J. C. Rajapakse, L. Wang (Eds.)

Neural Information Processing: Research and Development

Springer

Berlin
Heidelberg
New York
Hong Kong
London
Milano
Paris
Tokyo

Studies in Fuzziness and Soft Computing, Volume 152

Editor-in-chief
Prof. Janusz Kacprzyk
Systems Research Institute
Polish Academy of Sciences
ul. Newelska 6
01-447 Warsaw
Poland
E-mail: kacprzyk@ibspan.waw.pl

Further volumes of this series can be found on our homepage: springeronline.com

Vol. 133. Z.-Q. Liu, J. Cai, R. Buse
Handwriting Recognition, 2003
ISBN 3-540-40177-6

Vol 134. V.A. Niskanen
Soft Computing Methods in Human Sciences, 2004
ISBN 3-540-00466-1

Vol. 135. J.J. Buckley
Fuzzy Probabilities and Fuzzy Sets for Web Planning, 2004
ISBN 3-540-00473-4

Vol. 136. L. Wang (Ed.)
Soft Computing in Communications, 2004
ISBN 3-540-40575-5

Vol. 137. V. Loia, M. Nikravesh, L.A. Zadeh (Eds.)
Fuzzy Logic and the Internet, 2004
ISBN 3-540-20180-7

Vol. 138. S. Sirmakessis (Ed.)
Text Mining and its Applications, 2004
ISBN 3-540-20238-2

Vol. 139. M. Nikravesh, B. Azvine, I. Yager, L.A. Zadeh (Eds.)
Enhancing the Power of the Internet, 2004
ISBN 3-540-20237-4

Vol. 140. A. Abraham, L.C. Jain, B.J. van der Zwaag (Eds.)
Innovations in Intelligent Systems, 2004
ISBN 3-540-20265-X

Vol. 141. G.C. Onwubolu, B.V. Babu
New Optimzation Techniques in Engineering, 2004
ISBN 3-540-20167-X

Vol. 142. M. Nikravesh, L.A. Zadeh, V. Korotkikh (Eds.)
Fuzzy Partial Differential Equations and Relational Equations, 2004
ISBN 3-540-20322-2

Vol. 143. L. Rutkowski
New Soft Computing Techniques for System Modelling, Pattern Classification and Image Processing, 2004
ISBN 3-540-20584-5

Vol. 144. Z. Sun, G.R. Finnie
Intelligent Techniques in E-Commerce, 2004
ISBN 3-540-20518-7

Vol. 145. J. Gil-Aluja
Fuzzy Sets in the Management of Uncertainty, 2004
ISBN 3-540-20341-9

Vol. 146. J.A. Gámez, S. Moral, A. Salmerón (Eds.)
Advances in Bayesian Networks, 2004
ISBN 3-540-20876-3

Vol. 147. K. Watanabe, M.M.A. Hashem
New Algorithms and their Applications to Evolutionary Robots, 2004
ISBN 3-540-20901-8

Vol. 148. C. Martin-Vide, V. Mitrana, G. Păun (Eds.)
Formal Languages and Applications, 2004
ISBN 3-540-20907-7

Vol. 149. J.J. Buckley
Fuzzy Statistics, 2004
ISBN 3-540-21084-9

Vol. 150. L. Bull (Ed.)
Applications of Learning Classifier Systems, 2004
ISBN 3-540-21109-8

Vol. 151. T. Kowalczyk, E. Pleszczyńska, F. Ruland (Eds.)
Grade Models and Methods for Data Analysis, 2004
ISBN 3-540-21120-9

Jagath Chandana Rajapakse
Lipo Wang (Eds.)

Neural Information Processing: Research and Development

Springer

Prof. Dr. Jagath Chandana Rajapakse
Prof. Dr. Lipo Wang
Nanyang Technological University
School of Computer Engineering
Nanyang Avenue
639798 Singapore
Singapore
E-mail: elpwang@ntu.edu.sg

ISSN 1434-9922
ISBN 978-3-642-53564-2 ISBN 978-3-540-39935-3 (eBook)
DOI 10.1007/978-3-540-39935-3

Library of Congress Cataloging-in-Publication-Data

Neural information processing : research and development /
Jagath Chandana Rajapakse, Lipo Wang (eds).
p. cm. -- (Studies in fuzziness and soft computing, ISSN 1434-9922 ; v. 152)
Includes bibliographical references and index.
ISBN 978-3-642-53564-2
1. Neural networks (Computer science) I. Rajapakse, Jagath Chandana. II. Wang, Lipo.
III. Series
QA76.87.N4745 2004
006.3'2--dc22

Springer-Verlag is a part of Springer Science+Business Media
springeronline.com

Typesetting: camera-ready by editors
Cover design: E. Kirchner, Springer-Verlag, Heidelberg
Printed on acid free paper 62/3020/M - 5 4 3 2 1 0

Preface

The field of neural information processing has two main objects: investigation into the functioning of biological neural networks and use of artificial neural networks to solve real world problems. Even before the reincarnation of the field of artificial neural networks in mid nineteen eighties, researchers have attempted to explore the engineering of human brain function. After the reincarnation, we have seen an emergence of a large number of neural network models and their successful applications to solve real world problems.

This volume presents a collection of recent research and developments in the field of neural information processing. The book is organized in three Parts, i.e., (1) architectures, (2) learning algorithms, and (3) applications.

Artificial neural networks consist of simple processing elements called neurons, which are connected by weights. The number of neurons and how they are connected to each other defines the architecture of a particular neural network. Part 1 of the book has nine chapters, demonstrating some of recent neural network architectures derived either to mimic aspects of human brain function or applied in some real world problems.

Muresan provides a simple neural network model, based on spiking neurons that make use of shunting inhibition, which is capable of resisting small scale changes of stimulus. Hoshino and Zheng simulate a neural network of the auditory cortex to investigate neural basis for encoding and perception of vowel sounds. Masakazu, Mori, and Mitarai propose a convolutional spiking neural network model with population coding for robust object recognition. Kharlamov and Raevsky formulate a class of neural network, using neurobilogically feasible multilevel information processing premises, that realizes the temporal summation of signals. Kitano and Fukai introduce a computational neural model to investigate the underlying mechanism of synchrony of neurons in the primary motor cortex to improve the predictive power.

Huang, King, Lyu, and Yang present a novel approach to construct a kind of tree belief network, which improves the approximation accuracy and recognition rate. Chiewchanwattana, Lursinsap, and Chu present an architecture capable of time-series forecasting by using a selective ensemble neural network. Miyajima, Shigei, and Kiriki propose a higher-order multi-directional associative memory with an energy function, which has an increased memory capacity and higher ability for error correcting. Maire, Bader, and Wathne describe a new indexing tree system for high dimensional codebook vectors, by using a dynamic binary search tree with a fat decision hyperplanes.

Neural networks are large parametric models where parameters are stored as

weights of connections. Part 2 of this book investigates the recent developments in learning algorithms in seven chapters on adapting weights of neural networks.

Roy attempts to define some external characteristics of brain-like learning and investigate some logical flows of connectionism. Geczy and Usui establish a classification framework with superlinear learning algorithm to permit independent specification of functions and optimization techniques. Chaudhari and Tiwari investigate some approaches for adapting binary neural networks for multi-class classification problem. Ozawa and Abe present a memory-based reinforcement learning algorithm to prevent unlearning of weights. Takahama, Sakai, and Isomichi propose a genetic algorithm with degeneration to solve the difficulties by optimizing structures of neural networks. Wanas and Kamel present an algorithm to independently train the members of an ensemble classifier. Verma and Ghosh present a learning algorithm, by using different combination strategies, to find the optimal neural network architecture and weights.

Artificial neural networks and learning algorithms are increasingly being applied today to solve real world problems. Part 3 of this book contains nine chapters, each describing a recent application of artificial neural networks.

Neskovic, Schuster and Cooper use a neural network for the detection of cars from real-time video streams. Yang, King, Chan, and Huang uses non-fixed and asymmetrical margin setting with momentum in support vector regression for financial time-series prediction. Hu and Hirasawa present a neural network for control of non-linear systems. And Ricalde, Sanchez, and Perez provide an application of recurrent neural network for control of a robot manipulator. Ishikawa presents gesture recognition technique based on self-organizing feature maps (SOMs) using multiple sensors. Hussin, Bakus and Kamel present a technique based on SOMs for phase-based document clustering. Kasabov and Dimitrov discover gene regulatory networks from gene expression data with the use of evolving connectionist systems. Harati and Ahmadabadi use neural networks to solve the multi-agent credit assignment problem. Kim, Lee, Shin, and Yang present an implementation of visual tracking system using an artificial retina chip and a shape memory alloy actuator.

We would like to sincerely thank all authors who have spent time and effort to make important contributions to this book. Our gratitude also goes to Professor Janusz Kacprzyk and Dr. Thomas Ditzinger for their most kind support and help for this book.

Jagath C. Rajapakse
Lipo Wang

Contents

Part 2: Learning Algorithms

Part 3: Applications