

Preface

In recent years, computational intelligence has attracted many researchers' attention and so became a consolidated methodology to automatically create new competitive solution to complex real-world problems. Concise and efficient synthesis of a variety of systems has been generated using computationally intelligent techniques. This book puts together a set of chapters, in which some real-world applications of interest are approached using computational intelligence. In the following, we give a brief description of the main contribution of each of the included chapters.

In Chap. 1, which is entitled *On Using Fuzzy Logic to Control a Simulated Hexacopter Carrying an Attached Pendulum*, the authors propose an approach based on multiple interconnected fuzzy controllers, aiming at controlling the various aspects related to maneuverability of a hexacopter carrying a free payload forming a pendulum. They simulated the behavior produced by the proposed control system on a robotics simulation environment and analyzed the achieved results in terms of flight stability, roll, pitch and yaw movements. The authors claim that the results show the feasibility of the proposed approach, which allowed the flight stability of the hexacopter.

In Chap. 2, which is entitled *Monocular Pose Estimation for an Unmanned Aerial Vehicle Using Spectral Features*, the authors propose a visual position and orientation estimation algorithm based on the discrete homography constraint, induced by the presence of planar scenes and the so-called spectral features in the image. The authors claim the their approach has some unique characteristics, which are the selection of an appropriate distribution of the features, no requirement of an initialization step nor a search for features and no impact of the presence of corner-like features in the scene. The authors tested the proposed pose estimation algorithm in a simulated dataset. They prove the robustness of the spectral features in different conditions using a conveyor belt.

In Chap. 3, which is entitled *Simultaneous Navigation and Mapping in an Autonomous Vehicle Based on Fuzzy Logic*, the authors present a navigation control and mapping of an autonomous car using fuzzy logic, enabling automatic obstacle avoidance in unknown environments. The author's strategy is based on a map of the environment to plan the trajectories avoiding obstacles through the search algorithm

A*. They evaluated the proposed approach in a virtual environment, where the autonomous car moves among different obstacles.

In Chap. 4, which is entitled *Fully Scalable Parallel Hardware for Wheeled Robot Navigation Using Fuzzy Control*, the authors describe a reconfigurable-efficient architecture for fuzzy controllers, suitable for embedding in final products. They show that the architecture is parameterizable allowing the setup and configuration of the controller so it can be used as a control in many applications. The authors present and evaluate an application of the fuzzy controller hardware architecture in the supervision of a wheeled robot during navigation in an unknown environment.

In Chap. 5, which is entitled *Nonlinear Correction for an Energy Estimator Operating at Severe Pile-Up Conditions*, the authors describe how computational intelligence can be used to assist during energy estimation performed by an optimal linear method. They use an artificial neural network that is trained aiming at correcting the nonlinearities introduced by the signal pile-up statistics. The authors evaluate the efficiency of the various energy estimation methods using simulation data under various signal pile-up scenarios.

In Chap. 6, which is entitled *Non-supervised Learning Applied to Analysis of Topological Metrics of Optical Networks*, the authors offer a systematic method to analyze different backbone optical networks, based on a non-supervised algorithm for clustering. They investigate the power of a recently proposed topological metrics, which along with three others are applied to identify the best canonical model to represent real backbone optical networks. The authors claim that according to the obtained results, the proposed clustering procedure that the investigate metric is the best metric to explain the installed capacity for the analyzed networks.

In Chap. 7, which is entitled *Mole Features Extraction for a Melanoma Recognition System*, the authors propose three algorithms to extract features of skin moles based on dermatological studies, using digital image processing techniques existing in the lecture. They also evaluate these features as input to classifiers creating a melanoma recognition, and indicating whether it is a melanoma or normal mole. The authors analyze the obtained results, which are shown through ROC curve and 10-fold cross-validation from two dermatological datasets Atlas of Clinical Dermatology and DermNet NZ.

In Chap. 8, which is entitled *Human–Machine Musical Composition in Real-Time Based on Emotions Through a Fuzzy Logic Approach*, the authors present a method for representing human emotions in the context of musical composition, which is used to artificially generate musical melodies using fuzzy logic. They tested the generated melodies with listeners in an experiment aiming at of verifying if these melodies can produce emotions in them and whether those emotions match the emotional intentions captured by humans.

In Chap. 9, which is entitled *A Recursive Genetic Algorithm-Based Approach for Educational Timetabling Problems*, the authors address the educational timetabling problem for multiple courses, aiming at finding solutions that satisfy the hard constraints and minimize the soft constraint violations. They propose a simple,

scalable and parameterized recursive approach to solve timetabling problems for multiple courses with genetic algorithms, which are efficient search methods used to achieve an pseudo-optimal solution.

In Chap. 10, which is entitled *Evolving Connection Weights of Artificial Neural Network Using a Multi-Objective Approach with Application to Class Prediction*, the authors investigate the applicability of two novel multi-objective evolutionary algorithms: Speed constrained multi-objective particle swarm optimization and multi-objective differential evolution algorithm based on decomposition with dynamical resource allocation. They compare the obtained results using the hypervolume as quality indicator.

In Chap. 11, which is entitled *Diversification Strategies in Evolutionary Algorithms: Application to the Scheduling of Power Network Outages*, the authors propose different strategies to avoid and/or fix premature convergence of evolutionary algorithms. They claim that high diversification level is maintained throughout the evolution process, so that an adequate trade-off between solution quality and computational cost is achieved. Through numerical results, they illustrate the application of the proposed strategies and respective impact on the quality and computational cost of solutions.

In Chap. 12, which is entitled *WBdetect: Particle Swarm Optimization for Segmenting Weld Beads in Radiographic Images*, the authors present an approach for automatically segmenting weld beads in double wall double image X-ray photographs by combining two known methods: Particle swarm optimization and dynamic time warping. They show through experiments that the achieved results are promising and outperform existing approach.

The editors are very much grateful to the authors of this volume and to the reviewers for their tremendous service by critically reviewing the chapters. The editors would like also to thank Prof. Janusz Kacprzyk, the editor-in-chief of the Studies in Computational Intelligence Book Series and Dr. Thomas Ditzinger, Springer Verlag, Germany for the editorial assistance and excellent collaboration to produce this important scientific work. We hope that the reader will share our excitement to present this volume and will find it useful.

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