometimes reports? I have no idea—or interest. Such speculation is counterproductive and unprofessional, and something I would like to see disappear. I do

Continued on back page

Wesley E. Snyder
North Carolina State University

NNC Standards Committee

Walter Klarplus, UCLA
Mary Lou Padgett, Auburn University

The Standards Committee of NNC has expanded its activities and invites your participation in the formal working groups and in upcoming events. The Artificial Neural Networks (ANN) Standards Working Groups are moving forward with formal procedures outlined by the IEEE Standards Board for groups with approved Project Authorization Requests (PAR). Balloting to approve standards and the eventual publication of standards is anticipated.

Recent reorganization has produced the following Working Groups and sub-groups:

- Definition of Terms for Artificial Neural Networks: International Language and Symbology Paradigms
- Guidelines for Evaluation of Artificial Neural Network Implementations: Trained Feed-forward Networks Supervised Training
- Artificial Neural Network Interfaces: Hardware Software
- Fuzzy Systems
- Virtual Reality

Reports from individual groups follow:

ANN Definition Of Terms

The Working Group on Definition of Terminology for Artificial Neural Networks has several activities in progress.

1. Methodology for Specification of ANN Paradigms and Supporting Terminology;
2. Panel discussions on International Language and Symbology at NNC International Conferences;
3. Paper and demonstration contests encompassing all the working group topics and supported by NASA;
4. WNN Workshops encompassing all working group topics and co-sponsored by NASA planned for 1994 and 1995.

The first effort, specification of paradigms, is an outgrowth of the glossary group. Careful development of

appropriate definitions requires a modular, modifiable approach. Diagrams and supporting references are being gathered to help clarify the procedure recommended.

The second project, development of an international language and symbology, is gaining momentum. Initiated last year at IJCNN/Beijing, it will be extended at IJCNN/Nagoya in October.

A panel discussion covering all the ANN Standards groups is planned for Thursday, October 28 from 14:00 to 17:00. Chairs will be Walter Karplus and Mary Lou Padgett. Participants will include Toshio Fukuda, Shiro Usui, Harold Szu and other international representatives.

Informal interaction and social events will be scheduled throughout the conference.

Also scheduled at IJCNN/Nagoya is a tutorial, "Standards, Basic Concepts And Applications". Participants will receive an educational copy of the NASA Nets software, and individual interaction and demonstrations will be continued throughout the conference. Each registrant will have the opportunity to ask individual questions and experiment with the software. (*Monday, October 25, Tutorial 7-III, Mary Lou Padgett, Auburn University.*)

The third and fourth projects are intended to stimulate interest in the careful development of standards and paradigm comparisons. Professors E. Tzanakou, Walter Karplus and a NASA representative will participate in the review process. The projects and conferences will be organized by Mary Lou Padgett, who can provide details on request.

ANN Performance Evaluation Methodology

In accordance with the plan of the working group to establish a repository for benchmark data sets, a new collection of pattern classification signatures is under consideration for inclusion in the

suite. These patterns are comprised of over 700 60-point AC electric current demand signatures for devices found on the space shuttle orbiter followed by a class code consisting of 9 values of either 0.1 or 0.9, with the higher value in position k ($k = 0, \dots, 8$) signifying membership in class k , and all low (0.1) values signifying "none of the above".

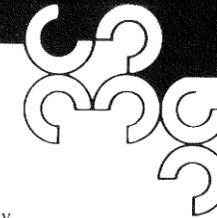
The possible inclusion of these real signatures has raised a number of administrative and technical issues. The administrative questions are not new to standards efforts in that they pertain to the value and ownership of material which might become part of a public domain standard. As data-driven systems such as adaptive neural pattern classification algorithms become more common, it is increasingly clear that the cost of creating such systems is primarily driven by the cost of acquiring and cataloging training sets. It is now clear that in many cases, training data is at least as valuable as the actual pattern classification algorithms.

The other side of this issue is the value of the standard to the industrial and scientific community as a whole. Specifically, from a scientific point of view, the quality of algorithms as well as that of their implementations tends to be improved by the availability of large, diverse and challenging data sets. Due to the fact that the signature data came from real systems and was hand-cataloged by human experts, a number of technical issues must also be addressed. In particular, what are the implications of cataloging errors in the data, and how should the group decide what makes a good benchmark as opposed to a data set which produces a robust classifier?

Please address any thoughts or comments to the working group chair, Dr. Robert Shelton, NASA/JSC.

Evaluation of ANN Training Algorithms

The formation of a Working Group on Methodology for Evaluation of ANN



May 8-13, 1994
 Princess Resort
 San Diego, California

Sponsored by the IEEE Robotics and Automation Society

General Chair: W.A. Gruver, Simon Fraser University, Canada
 Program Chair: H.E. Stephanou, Rensselaer Polytechnic Institute, U.S.A.
 Program Vice-Chairs: T. Fukuda, Nagoya University, Japan
 G. Hirzinger, German Aerospace Research Establishment, Germany
 P.K. Khosla, Carnegie Mellon University, U.S.A.
 M. Vuskovlc, San Diego State University, U.S.A.
 S. Harmon, Hughes Research Laboratories
 Treasurer and Coordinator: H. Hayman, U.S.A.

ADVANCE ANNOUNCEMENT

The theme of the 1994 Conference is "Robotics and Automation in the Service of Humankind". This year, the Conference celebrates its 11th anniversary. Major scientific and engineering accomplishments have been reported over the last decade. As the field matures, the research community is now looking into the future with a renewed sense of purpose, entrepreneurship, and dedication to the enhancement of the quality of life. Intelligent robotic systems are being developed by the rapidly emerging service robotics industry. Applications of advanced automation technology are having an increasing impact on productivity and quality control in many manufacturing sectors, and have become a key competitive factor in the global economy. The 1994 Conference will bring together researchers and practitioners to present the latest accomplishments, and explore future directions. Special emphasis will be placed on **applications and industrial case studies** to help identify new "pulling forces" for research in the 21st century. Technical papers presented on Tuesday, Wednesday, and Thursday, May 10-12, will appear in the bound proceedings. Topics include but are not limited to:

- Robot sensing and sensor data fusion
- Reasoning and planning
- Multirobot coordination
- Dexterous and redundant manipulation
- Robot dynamics and control
- Telerobotics and shared control
- Autonomous systems
- Micro electromechanical and micro robotic systems
- Advanced actuators
- Mechatronic design issues

- Distributed intelligence and self-organizing systems
- Robot systems in unstructured and hazardous environments
- Virtual reality and environments
- Industrial inspection
- Design automation and rapid prototyping
- Computer integrated manufacturing
- Scheduling and control of manufacturing systems
- Modeling and performance evaluation of discrete event systems
- Advanced process control and automation
- Materials processing automation

TUTORIALS AND WORKSHOPS:

Half day and full day tutorials and workshops will be held on Sunday, May 8; Monday, May 9; and Friday, May 13, 1994.

EXHIBITS:

There will be exhibits of state-of-the-art hardware and software products at the conference. Reservations for space and further information may be obtained from:

Scott Harmon
 Hughes Research Laboratories
 3011 Malibu Canyon Road
 M/S RL 96
 Malibu, CA 90265, U.S.A.
 Telephone: 310-317-5140
 Fax: 310-317-5695
 Email: harmon@aic.hrl.hac.com

CONFERENCE SITE:

Located on the Southern Coast of California, adjacent to the Mexican border and the Baja Peninsula, the greater San Diego area has grown rapidly to more than 3 million inhabitants. It is serviced by 16 major airlines with direct flights to many international cities. San Diego is a center for high technology, R&D, manufacturing, software companies, federal labs, and leading universities and colleges.

Training Algorithms is proposed. The objective is to provide a means of evaluating algorithms for various aspects of training feedforward networks, such as weight initialization, training data selection, error minimization, and weight decay/pruning.

There are four major tasks for this group. The first is development of a taxonomy of learning problems. This involves issues such as the nature of the mapping (continuous, discontinuous, classification), the nature of the training data (sparse/plentiful, noisy/clean), and the learning criteria (numeric accuracy, misclassification).

The second task is the development of training algorithm performance criteria, which may be dependent upon the class of learning problem. Evident error minimization algorithm criteria include execution time and space requirements, generalization, sensitivity to algorithm parameters, and avoidance of local minima. Criteria are also needed for algorithms involving weight initialization, training data selection, and pruning.

The third task is an ongoing effort to collect and document training-related algorithms. A 'collected training algorithms' document will be maintained, and made available by anonymous ftp. Criteria for algorithm inclusion might include: common usage, novelty, or demonstrated effectiveness.

The final task is development of a benchmark set which is suitable for evaluation of the range of training-related algorithms, as applied to the range of learning problems. This, too, will be made available by anonymous ftp, and will be updated as experience and understanding dictate.

Contacts are Dr. Robert W. Green and Christopher M. DeAngelis.

Standards in Virtual Reality

The Working Group on Standards in Virtual Reality is still recruiting members through Virtual Reality News and other avenues. The group will soon report on the plans evolved at its working session at the VRAIS in Seattle, Sept 18-22. Another intensive meeting is planned for WNN93/San Francisco, Nov 7-10. NASA will also cooperate with meetings in 1994 and 1995. If interested in participating or just receiving reports, please contact the chair, Richard Blade, UCCS, by email.

NNC Standards Committee Contacts

These groups plan a series of meetings for the fall of 1993, and for 1994. Between conferences, the groups interact by email. Your concern and contributions will contribute to the success of this effort. Any of the committee members will be happy to receive your comments and expressions of interest and concern. Regular reports on committee activities are published in the IEEE-NNC Newsletter, *Connections*.

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Standards Calendar

- Sept. 18-22, 1993 **Virtual Reality Annual Int'l Symposium VRAIS'93** Seattle VR Working Group; ANN Working Groups
- Oct. 25-29, 1993 **IJCNN'93/Nagoya Panel** - International Language and Symbolology. *Tutorial 7-III* - Neural Network Basics: Applications, Examples and Standards (includes NASA software) Discussion Groups and Social Events
- Nov. 7-10, 1993 **WNN/FNN93/ San Francisco**: Meetings of ALL working groups. Tutorials, discussions, tour of NASA/Ames; **CONTESTS**: papers and demonstrations

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**Newsletter Deadline
 November 15, 1993**



World Congress on Computational Intelligence

International Conference on Neural Networks

FUZZ/IEEE '94

IEEE International Symposium on Evolutionary Computation

June 26 - July 2, 1994

Walt Disney World Dolphin Hotel,
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General Chair

Steven K. Rogers
United States Air Force
Institute of Technology
rogers@afit.af.mil

Topics: Applications, architectures, artificially intelligent neural networks, artificial life, associative memory, computational intelligence, cognitive science, embedology, filtering, fuzzy neural systems, hybrid systems, image processing, implementations, intelligent control, learning and memory, machine vision, motion analysis, neurobiology, neurocognition, neurodynamics, optimization, pattern recognition, prediction, robotics, sensation and perception, sensorimotor systems, speech, hearing and language, system identification, supervised and unsupervised learning, tactile sensors, and time series analysis.

FUZZ/IEEE '94

General Chair

Piero P. Bonissone
General Electric Corporate
Research and Development
bonissone@crd.ge.ge.com

Topics: Basic principles and foundations of fuzzy logic, relations between fuzzy logic and other approximate reasoning methods, qualitative and approximate-reasoning modeling, hardware implementations of fuzzy-logic algorithms, design, analysis, and synthesis of fuzzy-logic controllers, learning and acquisition of approximate models, relations between fuzzy logic and neural networks, integration of fuzzy logic and neural networks, integration of fuzzy logic and evolutionary computing, and applications.

IEEE CONFERENCE ON EVOLUTIONARY COMPUTATION

General Chair

Zbigniew Michalewicz
University of North Carolina,
Charlotte
zbyczek@mosaic.uncc.edu

Topics: Theory of evolutionary computation, evolutionary computation applications, efficiency and robustness comparisons with other direct search algorithms, parallel computer applications, new ideas incorporating further evolutionary principles, artificial life, evolutionary algorithms for computational intelligence, comparisons between different variants of evolutionary algorithms, machine learning applications, evolutionary computation for neural networks, and fuzzy logic in evolutionary algorithms.

INSTRUCTIONS FOR ALL THREE CONFERENCES

Papers must be received by **December 10, 1993**. Papers will be reviewed by senior researchers in the field, and all authors will be informed of the decisions at the end of the review process. All accepted papers will be published in the Conference Proceedings. Six copies (one original and five copies) of the paper must be submitted. Original must be camera ready, on 8.5x11-inch white paper, one-column format in Times or similar fontstyle, 10 points or larger with one-inch margins on all four sides. Do not fold or staple the original camera-ready copy. Four pages are encouraged. The paper must not exceed six pages including figures, tables, and references, and should be written in English. Centered at the top of the first page should be the complete title, author name(s), affiliation(s) and mailing address(es). In the accompanying letter, the following information must be included: 1) Full title of paper, 2) Corresponding authors name, address, telephone and fax numbers, 3) First and second choices of technical session, 4) Preference for oral or poster presentation, and 5) Presenter's name, address, telephone and fax numbers. Mail papers to (and/or obtain further information from): World Congress on Computational Intelligence, Meeting Management, 5665 Oberlin Drive, #110, San Diego, California 92121, USA (email: 70750.345@compuserve.com, telephone: 619-453-6222).

Calendar

Upcoming Conferences with a Neural Networks component (ordered by date of submission deadline, or by conference date if the deadline has passed) If you have any conference details to add to this list, please send (preferably) a Call-For-Papers to

Paul Bakker
Computer Science Dept.
The University of Queensland
QLD 4072, Australia
Fax: +61 7 365 1999
email: bakker@cs.uq.oz.au

Email or fax submissions are not usually acceptable. Please contact the program chair or other contact for submission requirements. The designation [passed] refers to the deadline date. We include some deadlines even after the official cutoff since these are sometimes changed

—Expired Submission Deadlines—

Ordered by conference date. Deadlines are sometimes extended.

- **Neuronet'93 20-26 Sep 93** Prague, Czech. [31 May 93] "Theory and applications of neural networks" Contact: cvs15@cspgcs11.bitnet (Mirko Novak)
- **The Artificial Intelligence Technology Transfer Conference 22-24 Sep 93** Monterrey, Mexico [passed] "AI techniques such as neural networks, fuzzy systems, cognitive systems" Contact: r.soto@ieee.org (Rogelio Soto)
- **IEEE Workshop on Emerging Technologies and Factory Automation (EFTA '93) 27-29 Sep 93** Palm Cove, Q, Australia [passed] "Neural networks & Genetic Algorithms" Contact: JOHN@topaz.ucq.edu.au (Prof. John Smith)
- **International Conference on Signal Processing Applications & Technology (ICSPAT '93) 28 Sep-1 Oct 93** Santa Clara, CA, USA [30 Apr 93] "Neural Networks, Parallel Processing" Contact: DSPWorld@world.std.com (Amnon Aliphass)
- **Workshop on Integration Technology for Real-Time Intelligent Control Systems (IRTICS'93) 5-7 Oct 93** Madrid, Spain [passed] "Integrating Expert Systems, Neural Networks, Fuzzy Logic." Contact: CHIOZZA@iic.uam.es (Enrica Chiozza)
- **Fuzzy Theory and Technology - Control & Decision 13-16 Oct 93** Durham, NC, USA "Neural computing, Fuzzy self-organizing network, Pattern recognition" Contact: ctyan@ee.egr.duke.edu (Jerry C. Y. Tyan)
- **IEEE SMC'93 Conference 17-20 Oct 93** Le Touquet, France [passed] "Special

Session: Applications of Neural Networks to Control Problems" Contact: dominique@v31002.decnet.citilille.fr

- **International Workshop on Applications of Neural Networks to Telecommunications 18-20 Oct 93** Princeton, NJ, USA [14 May 93] (summary) "Speech Recognition, Fraud Detection, Financial and Market Prediction." Contact: bg1@faline.bellcore.com (Betty Greer)
- **National Conference on AI and Expert Systems (CNIASE'93) 19-22 Oct 93** Barquisimeto, Venezuela [15 Jun 93] "Connectionist Architectures, Neural Networks Applications, Knowledge-based Systems, Theoretical AI..." Contact: itorres@conicit.ve
- **Neural Architectures and Distributed AI: >From Schema Assemblages to Neural Networks (Workshop) 19-20 Oct 93** Los Angeles, CA, USA [30 Aug 93] "While the emphasis will be on technological systems, papers will also be accepted on biological and cognitive systems." Contact: arbib@pollux.usc.edu (Michael Arbib)
- **International Conference on Document Analysis and Recognition (ICDAR'93) 20-22 Oct 93** Tsukuba, Japan [passed] "Neural networks" Contact: ICDAR93@etl.go.jp
- **1993 International Conference On Application-specific Array Processors 25-27 October 1993 - Venice, Italy** Contact: Mrs. Chiquita Snippe-Marlisa Fax +31-55-557393
- **IEEE Visualization '93: Workshop on Visualization and Decision Support 26 Oct 93** San Jose, CA, USA [1 Sep 93] "Adaptive Representation; Mediated (AI/neural net) vs. unmediated display; Perceptual/cognitive issues in representation" Contact: beddow@staff.tc.umn.edu (Jeff Beddow)
- **1993 International Conference on Application-Specific Array Processors (ASAP'93) 25-27 Oct 93** Venice, Italy [passed] "Applications that Require Specialized Computing Systems: Neural Networks" Contact: dadda@ipmel2.elet.polimi.it (Prof. Luigi DADDA)
- **International Joint Conference on Neural Networks (IJCNN '93) 25-29 Oct 93** Nagoya, Japan [30 Apr 93] Contact: IJCNN'93-NAGOYA Secretariat (Fax: +81-52-561-1241) (Phone: +81-52-561-9880/8655)
- **1993 International Conference on Neural Networks and Signal Processing**

(ICNNSP'93) 2-5 Nov 93 Guangzhou, China [passed] Contact: Prof. Zhen-Ya He (Fax: +86 25 714212)

- **International Symposium on Computer and Information Sciences (ISCIS VIII) 3-5 Nov 93** Antalya, Turkey [[30 Jun 93] "Neural Networks, Parallelism, Artificial Intelligence" Contact: iscis@vm.cc.metu.edu.tr (Ugur Halici)
- **International Simulation Technology Conference 93** (incorporating WNN93, a Neural Networks conference) 7-10 Nov 93 Clear Lake, TX, USA [1 May 93] "Parallel and Distributed Processing, Fuzzy Logic, Neural Networks" Contact: mpadgett@eng.auburn.edu (Mary Lou Padgett)
- **Computational AI Conference (WNN93)/Tutorials and Standards Seminar (FNN93) 7-10 Nov 93** San Francisco, CA, USA [1 Jun 93] "Neural Networks, Fuzzy Logic, Virtual Reality" Contact: mpadgett@eng.auburn.edu (Mary Lou Padgett)
- **Fourth Workshop on Algorithmic Learning Theory (ALT'93) 8-10 Nov 93** Tokyo, Japan [30 Apr 93] "Learning Mechanisms in Neural Networks and Pattern Recognition" Contact: alt93@cs.uec.ac.jp
- **Third International Conference on Automation, Robotics and Computer Vision (ICARCV'94) 8-11 Nov 93** Singapore [30 Apr 93] "Neural Networks and Fuzzy Systems; AI & Expert Systems" Contact: ensundara@ntu-vax.ntu.ac.sg (Professor N. Sundararajan)
- **5th IEEE International Conference on Tools with Artificial Intelligence 8-11 Nov 93** Boston, MA, USA [passed] "Artificial neural networks" Contact: jm@cs.toronto.ca (John Mylopoulos)
- **Australian Joint Conference on Artificial Intelligence (AI'93) 16-19 Nov 93** Melbourne, Australia [28 May 93] "Machine Learning; Neural Networks & Genetic Algorithms" Contact: Trudi Dwyer (fax: +61 002 34 4464)
- **4th International Workshop on Parallel Applications in Statistics and Economics (PASE'93) 22-26 Nov 93** Ascona, Switzerland [1 Aug 93] (abstracts) "Innovative information processing systems and their applications in the areas of statistics, finance and economics" Contact: pase@uiv-t1.uivt.cas.cs
- **The First New Zealand International Two-stream Conference on Artificial Neural Networks and Expert Sys-**

tems (ANNES'93) 24-26 Nov 93
Dunedin, New Zealand [30 Apr 93]
Contact: gporteous@otago.ac.nz (Ms
Gina Porteous)

• **Neural Information Processing Systems -
Natural and Synthetic- (NIPS'93)**
29 Nov-2 Dec 93 Denver, CO, USA
[22 May 93] Contact: cowan@synap-
se.uchicago.edu (Jack Cowan)

• **The First Australian and New Zealand
Conference on Intelligent Informa-
tion Systems (ANZIS-93)** 1-3 Dec 93
Perth, WA, Australia [4 Jun 93] "Neu-
robiological systems, neural networks,
neurofuzzy controls" Contact: violet-
ta@swanee.ee.uwa.edu.au (Ms V. Di
Giacomo)

• **3rd International Conference on Indus-
trial Fuzzy Control & Intelligent
Systems (IFIS-93)** 1-3 Dec 93 Col-
lege Station, TX USA [1 Jun 93]
"Neural networks, genetic algorithms"
Contact: cfl@cs.tamu.edu

• **Fifth IEEE Symposium on Parallel and
Distributed Processing** 1-4 Dec 93
Dallas, TX, USA [1 May 93] "Neural
Networks, Parallel Algorithms, Arti-
ficial Intelligence" Contact:
pakzad@ecl.psu.edu (S. Pakzad)

• **1993 International Symposium on Non-
linear Theory and its Applications** 5-
9 Dec 93 Waikiki, HI, USA [15 Aug
93] (summary) "Neural Networks, Cel-
lular Neural Networks,
Biocybernetics" Contact: tanaka@-
mamoru.ee.sophia.ac.jp (Mamoru
Tanaka)

• **Digital Image Computing: Techniques
and Applications (DICTA'93)** 8-10
Dec 93 Sydney, NSW, Australia [25
Jun 93] "Fuzzy logic and neural net-
works" Contact:

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• **Conference on Computational Learning
Theory (EURO-COLT '93)** 20-22
Dec 93 London, UK [15 May 93]

"Learning algorithms and the theory of
machine learning, including artificial
and biological neural networks." Con-
tact: john@cs.rhnc.ac.uk (John
Shawe-Taylor)

• **1993 International Symposium on Arti-
ficial Neural Networks (ISANN'93)**
20-22 Dec 93 Hsinchu, Taiwan [15 Jun
93] Contact: isann93@hsinchu.csie.nc-
tu.edu.tw

• **10th Israeli Symposium on Artificial
Intelligence and Computer Vision**
27-28 Dec 93 Tel-Aviv, Israel [30 Jun
93] "Cognitive Modeling; Pattern Rec-
ognition and Neural Networks"
Contact: schild@bimacs.cs.biu.ac.il
(Dr. Uri J. Schild)

• **Third International Symposium on Arti-
ficial Intelligence and Mathematics**
2-5 Jan 94 Ft Lauderdale, FL, USA
[30 Jul 93] "Mathematical methods in
neural networks, learning theory, learn-
ing algorithms, complexity of neural
computation" Contact: hoffman@ac-
c.fau.edu (Frederick Hoffman)

• **27th Annual Hawaii International Con-
ference on System Sciences Mini-
Track on Neural Network Applica-
tions in Organizations** 4-7 Jan 94
Maui, HI, USA [1 Jun 93] "Bond rat-
ing, forecasting, data analysis,
production scheduling,..." Contact:
thill@uhunix.uhcc.hawaii.edu (Prof.
Tim Hill)

• **The Third Annual Conference on Evolu-
tionary Programming (EP94)** 24-25
Feb 94 San Diego, CA, USA [30 Jun
93] (abstract) "Neural network training
and Design; Pattern Recognition" Con-
tact: pja@cis.ohio-state.edu (Peter J
Angeline)

• **The Tenth IEEE Conference on Artificial
Intelligence for Applications (CAIA-
94)** 1-4 Mar 94 San Antonio, TX, USA
31 Aug 93 Contact: caia@cs.umbc.edu

• **International Conference on Expert Sys-
tems for Development** 28-31 Mar 94
Bangkok, Thailand [15 Aug 93]
(abstracts) "Associative Memories,
Machine Learning, Neural Networks"
Contact: sada@cs.ait.ac.th (Dr. R.
Sadananda)

• **1994 American Control Conference
Invited Session: Neural Network
Application for Aircraft & Space-
craft** 29 Jun-1 Jul 94 Baltimore, MD,
USA 1 Sep 93 (abstract) Contact:
feteih@evax12.eng.fsu.edu (Salah

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Feteih)

—Unexpired Submission Deadlines— Ordered by Submission Deadline

• **1st International Workshop: Neural Net-
works in the Capital Markets** 18-19
Nov 93 London, UK 15 Sep 93 "time
series forecasting, multivariate dataset
analysis, classification and pattern rec-
ognition" Contact:
refenes@cs.ucl.ac.uk (Dr. A. N.
Refenes)

• **Workshop on Automatic Speaker Recog-
nition, Identification and
Verification (IDIAP-ESCA Work-
shop)** 5-7 Apr 94 Martigny,
Switzerland 15 Sep 93 Contact:
esca@idiap.ch

• **Fifth Australian Conference on Neural
Networks (ACNN'94)** 31 Jan-2 Feb 94
Brisbane, Q, Australia 17 Sep 93 Con-
tact: acnn94@s1.elec.uq.oz.au

• **1994 ACM Symposium on Applied Com-
puting (SAC'94)** Track on Fuzzy
Logic in Applications 6-8 Mar 94
Phoenix, AZ, USA 17 Sep 93 "Appli-
cations of Fuzzy Systems to Neural
Systems" Contact: fathi@isl.informa-
tik.uni-dortmund.de (Madjid Fathi)

• **The Ninth Annual Goddard Conference
on Space Applications of Artificial
Intelligence** 10-12 May 94 Greenbelt,
MD, USA 20 Sep 93 "Neural net-
works, Parallel Processing, Robotics
and telerobotics." Contact: short@-
dunloggin.gsfc.nasa.gov (Nick Short)

• **IMACS International Symposium on Sig-
nal Processing, Robotics And Neural
Networks (SPRANN'94)** 25-27 Apr
94 Lille, France 1 Oct 93 "Neural Nets
in Robotics, Control, Computing,..."
Contact: SPRANN94@idnges.dec-
net.citilille.fr

• **International Symposium on Speech,
Image Processing & Neural Net-
works (ICASSP'94)** 14-16 Apr 94
Hong Kong 4 Oct 93 Contact: enpk-
lun@hkpc.hkpc.hk (Dr. Daniel Lun)

• **European Meeting on Cybernetics and
Systems Research (EMCSR'94)** 5-8
Apr 94 Vienna, Austria 8 Oct 93 "Arti-
ficial Neural Networks and Adaptive
Systems" Contact: sec@ai.univie.ac.at

• **Representation, Analogy, and Cognition:**
An Interdisciplinary Graduate Student
Conference 18-19 Feb 94 Binghamton,
NY, USA 15 Oct 93 "Developmental
and Scaffolded Connectionist
Models" Contact: timothy@turing.pac-
ss.binghamton.edu (Timothy Buczak)

• **14th IMACS World Congress on Compu-
tation and Applied Mathematics** 11-
15 Jul 94 Atlanta, GA, USA 15 Oct 93
(abstract) "Neural network architec-
tures and implementations; application
of neural techniques for signal and

image processing" Contact: piuri@ip-
mell1.polimi.it (Prof. Vincenzo Piuri)

• **AAAI 1994 Spring Symposium: Artificial
Intelligence in Medicine: Interpret-
ing Clinical Data** 21-23 Mar 94
Stanford, CA, USA 15 Oct (abstracts)
"A large data sample will be made
available to participants to serve as
training and test sets for various
approaches to information manage-
ment and to provide a common domain
of discourse." Contact: aim-94@cam-
is.stanford.edu

• **7th European Conference on Machine
Learning (ECML'94)** 6-8 Apr 94 Sic-
ily, Italy 15 Oct 93 "computational
learning theory, neural networks,
genetic algorithms." Contact: ecm-
l@cs.kuleuven.ac.be

• **Florida AI Research Symposium
(FLAIRS-94)** 5-7 May 94 Pensacola
Beach, FL, USA 18 Oct 93 "knowl-
edge-based approaches to the
construction of intelligent systems"
Contact: ddd@panther.cis.ufl.edu
(Douglas D. Dankel II)

• **Third Conference on Information Tech-
nology and its Applications (ITA'94)**
Association of Muslim Researchers. 2-
3 Apr 94 Leicester, UK 1 Nov 93
"Expert Systems, Neural Networks,
Fuzzy Logic, Genetic Algorithms,
Robotics" Contact: wani@taff.cf.ac.uk
(Dr. A Wani)

• **Principles of Knowledge Representation
and Reasoning (KR'94)** 24-27 May 94
Bonn, Germany 8 Nov 93 "Explicit
representations of knowledge; con-
straint solving; classification".
Contact: kr94@mail2.ai.univie.ac.at

• **7th IEEE Symposium on Computer-
Based Medical Systems.** 10-12 June
94. Winston-Salem NC 1 December 93.
Contact: carla@relito.medeng.wfu.edu

• **IEEE International Conference on Neu-
ral Networks** (part of IEEE World
Congress on Computational Intelli-
gence) 26 Jun-2 Jul 94 Lake Buena
Vista, FL, USA 10 Dec 93 Contact:
70750.345@compuserve.com

• **First World Congress on Computational
Medicine, Public Health and Bio-
technology** 24-28 Apr 94 Austin, TX,
USA 1 Nov 93 "Brain modeling, Neu-
ral nets and clinical applications,
Neurological disorder modeling" Con-
tact: compmed94@chpc.utexas.edu

• **Pan Pacific Conference on Brain Electric
Topography** 10-12 Feb 94 Sydney,
Australia 10 Nov 93 "Analysis and
models of electrical brain function;
findings of brain topography and cog-
nitive processes" Contact:
pan@brain.physics.swin.oz.au

• **International Symposium on Integrating**

**Knowledge and Neural Heuristics
(ISIKNH'94)** 9-10 May 94 Pensacola
Beach, FL, USA 15 Dec 93 (summa-
ries) Contact: Rob Francis (fax: +1
904-392-6950)

• **International Conference on Artificial
Neural Networks (ICANN'94)** 26-29
May 94 Sorrento, Italy 15 Dec 93
"Cognitive Science, Mathematical
Models, Neurobiology." Contact:
iiass@salerno.infn.it (Prof. Eduardo R.
Caianiello)

• **From Animals to Animats: Third Inter-
national Conference on Simulation
of Adaptive Behavior (SAB'94)** 8-12
Aug 94 Brighton, UK 5 Jan 94 "Neural
correlates of behavior; Neural net-
works and evolutionary computation;
Hierarchical and parallel organiza-
tions" Contact:
sab94@cogs.susx.ac.uk

• **11th European Conference on Artificial
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Amsterdam, Holland 8 Jan 94
"Machine Learning; Neural Networks;
Cognitive Modelling; Connectionist
and PDP Models for AI" Contact:

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cine The 7th IEEE Symposium on
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Important Dates:
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Notice of Acceptance: February 1, 1994
Camera-ready Papers: March 15, 1994

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- **Sixteenth Annual Conference of the Cognitive Science Society** 27-30 Jul 94 Atlanta, GA, USA 14 Jan 94 Contact: cogsci94@cc.gatech.edu (Prof. Kurt Eiselt)
- **Twelfth National Conference on Artificial Intelligence (AAAI-94)** 31 Jul-4 Aug 94 Seattle, WA, USA 24 Jan 94 "Distributed AI, Neural Networks, Machine Learning" Contact: bhr@ksl.stanford.edu (Barbara Hayes-Roth)
- **IEEE Int'l Conference on Systems, Man and Cybernetics** 2-5 October 94, San Antonio TX. Contact: dicesare@ecse.rpi.edu (Prof Frank DiCesare)
- **12th International Conferences on Pattern Recognition (ICPR)** 9-13 Oct 94 Jerusalem, Israel 1 Feb 94 "Pattern recognition and neural networks; parallel computing" Contact: icpr@math.tau.ac.il
- **First IEEE International Conference on Image Processing (ICIP-94)** 13-16 Nov 94 Austin, TX, USA 15 Feb 94 (abstracts) "Neural Networks for image processing and model-based compression" Contact: cip@pine.ece.utexas.edu
- **1994 IEEE/Nagoya University World Wisemen/women Workshop (WWW) On Fuzzy Logic and Neural Networks/Genetic Algorithms** 9-10 Aug 94 Nagoya, Japan 31 Apr 94 Contact: furu@uchikawa.nuem.nagoya-u.ac.jp (Takeshi Furuhashi)
- **FUZZ-IEEE/IFES'95: Int'l J. Conf. of the 4th IEEE Int'l Conf. on Fuzzy Systems and the 2nd Int'l Fuzzy Engineering Symp.** 20-24 March 95, Yokohama Japan. 31 August 94. Contact: Fax: 81 45-212-8255 (Ms. Mieko Hemmi).

IEEE Neural Networks Council NNC-Sponsored Conferences

Virtual Reality Annual International Symposium
September 18-22, 1993
Seattle, Washington

International Joint Conference on Neural Networks
October 25-29, 1993
Nagoya, Japan

World Congress on Computational Intelligence
IEEE International Conference on Neural Networks
FUZZ-IEEE

IEEE International Symposium on Evolutionary
Computation
June 26-July 2, 1994
Walt Disney World
Orlando Florida

Virtual Reality Annual International Symposium
TBA: September-October 1994
Research Triangle Park, North Carolina

1995 and Beyond...

FUZZ-IEEE (with IFES)
Yokohama Japan, March 1995
ICNN, Perth, Australia, October 1995
ICNN, Washington DC, March 1995

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The Neural Networks Council has agreed to be a "technical co-sponsor" or "cooperating organization" for the meetings listed below.*

Name	Site	Date
1993 IEEE/Nagoya Univ. WWW on Learning and Adaptive Systems	Nagoya, Japan	Oct. 22-23 '93
1993 IEEE/Nagoya Univ. WWW on Multiple and Distributed Robotic Systems	Nagoya, Japan	Oct. 22-23 '93
Int'l Conf. on Neural Networks & Signal Processing	Guangzhou, China	Nov. 2-5 '93
2nd IEEE Int'l Wkshop on Robots & Human Communication	Tokyo	Nov. 3-5 '93
WNN'93	San Francisco CA	Nov. 7-10 '93
1993 Int'l Symp. on Nonlinear Theory & its Applications	Hawaii	Dec. 6-9 '93
EP'94: 3rd Evolutionary Programming Conf.	San Diego CA	Feb. 24-25 '94

* The NNC has agreed to be named in the Call for Papers and other promotional materials for these meetings, but the Council does not have a financial interest. Conference organizers who wish to list the NNC as a cooperating or technical co-sponsor should contact James Bezdek, Chairman of the NNC Meetings Committee for information on the approval process. (email: jbezdek@uwf.bitnet; Tel: (904)474-2784; FAX (904)484-3023.)

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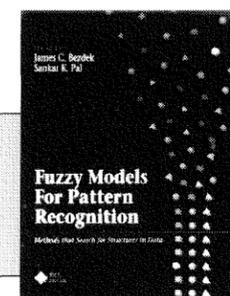
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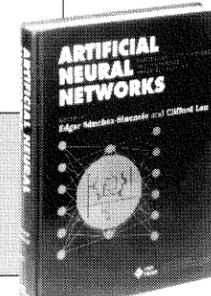
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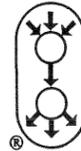


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