# Lecture Notes in Computer Science

4234

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

#### **Editorial Board**

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

University of Dortmund, Germany

Madhu Sudan

Massachusetts Institute of Technology, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Moshe Y. Vardi

Rice University, Houston, TX, USA

Gerhard Weikum

Max-Planck Institute of Computer Science, Saarbruecken, Germany

Irwin King Jun Wang Laiwan Chan DeLiang Wang (Eds.)

# Neural Information Processing

13th International Conference, ICONIP 2006 Hong Kong, China, October 3-6, 2006 Proceedings, Part III



#### Volume Editors

Irwin King
Laiwan Chan
Chinese University of Hong Kong
Department of Computer Science and Engineering
Shatin, New Territories, Hong Kong
E-mail:{king,lwchan}@cse.cuhk.edu.hk

Jun Wang
Chinese University of Hong Kong
Department of Automation and Computer-Aided Engineering
Shatin, New Territories, Hong Kong
E-mail: jwang@acae.cuhk.edu.hk

DeLiang Wang
Ohio State University
Department of Computer Science and Engineering
Columbus, Ohio, USA
E-mail: dwang@cse.ohio-state.edu

Library of Congress Control Number: 2006933758

CR Subject Classification (1998): F.1, I.2, I.5, I.4, G.3, J.3, C.2.1, C.1.3, C.3

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

ISSN 0302-9743

ISBN-10 3-540-46484-0 Springer Berlin Heidelberg New York ISBN-13 978-3-540-46484-6 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

Springer is a part of Springer Science+Business Media

springer.com

© Springer-Verlag Berlin Heidelberg 2006 Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India Printed on acid-free paper SPIN: 11893295 06/3142 5 4 3 2 1 0

#### **Preface**

This book and its companion volumes constitute the Proceedings of the 13th International Conference on Neural Information Processing (ICONIP 2006) held in Hong Kong during October 3–6, 2006. ICONIP is the annual flagship conference of the Asia Pacific Neural Network Assembly (APNNA) with the past events held in Seoul (1994), Beijing (1995), Hong Kong (1996), Dunedin (1997), Kitakyushu (1998), Perth (1999), Taejon (2000), Shanghai (2001), Singapore (2002), Istanbul (2003), Calcutta (2004), and Taipei (2005). Over the years, ICONIP has matured into a well-established series of international conference on neural information processing and related fields in the Asia and Pacific regions. Following the tradition, ICONIP 2006 provided an academic forum for the participants to disseminate their new research findings and discuss emerging areas of research. It also created a stimulating environment for the participants to interact and exchange information on future challenges and opportunities of neural network research.

ICONIP 2006 received 1,175 submissions from about 2,000 authors in 42 countries and regions (Argentina, Australia, Austria, Bangladesh, Belgium, Brazil, Canada, China, Hong Kong, Macao, Taiwan, Colombia, Costa Rica, Croatia, Egypt, Finland, France, Germany, Greece, India, Iran, Ireland, Israel, Italy, Japan, South Korea, Malaysia, Mexico, New Zealand, Poland, Portugal, Qatar, Romania, Russian Federation, Singapore, South Africa, Spain, Sweden, Thailand, Turkey, UK, and USA) across six continents (Asia, Europe, North America, South America, Africa, and Oceania). Based on rigorous reviews by the Program Committee members and reviewers, 386 high-quality papers were selected for publication in the proceedings with the acceptance rate being less than 33%. The papers are organized in 22 cohesive sections covering all major topics of neural network research and development. In addition to the contributed papers, the ICONIP 2006 technical program included two plenary speeches by Shun-ichi Amari and Russell Eberhart. In addition, the ICONIP 2006 program included invited talks by the leaders of technical co-sponsors such as Wlodzislaw Duch (President of the European Neural Network Society), Vincenzo Piuri (President of the IEEE Computational Intelligence Society), and Shiro Usui (President of the Japanese Neural Network Society), DeLiang Wang (President of the International Neural Network Society), and Shoujue Wang (President of the China Neural Networks Council). In addition, ICONIP 2006 launched the APNNA Presidential Lecture Series with invited talks by past APNNA Presidents and the K.C. Wong Distinguished Lecture Series with invited talks by eminent Chinese scholars. Furthermore, the program also included six excellent tutorials, open to all conference delegates to attend, by Amir Atiya, Russell Eberhart, Mahesan Niranjan, Alex Smola, Koji Tsuda, and Xuegong Zhang. Besides the regular sessions, ICONIP 2006 also featured ten special sessions focusing on some emerging topics.

#### VI Preface

ICONIP 2006 would not have achieved its success without the generous contributions of many volunteers and organizations. ICONIP 2006 organizers would like to express sincere thanks to APNNA for the sponsorship, to the China Neural Networks Council, European Neural Network Society, IEEE Computational Intelligence Society, IEEE Hong Kong Section, International Neural Network Society, and Japanese Neural Network Society for their technical co-sponsorship, to the Chinese University of Hong Kong for its financial and logistic supports, and to the K.C. Wong Education Foundation of Hong Kong for its financial support. The organizers would also like to thank the members of the Advisory Committee for their guidance, the members of the International Program Committee and additional reviewers for reviewing the papers, and members of the Publications Committee for checking the accepted papers in a short period of time. Particularly, the organizers would like to thank the proceedings publisher, Springer, for publishing the proceedings in the prestigious series of Lecture Notes in Computer Science. Special mention must be made of a group of dedicated students and associates, Haixuan Yang, Zhenjiang Lin, Zenglin Xu, Xiang Peng, Po Shan Cheng, and Terence Wong, who worked tirelessly and relentlessly behind the scene to make the mission possible. There are still many more colleagues, associates, friends, and supporters who helped us in immeasurable ways; we express our sincere thanks to them all. Last but not the least, the organizers would like to thank all the speakers and authors for their active participation at ICONIP 2006, which made it a great success.

October 2006

Irwin King Jun Wang Laiwan Chan DeLiang Wang

# Organization

#### Organizer

The Chinese University of Hong Kong

#### Sponsor

Asia Pacific Neural Network Assembly

#### Financial Co-sponsor

K.C. Wong Education Foundation of Hong Kong

#### **Technical Co-sponsors**

IEEE Computational Intelligence Society International Neural Network Society European Neural Network Society Japanese Neural Network Society China Neural Networks Council IEEE Hong Kong Section

## Honorary Chair and Co-chair

Lei Xu, Hong Kong

Shun-ichi Amari, Japan

## **Advisory Board**

Walter J. Freeman, USA
Toshio Fukuda, Japan
Kunihiko Fukushima, Japan
Tom Gedeon, Australia
Zhen-ya He, China
Nik Kasabov, New Zealand
Okyay Kaynak, Turkey
Anthony Kuh, USA
Sun-Yuan Kung, USA
Soo-Young Lee, Korea
Chin-Teng Lin, Taiwan
Erkki Oja, Finland

Nikhil R. Pal, India
Marios M. Polycarpou, USA
Shiro Usui, Japan
Benjamin W. Wah, USA
Lipo Wang, Singapore
Shoujue Wang, China
Paul J. Werbos, USA
You-Shou Wu, China
Donald C. Wunsch II, USA
Xin Yao, UK
Yixin Zhong, China
Jacek M. Zurada, USA

VIII Organization

#### General Chair and Co-chair

Jun Wang, Hong Kong Laiwan Chan, Hong Kong

#### Organizing Chair

Man-Wai Mak, Hong Kong

# Finance and Registration Chair

Kai-Pui Lam, Hong Kong

## Workshops and Tutorials Chair

James Kwok, Hong Kong

#### Publications and Special Sessions Chair and Co-chair

Frank H. Leung, Hong Kong Jianwei Zhang, Germany

#### **Publicity Chair and Co-chairs**

Jeffrey Xu Yu, Hong Kong Derong Liu, USA

Chris C. Yang, Hong Kong Wlodzislaw Duch, Poland

## Local Arrangements Chair and Co-chair

Andrew Chi-Sing Leung, Hong Kong Eric Yu, Hong Kong

## Secretary

Haixuan Yang, Hong Kong

# Program Chair and Co-chair

Irwin King, Hong Kong DeLiang Wang, USA

#### **Program Committee**

Shigeo Abe, Japan Peter Andras, UK Sabri Arik, Turkey

Abdesselam Bouzerdoum, Australia

Ke Chen, UK

Liang Chen, Canada Luonan Chen, Japan Zheru Chi, Hong Kong Sung-Bae Cho, Korea Sungzoon Cho, Korea Seungjin Choi, Korea Andrzej Cichocki, Japan Chuangyin Dang, Hong Kong Wai-Keung Fung, Canada Takeshi Furuhashi, Japan Artur dAvila Garcez, UK Daniel W.C. Ho, Hong Kong

Edward Ho, Hong Kong

Sanqing Hu, USA

Guang-Bin Huang, Singapore Kaizhu Huang, China Malik Magdon Ismail, USA Takashi Kanamaru, Japan

James Kwok, Hong Kong James Lam, Hong Kong Kai-Pui Lam, Hong Kong

Doheon Lee, Korea Minho Lee, Korea

Andrew Leung, Hong Kong Frank Leung, Hong Kong

Yangmin Li, Macau

Xun Liang, China Yanchun Liang, China Xiaofeng Liao, China Chih-Jen Lin, Taiwan Xiuwen Liu, USA Bao-Liang Lu, China Wenlian Lu, China Jinwen Ma, China

Man-Wai Mak, Hong Kong Sushmita Mitra, India Paul Pang, New Zealand

Jagath C. Rajapakse, Singapore

Bertram Shi, Hong Kong Daming Shi, Singapore Michael Small, Hong Kong

Michael Stiber, USA

Ponnuthurai N. Suganthan, Singapore

Fuchun Sun, China Ron Sun, USA

Johan A.K. Suykens, Belgium Norikazu Takahashi, Japan Michel Verleysen, Belgium

Si Wu, UK

Chris Yang, Hong Kong

Hujun Yin, UK Eric Yu, Hong Kong Jeffrey Yu, Hong Kong Gerson Zaverucha, Brazil Byoung-Tak Zhang, Korea Liqing Zhang, China

#### Reviewers

Shotaro Akaho
Toshio Akimitsu
Damminda Alahakoon
Aimee Betker
Charles Brown
Gavin Brown
Jianting Cao
Jinde Cao
Hyi-Taek Ceong

Pat Chan Samuel Chan Aiyou Chen Hongjun Chen Lihui Chen Shu-Heng Chen Xue-Wen Chen Chong-Ho Choi Jin-Young Choi

M.H. Chu Sven Crone Bruce Curry Rohit Dhawan Deniz Erdogmus Ken Ferens Robert Fildes Tetsuo Furukawa

John Q. Gan

Kosuke Hamaguchi Yangbo He Steven Hoi Pingkui Hou Zeng-Guang Hou Justin Huang Ya-Chi Huang Kunhuang Huarng Arthur Hsu Kazushi Ikeda Masumi Ishikawa

Jaeseung Jeong

Liu Ju

Christian Jutten Mahmoud Kaboudan Sotaro Kawata Dae-Won Kim Dong-Hwa Kim Cleve Ku Shuichi Kurogi Cherry Lam Stanley Lam Toby Lam Hyoung-Joo Lee Raymond Lee

Heui-Seok Lim Hsuan-Tien Lin Wei Lin Wilfred Lin Rujie Liu Xiuxin Liu Xiwei Liu

Yuh-Jye Lee

Bresley Lim

Chi-Hong Leung

Zhi-Yong Liu

Hongtao Lu Xuerong Mao Naoki Masuda Yicong Meng Zhiqing Meng Yutaka Nakamura Nicolas Navet Raymond Ng Rock Ng

Edith Ngai

Minh-Nhut Nguyen Kvosuke Nishida Yugang Niu YewSoon Ong Nevir Ozcan Keeneth Pao Ju H. Park Mario Pavone Renzo Perfetti Dinh-Tuan Pham Tu-Minh Phuong

Libin Rong Akihiro Sato Xizhong Shen Jinhua Sheng Qiang Sheng Xizhi Shi Noritaka Shigei Hyunjung Shin

Vimal Singh

Vladimir Spinko Robert Stahlbock Hiromichi Suetant

Jun Sun Yanfeng Sun Takashi Takenouchi

Yin Tang

Thomas Trappenberg Chueh-Yung Tsao Satoki Uchiyama

Feng Wan Dan Wang Rubin Wang Ruiqi Wang Yong Wang Hua Wen

Michael K.Y. Wong

Chunguo Wu Guoding Wu Qingxiang Wu Wei Wu Cheng Xiang Botong Xu X11 X11 Lin Yan Shaoze Yan Simon X. Yang Michael Yiu

Junichiro Yoshimoto

Enzhe Yu Fenghua Yuan Huaguang Zhang Jianyu Zhang Kun Zhang Liqing Zhang Peter G. Zhang Ya Zhang

Ding-Xuan Zhou

Jian Zhou Jin Zhou Jianke Zhu

# Table of Contents - Part III

Bioinformatics and Biomedical Applications	
DRFE: Dynamic Recursive Feature Elimination for Gene Identification Based on Random Forest	1
Gene Feature Extraction Using T-Test Statistics and Kernel Partial Least Squares	11
An Empirical Analysis of Under-Sampling Techniques to Balance a Protein Structural Class Dataset	21
Prediction of Protein Interaction with Neural Network-Based Feature Association Rule Mining	30
Prediction of Protein Secondary Structure Using Nonlinear Method Silvia Botelho, Gisele Simas, Patricia Silveira	40
Clustering Analysis for Bacillus Genus Using Fourier Transform and Self-Organizing Map	48
Recurrence Quantification Analysis of EEG Predicts Responses to Incision During Anesthesia	58
Wavelet Spectral Entropy for Indication of Epileptic Seizure in Extracranial EEG	66
The Study of Classification of Motor Imaginaries Based on Kurtosis of EEG	74
Automatic Detection of Critical Epochs in coma-EEG Using Independent Component Analysis and Higher Order Statistics	82

XII

Sparse Bump Sonification: A New Tool for Multichannel EEG Diagnosis of Mental Disorders; Application to the Detection of the Early Stage of Alzheimer's Disease	92
Effect of Diffusion Weighting and Number of Sensitizing Directions on Fiber Tracking in DTI	102
3-D Reconstruction of Blood Vessels Skeleton Based on Neural Network	110
Design of a Fuzzy Takagi-Sugeno Controller to Vary the Joint Knee Angle of Paraplegic Patients	118
Characterization of Breast Abnormality Patterns in Digital Mammograms Using Auto-associator Neural Network  Rinku Panchal, Brijesh Verma	127
Evolving Hierarchical RBF Neural Networks for Breast Cancer Detection	137
Ovarian Cancer Prognosis by Hemostasis and Complementary Learning	145
Multi-class Cancer Classification with OVR-Support Vector Machines Selected by Naïve Bayes Classifier	155
Breast Cancer Diagnosis Using Neural-Based Linear Fusion Strategies	165
A Quantitative Diagnostic Method Based on Bayesian Networks in Traditional Chinese Medicine	176
Information Security	
High-Order Markov Kernels for Network Intrusion Detection  Shengfeng Tian, Chuanhuan Yin, Shaomin Mu	184

Table of Contents – Part III	XIII
Improved Realtime Intrusion Detection System	192
A Distributed Neural Network Learning Algorithm for Network Intrusion Detection System	201
A DGC-Based Data Classification Method Used for Abnormal Network Intrusion Detection	209
Intrusion Alert Analysis Based on PCA and the LVQ Neural Network	217
A Novel Color Image Watermarking Method Based on Genetic Algorithm and Neural Networks	225
Color Image Watermarking Algorithm Using BPN Neural Networks Cheng-Ri Piao, Sehyeong Cho, Seung-Soo Han	234
A Novel Blind Digital Watermark Algorithm Based on Neural Network and Chaotic Map	243
Data and Text Processing	
Stimulus Related Data Analysis by Structured Neural Networks	251
Scalable Dynamic Self-Organising Maps for Mining Massive Textual  Data	260
Maximum-Minimum Similarity Training for Text Extraction  Hui Fu, Xiabi Liu, Yunde Jia	268
Visualization of Depending Patterns in Metabonomics	278
A RBF Network for Chinese Text Classification Based on Concept Feature Extraction	285

Ontology Learning from Text: A Soft Computing Paradigm	295
Text Categorization Based on Artificial Neural Networks	302
Knowledge as Basis Broker — The Research of Matching Customers Problems and Professionals Métiers	312
A Numerical Simulation Study of Structural Damage Based on RBF Neural Network	322
Word Frequency Effect and Word Similarity Effect in Korean Lexical Decision Task and Their Computational Model	331
Content-Based 3D Graphic Information Retrieval	341
Performance Improvement in Collaborative Recommendation Using Multi-Layer Perceptron	350
Financial Applications	
NN-OPT: Neural Network for Option Pricing Using Multinomial Tree	360
A Brain-Inspired Cerebellar Associative Memory Approach to Option Pricing and Arbitrage Trading	370
A Reliability-Based RBF Network Ensemble Model for Foreign Exchange Rates Predication	380
Combining Time-Scale Feature Extractions with SVMs for Stock Index Forecasting	390

Table of Contents – Part III	XV
Extensions of ICA for Causality Discovery in the Hong Kong Stock  Market	400
Pricing Options in Hong Kong Market Based on Neural Networks Xun Liang, Haisheng Zhang, Jian Yang	410
Global Optimization of Support Vector Machines Using Genetic Algorithms for Bankruptcy Prediction	420
Neural Networks, Fuzzy Inference Systems and Adaptive-Neuro Fuzzy Inference Systems for Financial Decision Making	430
Online Forecasting of Stock Market Movement Direction Using the Improved Incremental Algorithm	440
Pretests for Genetic-Programming Evolved Trading Programs: "zero-intelligence" Strategies and Lottery Trading  Shu-Heng Chen, Nicolas Navet	450
Currency Options Volatility Forecasting with Shift-Invariant Wavelet  Transform and Neural Networks	461
Trend-Weighted Fuzzy Time-Series Model for TAIEX Forecasting	469
Intelligence-Based Model to Timing Problem of Resources Exploration in the Behavior of Firm	478
Manufacturing Systems	
Application of ICA in On-Line Verification of the Phase Difference of the Current Sensor	488
Neural Networks Based Automated Test Oracle for Software Testing  Mao Ye, Boqin Feng, Li Zhu, Yao Lin	498
Tool Wear Condition Monitoring in Drilling Processes Using Fuzzy Logic	508

Fault Diagnosis in Nonlinear Circuit Based on Volterra Series and Recurrent Neural Network	518
Manufacturing Yield Improvement by Clustering	526
Gear Crack Detection Using Kernel Function Approximation	535
The Design of Data-Link Equipment Redundant Strategy	545
Minimizing Makespan on Identical Parallel Machines Using Neural Networks	553
Ensemble of Competitive Associative Nets for Stable Learning Performance in Temperature Control of RCA Cleaning Solutions	563
Predication of Properties of Welding Joints Based on Uniform  Designed Neural Network	572
Applying an Intelligent Neural System to Predicting Lot Output Time in a Semiconductor Fabrication Factory	581
Multi-degree Prosthetic Hand Control Using a New BP  Neural Network	589
Control and Robotics	
Neural-Network-Based Sliding Mode Control for Missile Electro-Hydraulic Servo Mechanism	596
Turbulence Encountered Landing Control Using Hybrid Intelligent System	605

Table of Contents – Part III	XVII
An AND-OR Fuzzy Neural Network Ship Controller Design	616
RBF ANN Nonlinear Prediction Model Based Adaptive PID Control of Switched Reluctance Motor Drive	626
Hierarchical Multiple Models Neural Network Decoupling Controller or a Nonlinear System	636
Sensorless Control of Switched Reluctance Motor Based on ANFIS	645
Hybrid Intelligent PID Control for MIMO System	654
$H^{\infty}$ Neural Networks Control for Uncertain Nonlinear Switched mpulsive Systems	664
Reliable Robust Controller Design for Nonlinear State-Delayed Systems Based on Neural Networks	674
Neural Network Applications in Advanced Aircraft Flight Control System, a Hybrid System, a Flight Test Demonstration	684
Vague Neural Network Based Reinforcement Learning Control System for Inverted Pendulum	692
Neural-Network Inverse Dynamic Online Learning Control on Physical Exoskeleton	702
Fuzzy Adaptive Particle Filter Algorithm for Mobile Robot Fault Diagnosis	711
Tracking Control of a Mobile Robot with Kinematic Uncertainty  Jsing Neural Networks	721

Movement Control of a Mobile Manipulator Based on Cost Optimization	731
Evolutionary Algorithms and Systems	
Synthesis of Desired Binary Cellular Automata Through the Genetic Algorithm	738
Satoshi Suzuki, Toshimichi Saito	
On Properties of Genetic Operators from a Network Analytical Viewpoint	746
Hiroyuki Funaya, Kazushi Ikeda	
SDMOGA: A New Multi-objective Genetic Algorithm Based on Objective Space Divided	754
Hamming Sphere Solution Space Based Genetic Multi-user  Detection	763
UEAS: A Novel United Evolutionary Algorithm Scheme	772
Implicit Elitism in Genetic Search	781
The Improved Initialization Method of Genetic Algorithm for Solving the Optimization Problem	789
Optimized Fuzzy Decision Tree Using Genetic Algorithm	797
A Genetic-Inspired Multicast Routing Optimization Algorithm with Bandwidth and End-to-End Delay Constraints	807
Integration of Genetic Algorithm and Cultural Algorithms for Constrained Optimization	817
Neuro-genetic Approach for Solving Constrained Nonlinear Optimization Problems	826

A Double-Stage Genetic Optimization Algorithm for Portfolio

Kin Keung Lai, Lean Yu, Shouyang Wang, Chengxiong Zhou

928

Image Reconstruction Using Genetic Algorithm in Electrical Impedance Tomography	938
Mitigating Deception in Genetic Search Through Suitable Coding S.K. Basu, A.K. Bhatia	946
The Hybrid Genetic Algorithm for Blind Signal Separation	954
Genetic Algorithm for Satellite Customer Assignment	964
Fuzzy Systems	
A Look-Ahead Fuzzy Back Propagation Network for Lot Output Time Series Prediction in a Wafer Fab	974
Extraction of Fuzzy Features for Detecting Brain Activation from Functional MR Time-Series	983
An Advanced Design Methodology of Fuzzy Set-Based Polynomial Neural Networks with the Aid of Symbolic Gene Type Genetic Algorithms and Information Granulation	993
A Hybrid Self-learning Approach for Generating Fuzzy Inference Systems	1002
A Fuzzy Clustering Algorithm for Symbolic Interval Data Based on a Single Adaptive Euclidean Distance	1012
Approximation Accuracy of Table Look-Up Scheme for Fuzzy-Neural Networks with Bell Membership Function	1022
Prototype-Based Threshold Rules	1028

A Fuzzy LMS Neural Network Method for Evaluation of Importance of Indices in MADM	1038
Fuzzy RBF Neural Network Model for Multiple Attribute Decision Making	1046
A Study on Decision Model of Bottleneck Capacity Expansion with Fuzzy Demand	1055
Workpiece Recognition by the Combination of Multiple Simplified Fuzzy ARTMAP	1063
Stability of Periodic Solution in Fuzzy BAM Neural Networks with Finite Distributed Delays	1070
Design Methodology of Optimized IG_gHSOFPNN and Its Application to pH Neutralization Process	1079
Neuro-fuzzy Modeling and Fuzzy Rule Extraction Applied to Conflict Management	1087
Hardware Implementations	
Hardware Implementation of a Wavelet Neural Network Using FPGAs	1095
Neural Network Implementation in Hardware Using FPGAs	1105
FPGA Discrete Wavelet Transform Encoder/Decoder Implementation	1113
Randomized Algorithm in Embedded Crypto Module	1122

#### $XXII \quad \ \, Table \,\, of \,\, Contents - Part \,\, III \,\,$

Hardware Implementation of an Analog Neural Nonderivative Optimizer	1131
Rodrigo Cardim, Marcelo C.M. Teixeira, Edvaldo Assunção, Nobuo Oki, Aparecido A. de Carvalho, Márcio R. Covacic	
Synchronization Via Multiplex Spike-Trains in Digital Pulse Coupled Networks	1141
A Bit-Stream Pulse-Based Digital Neuron Model for Neural Networks $C\acute{e}sar\ Torres ext{-}Huitzil$	1150
From Hopfield Nets to Pulsed Neural Networks	1160
A Digital Hardware Architecture of Self-Organizing Relationship (SOR) Network	1168
Towards Hardware Acceleration of Neuroevolution for Multimedia Processing Applications on Mobile Devices	1178
Neurocomputing for Minimizing Energy Consumption of Real-Time Operating System in the System-on-a-Chip	1189
A Novel Multiplier for Achieving the Programmability of Cellular Neural Network	1199
Neural Network-Based Scalable Fast Intra Prediction Algorithm in H.264 Encoder	1206
Author Index	1217