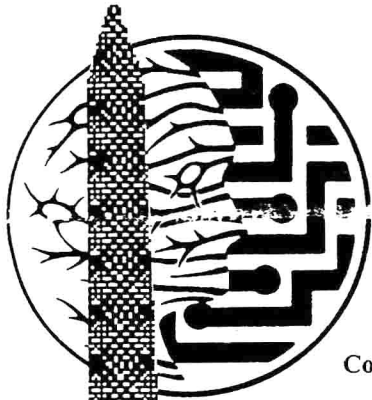
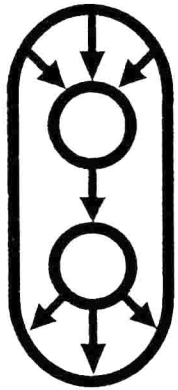


**1999 International Joint Conference on  
Neural Networks  
(V.3)**



# IJCNN'99



Cosponsored by: The International Neural Network Society  
The Neural Networks Council of IEEE

## International Joint Conference on Neural Networks

WASHINGTON, DC

JULY 10-16, 1999

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# ***PROCEEDINGS***

Volume 3 of 6  
Pages 1471 - 2209

# **The 1999 International Joint Conference on Neural Networks Proceedings**

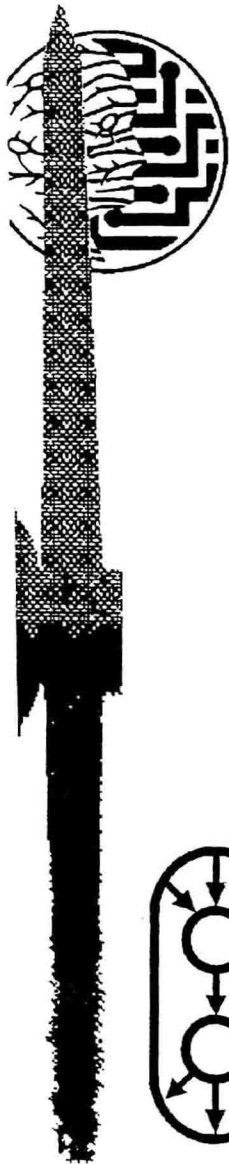
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## Welcome to IJCNN'99



Washington Monument and  
Colosseum dome as seen from the  
John F. Kennedy Memorial Reflecting Pool

On behalf of the Organizing Committee I would like to welcome all of our attendees to the 1999 International Joint Conference on Neural Networks (IJCNN'99). I believe that you will agree with me that the Conference is fortunate to have very high quality technical and tutorial programs and distinguished plenary speakers. We appreciate your participation and look forward to a very rewarding week.

Special appreciation is due to Elsevier Scientific for sponsoring the welcome reception and to Ward Systems Group for sponsoring the Financial Series Forecasting Competition.

These Proceedings are provided to enhance the benefit of the Conference to you. They complement the Book of Summaries distributed at the Conference. Every effort has been made to ensure inclusion of all papers appropriately submitted by registered authors and the accuracy of the various indexes and accompanying materials; however, we apologize for any errors which may have inadvertently been made in this regard. Special thanks to Dr. Mary Pastel Anderson, Vice General Chair, and Dr. Jonathan Boswell, Publications Chair, for doing the lion's share of the work in producing these Proceedings.

I would like to express our heartfelt thanks to the members of the Program Committee who carried out the review of summaries submitted for the Conference and who are listed on the next page. In addition I deeply appreciate the efforts of INNS staff and of Ms. Jackie Haynes, Mrs. Arlene Underdonk, Ms. Norma Knapp, and Mr. Phil Quinn for all of their assistance.

David G. Brown, Ph.D.  
General Chair, IJCNN'99

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## Message from the INNS President

Dear Colleagues,

It is my great pleasure as President of the International Neural Network Society (INNS) to welcome you to The International Joint Conference on Neural Networks (IJCNN'99), here in Washington, D.C. This premier conference on neural networks is jointly sponsored by INNS and the IEEE Neural Networks Council (IEEE/NNC), with INNS serving as conference management this year. I am sure that you will enjoy the excellent program that has been carefully developed by General Chair, David Brown, and Technical Program Co-Chairs, Daniel Alkon and Clifford Lau.

IJCNN'99 spans the neural network field from neurons to consciousness, from training algorithms to robotics, from chaos to control, from fuzzy logic to evolutionary computing. Leading off with a theme symposium on biological neural networks, the Conference will explore the potential impact of recent discoveries in neurobiology on the computational intelligence community.

The program of IJCNN'99 covers many important directions of research in neural networks. The various plenary talks, special sessions and tutorial short course program have been carefully chosen to further supplement the various core sessions.

We have greatly enjoyed working with Cliff Lau and the IEEE/NNC in putting IJCNN'99 together. I hope that you find the meeting both stimulating and inspiring and that you will appreciate the mission of our Society to serve the neural network community. Let me close this message by welcoming you again.

Sincerely,

David Casasent  
Carnegie Mellon University  
President, International Neural Network Society



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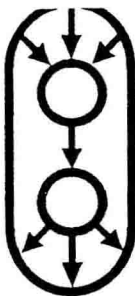
International Neural Network Society

19 Mantua Rd Mount Royal, NJ 08061

(609) 423-7222 (609) 432 3420 fax

innsmtg@talley.com





## Message From The IEEE/NNC President

Dear Colleagues:

On behalf of the IEEE and the Neural Networks Council (NNC), I would like to add my welcome to you in attending the 1999 International Joint Conference on Neural Networks (IJCNN'99). This year IJCNN brings us back to the Washington DC area, where there is no shortage of tourist attractions, fireworks and politics.

In IJCNN'99, we have put together a comprehensive program that covers the entire spectrum of activity in neural networks and applications, from biological neural models to mathematical foundations to pattern recognition. There is something for everyone. The tutorial program is extensive and outstanding. In conjunction with the conference, there is an exciting theme symposium on biological approaches and a NSF workshop on neural networks research in the Former Soviet Union. In addition there is the CEC'99 the week before the conference in DC. You are invited to participate in all these tutorials, workshops, symposiums, and conferences.

In addition to the technical activities, the NNC is also proud to sponsor a large number of students to travel to DC and to attend IJCNN. The student reception will bring together the future generation of neural networks researchers to interact with the current generation. There is also a special technical session by high school students, who will be the future leaders.

I hope this joint sponsorship of IJCNN'99 will benefit the neural networks community, and I hope you will enjoy this conference as much as I did in sponsoring it and organizing it.

Sincerely,

Clifford Lau  
IEEE/NNC President

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### **Booth #105**

Elsevier Science, Inc.  
655 Avenue of the Americas  
New York, NY 10010  
212-633-3758

### **Booth #107**

MIT Press  
5 Cambridge Center  
Cambridge, MA 02142  
617-258-5764  
arnesj@mit.edu  
www-mitpress.mit.edu/

The MIT Press publishes trade and academic books in the areas of computer science, neural networks, artificial intelligence, neuroscience and cognitive science.

### **Booth #111**

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P. O. Box 30130  
Phoenix, AZ 85046-0130  
602-971-1869  
info@pcai.com  
www.pcai.com/pcai

PCAI Magazine helps business professionals understand new developments in Artificial Intelligence. It's an application-oriented magazine, providing useful 'hands-on' information. PCAI features topics such as data mining, expert systems, neural networks, and object-oriented development. Every issue includes feature articles, product updates, real-world application stories, Buyer's Guide, and more.

### **Booth #109**

Scientific Book Displays  
3450 Martha Custis Drive, Suite 312  
Alexandria, VA 22302  
703-820-2320

Exhibits technical books and journals of interest to the scientific community. This year's display will include selected titles from Springer Verlag, Cambridge University Press among others. Order at the Conference and receive substantial savings.

## Tutorials Presented at IJCNN'99

### Saturday Short Courses

#### Introduction to Neural Networks

George Lendaris

#### When Your Coffee Pot Plays Chess: Fundamentals of Machine Intelligence

David Brown

### Sunday Tutorials

#### Track 1 Hybrid Systems & Soft Computing

##### A An Introduction to Evolutionary Computation

David Fogel

##### B Fuzzy Industrial Applications

Mo Jamshidi

##### C Soft Computing & Knowledge Management

Larry Medsker & Thomas Beckman

#### Track 2 Biomedical Diagnosis

##### A ROC Analysis & Finite-sample Dependence of Performance of Classical & Neural- Network Classifiers

Robert Wagner

##### B Brain Imaging

John Taylor

#### Track 3 Brains & Biological Neural Networks

##### A Neuromodulation & Cortical Function

Michael Hasselmo

##### C Ionic Current Model of the Outer Retinal Cells

Shiro Usui

##### D Massively Parallel Distributed Processing in the Brain: New Developments

Karl Pribram

##### E From Single Neurons to Brain Chaos

Walter Freeman & Stephen Bressler

#### Track 4 Cognition, Pattern Recognition

##### A Pattern Recognition & Neural Networks

David Casasent

##### B Adaptive Resonance Theory

Gail Carpenter

#### Track 5 Robot Control & Neurocontrol

##### A Neural Networks & Q-Learning for Robotics

Claude Touzet

##### B Neurocontrol

Paul Werbos

Track 6 Learning Algorithms & Architectures

- A Back-Propagation Learning Guided by Control Technique  
Antonio de Padua Braga
- B Practical Aspects of Vapnik-Chervonenkis (VC) Theory  
Vladimir Cherkassky
- C Stochastic Optimization Via The Simultaneous Perturbation Algorithm  
James Spall
- D Cortronic Neural Networks  
Robert Hecht-Nielsen
- E Autonomous Learning: The New Connectionist Algorithms  
Asim Roy

Track 7 Unsupervised Learning, Independent Component Analyses & Blind Source Separation

- B Independent Component Analysis  
Erkki Oja
- C Unsupervised Sensory Learning  
Harold Szu

Track 8 Speech & Language Processing

- C Connectionist & Hybrid HMM/Connectionist Systems for Speech Recognition  
Edmondo Trentin & Marco Gori

Track 9 Financial Analyses

- A Designing Neural Networks for Credit Analysis  
Andre de Carvalho

Track 10 Biosensors & Biocomputing

- C Analysis of DNA Sequences with Artificial Neural Networks  
A. G. Hatzigeorgiou, M. Reczko, V.B. Bajic & I.V. Bajic
- E Overview of pulse coupled neural networks (PCNNs)  
Mary Lou Padgett

Track 11 Engineering Diagnosis/Application

- B Neural Networks for Nondestructive Evaluation Applications  
L.W. Schmerr, L. Udpa, S. S. Udpa & F.C. Morabito
- D Neural Learning in Structured Domains  
M. Gori, M. Maggini

Track 12 Implementation

- B Implementation of Fuzzy Logic Control Systems  
Takeshi Yamakawa

## Financial Series Forecasting Competition

IFCIN 99 offered a financial series forecasting competition, which took place over the period of June 23, 1999, to July 7, 1999 inclusive. The objective of the competition was to forecast consistently the daily value of a financial series over the period using neurally inspired models. Twenty-three researchers participated in the competition, and the top competitors achieved outstanding results. In first place is Klaus Breslauer, Vancouver, British Columbia. He was closely followed by Min Qi, Kent State University, and Parinya Disornetiwat, University of Missouri, Rolla. Further details are given in the appended description of the Competition.

We are greatly indebted to Dr. Masud Cader, International Finance Corporation, for conceiving of and managing the Competition. Data was provided by the Emerging Market Database group of the IFC. Server space and web programming were provided by Melange Graphics, and prizes were provided by Ward Systems for the top two finishers.

## IJCNN'99 Keynote and Plenary Presentations

Sunday 7/11	Keynote Address Computational Neurobiology/Biophysics John Hopfield
Sunday 7/11	Plenary Speech Functional Approximation and Rule Extraction with Fuzzy Clustering Jim Bezdek
Monday 7/12	Joint Theme Symposium and Conference Plenary Speech The Valuated State Space Approach and Evolutionary Computation for Problem Solving Lawrence Fogel
Monday 7/12	Keynote Discussion Session John Hopfield
Wednesday 7/14	Plenary Speech Three Bedrooms, Two Baths, and Four Hidden Layers: The Neural Network House Michael Mozer
Wednesday 7/14	Awards Banquet Plenary The HAL9000 Computer and the Vision of 2001: A Space Odyssey David Stork
Thursday 7/15	Plenary Speech Independent Components of Functional Brain Imaging Terrence Sejnowski
Thursday 7/15	Plenary Discussion Session Terrence Sejnowski
Thursday 7/15	Plenary Discussion Session Michael Buro
Friday 7/16	Plenary Speech How Machines Have Learned to Play Othello Michael Buro



# Author Index

A	Page
James L. Abbas	2315, 2319
Hossam Abdelbaki	3236, 3241
Ashraf M. Abdelbar	1515, 4079
Ken-ichi Abe	4099
Robert J. Abraham	157
Pamela A. Abshire	182
Giuseppe Acerini	140, 3534
I. Acevedo-Sotoca	2363
Kristin L. Adair	2830
Tulay Adali	1429, 1433, 1560, 2976, 3425
Rafal Adamczak	659
K.M. Adeney	1362, 3656
Rafal Adamczak	659
Ramesh K. Agarwal	2076
Arturo Aguirre	467
Arturo Hernandez	467
Khushfard Amadi	1511, 2816
Sung M. Ahn	1136
Norihisa Aihara	233, 514
Kazuyuki Aihara	233, 514
Shotaro Akaho	927
Norio Akamatsu	2981
Kenzo Akazawa	2981
Norio Akita	2981
Matti Aksela	2812
Marinel Alangiu	862
L. Al-Dabbagh	3386
Frederic Alexandre	247, 252, 2441, 3451
A.R. Allen	851
Nigel M. Allinson	1491
Khalid Al-Mashouq	1491
Pablo Javier Alsina	3457
Torsten Alvager	3573, 3618
Hirohisa Aman	483
Veronique Amarger	3609
Mohammed Ameen	1022
Adnan Amin	2903
N. Ampazis	1850
Francois Ancil	3802
Eric Anderson	3618
Michimori Andoh	3170

Peter Andras	817
Stefano Andreon	3810
Andreas G. Andreou	182, 2329, 2333
M. Angali	4012
D. Anguita	939
R. Annan	3236
E.V. Antonova	239, 243
Oscar Araujo	514
Dalton S. Arantes	1265
Alfredo R.R. Araujo	1102
Cynthia Archer	916
William W. Armstrong	2282
Juan Ignacio Arribas	1429, 1560
Metin Arslan	770, 3239
Hideki Asai	2402, 3750
Hiroyuki Asakawa	3856
Raul R. Leal	3968
Ascencio	1594
Z.H. Ashour	1594
Amir Assadi	562, 1004, 1010
Murad Asgari	1515
Peter Aszalos	64
Amir A. Ayar	349, 3661
Yanni Attikiouzel	409
Yanni Attikiouzel	409
Gasser Auda	2777
Leonardo Auslander	924
Loretta S. Auvil	2480
E.D. Avram	379
Anatoliy B.	4107
Averbukh	456
A.A.S. Ayar	456
Arnulfo P. Azcarraga	510
Mahmoud R. Azim	3217, 3223
Sadach	3791

B	Page
Norio Baba	2867, 3856
Andrew D. Back	989
Jeremy B. Badler	146
Masood A. Badri	3533
Jalal Baghdadchi	1329
Sung-Wook Baik	1136, 3138
D. Bailey	3204
Leemon C. Baird	2152
Thiagarajan	3119
Balachander	27
Karthika Balakrishnan	27
Tracey A. Bale	1511, 2816
Sang-Woo Ban	2386

Zuhair Bandar	3114
Jason Bard	3779
J. Barhen	3779
G.V. Baric	3779
Cory Barker	1271
Barbara Barone	375
Andrew R. Barron	375
J.M. Barron	2429
Geoffrey L. Barrows	2296
I. Baruch	3147
Susan I. Bassett	3147
B. Basson	3147
Devasis Basu	359, 364, 1620
Chamirano Basu	359
Lia Caetano Bastos	1959, 3556, 3560
Rogério C. Bastos	1959, 3556, 3560
Mitra Basu	1259, 2674
Jargalsaihan	1271
Bakhtian	572
Eric Bax	572
N. Subashayam	2230
Thad W. Beavers	605
Walter Becanovic	388
Hans N. Beck	388
M. Becker	1356
Sven Behnke	1356
Elizabeth C. Behnke	374, 2351
Behnke	374, 2351
S.A. Belbas	655
Archie Belbin	1895
D.A. Bell	1895
D.R. Bell	243
Jesse L. Bemley	4422
Gyorgy Benedek	64
Didier Benjamin	1866
Younes Bennani	3008, 3291
Kristin P. Berman	304
Amine Bensaid	3894
Simon Y. Berkovich	69
Miguel A. Bernal	2114
Phillip J. Best	12
Tatiana G.	152
Bezudnaya	1215
Umesh Bhagwan	1215
R.M. Bharadwaj	3447
Dinesh K. Bhatta	621
Rushi Bhatt	27
Basabi Bhattacharya	188
Shoaib Bhuiyan	2839

Erik P. Blason	2792
M. Blumenstein	2893
Yan Bo	164
Ladislao Bodnar	117
A.A. Bogdanov	2026, 4115
Lois Boggess	4156
Karen F. Bolla	86
Kurt D. Bollacker	1924
Romuald Bone	2594
Yann Boniface	2441
Mario Bonifazi	2456
Borden	2200
Mauricio Jose Bordon	2200
Roman M. Borsini	42
Fabrice Bossaert	1866
Henry Bossaert	192
Celso Pascoli Bottura	2200
Laurent Bouvart	2456
Bouchra Bouqata	3894
A.P. Braga	1074
Rafik Braham	3030
Daniel Braham	3634
Neil M. Branton	535
Elizabeth J. Brault	2445, 2410
Macarie Breazu	1743, 2694
Steven H. Brossier	56
Michael E. Brier	3669
Marin Brier	2223
Eric L. Brown	2310
Cheryl Brown	274
Bernd Bruckner	3690
William Bruce	3685
Bill P. Buckles	467
James H. Bucklew	2445, 4197
Daniel Bullock	288
Eliz Bulya	2294
Darren Burford	2816
A.N. Burkin	268, 305
Philippe Burlina	2747
Pietro Bursano	985, 1117
Gyorgy Buzsaki	58
<b>C</b>	<b>Page</b>
Brian Callaway	2215
D. Calvert	1568
Shannon R. Campbell	97
P. Campolucci	2398
Heather M. Canady	3768
Angelo Cangelosi	4365
Nicola Capuano	3810

R. Caradonna	1140
Howard C. Card	3165, 3722
J.J. Romero Cardalda	4002
E. Cardelli	4012, 4027
John Carew	562, 1004, 1010
Gary Carhart	2342
John G. Carney	1215
Carl A. Carmona	1923
A.C.P.L.F. Carvalho	3371
David Casavant	3193, 3286
J.P. Castagna	3758
G. Castellano	3163
Oscar Castillo	4202, 4208
Thomas P. Caubell	1341, 1357
Thomas P. Caubell	1979, 3923
C.W. Caulkins	3371
Ger. Chavender	2061, 2282
Jose Homero Feitosa Cavalcanti	3457
Frederic Casmali	2222
Eui-Young Cha	2872
H. Chady	4027
Raymond K. Chafin	2704
Chang-Hyun Cha	2017
Lai-Wan Chan	1393, 1521
Linchen Alex. Chan	3161
Man-chung Chan	1554
Homa Chan	1275, 1389
Chandrasekaran	
Chein-I Chang	2698
Chih-Chi Chang	2245, 2249
Edmond Ching-Ping Chang	2763
Hsiao-I Chang	1206
Justin Chang	4151
Yuh-Young Chang	3541
Kui-yu Chang	1107
Yau-Zen Chang	4151
Yuan-Hsiang Chang	3674, 4181
Chao Charambous	3888
Andreas Charitou	3888
Sylvain Charter	1092
Chanchal Chatterjee	1043
Ravim Chaycesuk	3844
C. Chavy	3046
Gerald H. Cheang	375
Abdennasser Chebira	2141
Rama Chellappa	2747
C.H. Chen	3397, 3913
Chih-Ming Chen	1737
D. Chen	3622
Dingding Chen	1281
Hsuen-Fan Chen	4259
Hung-Pin Chen	3850

Jai-Juin Chen	1889
Jia-Lin Chen	2541
Jian Chen	258
Jun-Qing Chen	1712
Kaihua Chen	4111
Ke Chen	2653, 2240
Lihui Chen	1097
Mu Song Chen	2745
Penny Pei Chen	1973
Shih-Hong Chen	3177
Yan Qiu Chen	1097
Yan Qiu Chen	1097
Yi-Yuan Chen	4259
Yuan Chen	1244
Zhenxiang Chen	258, 1753
Zhong Chen	1727
Chun-Hao Cheng	3850
K.C. Cheng	3962
Vladimir Cherkassky	625, 1065
John Y. Cheung	3680
Yiu-ming Cheung	955, 961, 3883
Hsin-Hong Chi	2821, 2240
Sheng-Chai Chi	3098, 3850
Zhen Chi	4113
E. Chiarantoni	1140
William Chiriac	1554
Jeong-Nae Chio	2210
Huang-Sun Cho	1963, 1969
Jae-Heung Cho	2920
Jae-Hyun Cho	2872
Jun-Ki Cho	2386
Sungwon Cho	1245, 1086
Yong Cho	3063
Chang-Ho Choi	1313, 1635
Han-Go Choi	2920
H. Choi	1333
Sooyong Choi	1077
Chong-Hong Chen	3185
C.I. Christodoulou	3591
Chen Chua	1121
Naoya Chujo	3170
Chun D. Chu	1137
Jae H. Chung	1994
Chao-Hong Chung	2985
Angelo Ciarabella	975
Jesus Cid-Sueno	1229, 1569
Michael Ciraula	611
G.M. Clark	268
I. Cloete	1345, 1350, 1829
Eugene Clotiaux	2772
Brant Coghlan	2282
Marc Cohen	2343
Michael Cohen	288
Colin Cole	1934, 3982