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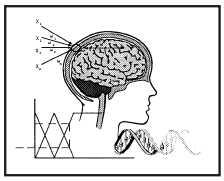

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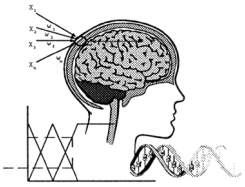

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PREFACE

Neural networks are a new generation of information processing paradigms designed to mimic some of the behaviors of the human brain. These networks have gained tremendous popularity due to their ability to learn, recall and generalize from training data. A number of neural network paradigms have been reported in the last four decades, and in the last decade the neural networks have been refined and widely used by researchers and application engineers.

The main purpose of this book is to report recent advances in neural network paradigms and their applications. It is impossible to include all recent advances in this book; hence, only a sample has been included.

This book consists of 10 chapters. Chapter 1, by Ghosh and Taha, presents the architecture of a neuro-symbolic hybrid system. This system embeds initial domain knowledge and/or statistical information into a custom neural network, refines this network using training data, and finally extracts refined knowledge in the form of refined rule base. Two successful applications of this hybrid system are described.

Chapter 2, by Karayiannis and Behnke, presents an axiomatic approach for formulating radial basis function neural networks. The batch and sequential learning algorithms are developed for reformulated radial basis function neural networks. This approach is demonstrated on handwritten digit recognition.

Chapter 3, by Vassilas, is on efficient neural network-based methodology for the design of multiple classifiers. An increase in speed in the neural network training phase as well as in the selection of fuzzy and statistical supervised classifiers is achieved by size reduction and redundancy removal from the data set. The catalog of self-organizing feature maps together with the index table is used as a compressed representation of the original data. This technique is demonstrated on land-cover classification of multi-spectral satellite image showing increased speed.

Versino and Gambardella describe the design of a self-organizing map-like neural network which learns to associate actions with perceptions under the supervision of a planning system in Chapter 4. This novel technique is validated in learning fine motion in robotics.

Chapter 5, by Fernández-Delgado, Presedo, Lama, and Barro, is on a new neural network called MART for adaptive pattern recognition of multichannel input signals. A real application related to the multichannel signal processing is presented to demonstrate the ability of this network to solve complex problems.

Caudell and Healy present their research on a new version of the lateral priming adaptive resonance theory network in Chapter 6. They demonstrate that this architecture not only has one of the highest bounds on learning convergence, but also has strong empirical evidence of excellent generalization performance.

Chapter 7, by Aboulenien and De Wilde, discusses an intelligent agent that employs a machine learning technique in order to provide assistance to users dealing with a particular computer application. The authors present actual results from a prototype agent built using this technique applied on flight reservation domain.

Chapter 8, by Halici, Leblebicioglu, Özgen, and Tuncay, presents some applications of neural networks in process control. The authors show that hybrid methods using neural networks are very promising for the control of nonlinear systems.

Chapter 9, by Howlett, de Zoysa, and Walters, is on monitoring internal combustion engines by neural network based virtual sensing. It is necessary to reduce the quantities of polluting gases emitted by this engine and to decrease the amount of fuel consumed per kilometer. The use of neural networks for monitoring the parameters of this engines is proposed.

Pedrycz presents a novel approach to pattern classification using a concept of fuzzy Petri nets in Chapter 10. The learning scheme is illustrated with the aid of numeric examples.

This book will be useful for application engineers, scientists, and research students who wish to use neural networks for solving real-world problems.

We would like to express our sincere thanks to Berend-Jan van der Zwaag, Irene van der Zwaag-Tong, Ashlesha Jain, Ajita Jain and Sandhya Jain for their help in the preparation of the manuscript. We are grateful to the authors for their contributions, and thanks are due to Dawn Mesa, Lyn Meany, and Suzanne Lassandro for their editorial assistance.

Lakhmi Jain, Australia
Anna Maria Fanelli, Italy

The Editors

Lakhmi Jain is a Director/Founder of the Knowledge-Based Intelligent Engineering Systems (KES) Centre, located in the University of South Australia. He is a fellow of the Institution of Engineers Australia. He has initiated a postgraduate stream by research in the Knowledge-based Intelligent Engineering Systems area. He has presented a number of Keynote addresses in International Conferences on Knowledge-Based Systems, Neural Networks, Fuzzy Systems and Hybrid Systems.

He is the Founding Editor-in-Chief of the International Journal of Knowledge-Based Intelligent Engineering Systems and served as an Associate Editor of the IEEE Transactions on Industrial Electronics. Dr Jain was the Technical chair of the ETD2000 International Conference in 1995, and Publications Chair of the Australian and New Zealand Conference on Intelligent Information Systems in 1996. He also initiated the First International Conference on Knowledge-based Intelligent Electronic Systems in 1997. This is now an annual event. He served as the Vice President of the Electronics Association of South Australia in 1997. He is the Editor-in-Chief of the International Book Series on Computational Intelligence, CRC Press USA. His interests focus on the applications of novel techniques such as knowledge-based systems, artificial neural networks, fuzzy systems and genetic algorithms and the application of these techniques

Anna Maria Fanelli received the "Laurea" degree in Physics from the University of Bari, Italy, in 1974. From 1975 to 1979, she was full time researcher at the Physics Department of the University of Bari, Italy, where she became Assistant Professor in 1980. In 1985 she joined the Department of Computer Science at the University of Bari, Italy, as Professor of Computer Science. Currently, she is responsible for the courses "Computer Systems Architectures" and "Neural Networks" in the computer science discipline Her research activity has involved issues related to pattern recognition, image processing and computer vision. Her work in these areas has been published in several journals and conference proceedings. Her current research interests include artificial neural networks, genetic algorithms, fuzzy systems, neuro-fuzzy modeling and hybrid systems.

Professor Fanelli is a member of the IEEE Society, the International Neural Network Society and AI*IA (Italian Association for Artificial Intelligence). She is the editorial board member of the *International Journal of Knowledge-Based Intelligent Engineering Systems.*

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This book is dedicated to all our students