

Oscar Castillo, Witold Pedrycz, and Janusz Kacprzyk (Eds.)

Evolutionary Design of Intelligent Systems in Modeling, Simulation and Control

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Preface

We describe in this book, new methods for evolutionary design of intelligent systems using soft computing and their applications in modeling, simulation and control. 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 evolutionary design of fuzzy systems in intelligent control, which consists of papers that propose new methods for designing and optimizing intelligent controllers for different applications. The second part contains papers with the main theme of evolutionary design of intelligent systems for pattern recognition applications, which are basically papers using evolutionary algorithms for optimizing modular neural networks with fuzzy systems for response integration, for achieving pattern recognition in different applications. The third part contains papers with the themes of models for learning and social simulation, which are papers that apply intelligent systems to the problems of designing learning objects and social agents. The fourth part contains papers that deal with intelligent systems in robotics applications and hardware implementations.

In the part of Intelligent Control there are 5 papers that describe different contributions on evolutionary optimization of fuzzy systems in intelligent control. The first paper, by Ricardo Martinez-Marroquin et al., deals with the design of membership functions of a fuzzy logic controller for an autonomous mobile robot using ant colony optimization. The second paper, by Ricardo Martinez et al., deals with the evolutionary optimization of type-2 fuzzy logic systems applied to the control of linear plants. The third paper, by Cynthia Solano-Aragon and Arnulfo Alanis, studies a multi-agent system with fuzzy logic control for autonomous mobile robots in known environments. The fourth paper, by Gerardo Mendez and Angeles Hernandez, proposes hybrid interval type-1 non-singleton type-2 fuzzy logic systems as equivalent to type-2 adaptive neuro-fuzzy inference systems. The fifth paper, by Ieroham Baruch and Rosalba Galvan-Guerra, proposes a centralized direct and indirect neural control of distributed parameter systems.

In the part of Pattern Recognition there are 5 papers that describe different contributions on achieving pattern recognition using hybrid intelligent systems. The first paper, by Martha Pulido et al., describes ensemble neural networks with fuzzy logic integration for complex time series prediction. The second paper, by Ricardo Munoz

et al., describes modular neural networks with fuzzy logic integration for face, fingerprint and voice recognition and the optimization of the network architecture with hierarchical genetic algorithms. The third paper, by Erika Ayala et al., describes the optimization of modular neural networks with fuzzy integration using a genetic algorithm with application to face recognition. The fourth 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 fifth paper, by Monica Beltran et al., deals with modular neural networks with fuzzy response integration for human signature recognition.

In the part of Learning and Social Simulation there are 3 papers that describe different contributions for creating learning objects and social intelligent agents. The first paper by Mario Garcia and Brunett Parra, describes a hybrid recommender system architecture for obtaining learning objects. The second paper, by Dora Luz Flores et al., deals with the application of fuzzy semantic networks for interaction representation in social simulation. The third paper, by Carelia Gaxiola et al., describes a fuzzy personality model based on transactional analysis for socially intelligent agents and robots.

In the part of Robotics and Hardware Implementations several contributions are described on the application evolutionary methods for achieving optimization of fuzzy systems in robotics applications and also hardware implementations of fuzzy systems. The first paper, by Nohe Cazarez et al., describes a new method for controlling unstable non-minimum phase systems with fuzzy logic. The second paper, by Selene Cardenas, describes a new genetic approach for the optimization of walking patterns of a biped robot. The third paper, by Oscar Montiel et al., deals with the design and simulation of the type-2 fuzzification stage with active membership functions and its hardware implementation on FPGAs. The fourth paper, by Roberto Sepulveda et al., deals with a methodology to test and validate a VHDL inference engine of a type-2 fuzzy system with the Xilinx system generator. The fifth paper, by Roberto Sepulveda et al., deal with the modeling and simulation of the defuzzification stage of a type-2 fuzzy controller using the Xilinx system generator and Simulink.

In conclusion, the edited book comprises papers on diverse aspects of evolutionary methods, fuzzy models, soft computing techniques and hybrid intelligent systems. The book addresses theoretical aspects of the models and methods as well as application papers, ranging from intelligent control, pattern recognition, robotics and hardware implementations.

June 30, 2009

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