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Bio-inspired Hybrid Intelligent Systems for Image Analysis and Pattern Recognition

Springer

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Preface

We describe in this book, new methods bio-inspired models and applications of hybrid intelligent systems using soft computing techniques for image analysis and pattern recognition. Soft Computing (SC) consists of several intelligent computing paradigms, including fuzzy logic, neural networks, and evolutionary algorithms, which can be used to produce powerful hybrid intelligent systems. The book is organized in four main parts, which contain a group of papers around a similar subject. The first part consists of papers with the main theme of introductory concepts and models, which are basically papers that propose new fuzzy and bio-inspired models to solve general problems. The second part contains papers with the main theme of modular neural networks in pattern recognition, which are basically papers using bio-inspired techniques, like modular neural networks, for achieving pattern recognition in different applications. The third part contains papers with the themes of modular neural networks and other soft computing models in time series prediction, which are papers that apply hybrid intelligent systems to the problem of time series analysis and prediction. The fourth part contains papers that deal with bio-inspired models in optimization and robotics applications.

In the part of Introductory Concepts and Models there are 3 papers that describe different contributions on fuzzy logic and bio-inspired models with application in image analysis and pattern recognition. The first paper, by Humberto Bustince et al., deals with a survey of applications of the extensions of fuzzy sets to image processing. The second paper, by Cecilia Leal-Ramirez et al., deals with an interval type-2 fuzzy cellular model applied to the dynamics of a uni-specific population induced by environment variations. The third paper, by Gustavo Olague and Leonardo Trujillo, studies a genetic programming approach to the design of interest point operators in images.

In the part of Modular Neural Networks in Pattern Recognition there are 5 papers that describe different contributions on achieving pattern recognition using hybrid intelligent systems. The first paper, by Ricardo Munoz et al., describes modular neural networks with fuzzy logic integration for face, fingerprint and voice recognition. The second paper, by Monica Beltran et al., deals with modular neural networks with fuzzy response integration for human signature recognition. The third paper, by Magdalena Serrano et al., proposes an intelligent hybrid system for person identification using biometric measures and modular neural

networks with fuzzy integration of responses. The fourth paper, by Denisse Hidalgo et al., describes the optimization of modular neural networks with type-2 fuzzy integration using a general evolutionary method with application in multimodal biometry. The fifth paper, by Miguel Lopez et al., deals with a comparative study of fuzzy methods for response integration in ensemble neural networks for pattern recognition.

In the part of Neural Network Models and Time Series Prediction there are 4 papers that describe different contributions of new neural network models and their application in solving time series prediction problems. The first paper by Martha Pulido et al., describes a hybrid model based on ensemble neural networks and fuzzy logic for aggregation of results for time series prediction in the Mackey-Glass problem. The second paper, by Gerardo Mendez and Angeles Hernandez, deals with the prediction of the MXNUSD exchange rate using a hybrid interval type-2 fuzzy logic system as a forecasting tool. The third paper, by Eduardo Gomez-Ramirez et al., describes a process for discovering universal polynomial cellular neural networks through genetic algorithms. The fourth paper by Mario Chacon et al., describes an EMG hand burst activity detection study based on hard and soft thresholding.

In the part of Optimization and Robotics several contributions are described on the application of bio-inspired methods for achieving optimization and robotics applications. The first paper, by Fevrier Valdez et al., describes a new evolutionary method combining particle swarm optimization and genetic algorithms using fuzzy logic, and its application in optimizing the architecture of modular neural networks. The second paper, by Cynthia Solano-Aragon and Arnulfo Alanis, describes a new multi-agent architecture for controlling autonomous mobile robots using fuzzy logic and obstacle avoidance with computer vision techniques. The third paper, by Ricardo Martinez-Marroquin et al., deals with the Optimization of type-1 and type-2 fuzzy logic controllers of autonomous mobile robots using particle swarm optimization.

In conclusion, the edited book comprises papers on diverse aspects of bio-inspired models, soft computing and hybrid intelligent systems. There are theoretical aspects as well as application papers.

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Contents