

Patricia Melin

Modular Neural Networks and Type-2 Fuzzy Systems for Pattern Recognition

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Preface

We describe in this book, hybrid intelligent systems using type-2 fuzzy logic and modular neural networks for pattern recognition applications. Hybrid intelligent systems combine several intelligent computing paradigms, including fuzzy logic, neural networks, and bio-inspired optimization algorithms, which can be used to produce powerful pattern recognition systems. The book is organized in three main parts, which contain a group of chapters around a similar subject. The first part consists of chapters with the main theme of theory and design algorithms, which are basically chapters that propose new models and concepts, which can be the basis for achieving intelligent pattern recognition. The second part contains chapters with the main theme of using type-2 fuzzy models and modular neural networks with the aim of designing intelligent systems for complex pattern recognition problems. The third part contains chapters with the theme of evolutionary optimization of type-2 fuzzy systems and modular neural networks in intelligent pattern recognition, which includes the application of genetic algorithms for obtaining optimal type-2 fuzzy integration systems and ideal neural network architectures.

In the part of theory and algorithms there are 4 chapters that describe different contributions that propose new models and concepts, which can be considered as the basis for achieving intelligent pattern recognition. The first chapter offers an introduction to the areas of type-2 fuzzy logic and modular neural networks for pattern recognition applications. The second chapter describes the basic concepts of type-2 fuzzy logic applied to the problem of edge detection in digital images. The third chapter describes a general methodology for applying type-2 fuzzy logic on improving the recognition ability of modular neural networks. The fourth chapter describes the use of type-2 fuzzy systems for improving the performance of response integration in modular neural networks.

In the part of type-2 fuzzy systems and modular neural networks for pattern recognition applications there are 4 chapters that describe different contributions on achieving human recognition using hybrid systems based on type-2 fuzzy logic. The first chapter describes the use of a modular neural network with fuzzy response integration for human recognition based on the iris biometric measure. The second chapter deals with the design of modular neural network architecture with fuzzy integration using the ear biometric measure as information for recognition. The third chapter describes the design of a type-2 fuzzy modular neural system for

signature recognition. The fourth chapter describes the application of type-2 fuzzy logic and modular neural networks for achieving efficient face recognition.

In the part of evolutionary optimization of type-2 fuzzy systems and modular neural networks there are 5 chapters that describe different contributions of new algorithms for optimization and their application to designing optimal type-2 fuzzy logic response integrators and ideal modular neural network architectures. The first chapter describes the optimization of type-2 fuzzy response integrators and modular neural networks using genetic algorithms for achieving human recognition based on the face, fingerprint and voice biometric measures. The second chapter deals with an approach for the optimization of number of rules and membership functions for type-2 fuzzy response integrators of modular networks with hierarchical genetic algorithms for human recognition based on face, fingerprint and voice. The third chapter describes the application a general method for designing type-2 fuzzy systems based on genetic algorithms that can be used as response integrators in modular neural networks. The fourth chapter describes the optimal design of the modular architecture and fuzzy response integrator based on genetic algorithms for achieving human recognition based on the iris biometric measure. The fifth chapter describes the application of a hierarchical genetic algorithm for designing optimal fuzzy response integrators and the modular neural network architecture for human recognition based on the ear biometric information.

In conclusion, the book comprises chapters on diverse aspects of type-2 fuzzy logic and modular neural networks with evolutionary models for achieving intelligent pattern recognition for different applications, including human recognition. The combination of evolutionary optimization methods with type-2 fuzzy logic and modular neural networks can be considered as a hybrid approach for obtaining efficient and accurate solutions to complex pattern recognition problems.

July 21, 2011

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