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Ensembles of Type 2 Fuzzy Neural Models and Their Optimization with Bio-Inspired Algorithms for Time Series Prediction

Springer

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Preface

This book focuses on the fields of hybrid systems, fuzzy systems, bio-inspired algorithms, and time series. This book describes the construction of ensembles of interval type-2 fuzzy neural network (IT2FNN) models and the optimization of their fuzzy integrators with bio-inspired algorithms for time series prediction. Interval type-2 and type-1 fuzzy systems are used to integrate the outputs of the ensemble of IT2FNN models which are used. Genetic Algorithms and Particle Swarm Optimization are the bio-inspired algorithms used for the optimization of fuzzy integrators. The Mackey–Glass, Mexican Stock Exchange, Dow Jones, and NASDAQ time series are used to test the performance of the proposed method. Prediction errors are evaluated by the following metrics: mean absolute error (MAE), mean square error (MSE), root mean square error (RMSE), mean percentage error (MPE), and mean absolute percentage error (MAPE).

In Chap. 1, a brief introduction to the book is presented, where the intelligence techniques that are used, the main contribution, motivations, application, and a general description of the proposed methods are mentioned.

In Chap. 2, we describe the State of the Art, basic theoretical and technical concepts about the areas of computational intelligence, forecasts as well as a brief introduction and operations are addressed, as all of them are of great importance for the development of this work.

In Chap. 3, we describe the Problem Statement and Development of the ensemble of IT2FNN models with optimization of the fuzzy integrators used GAs and PSO algorithms for time series prediction; we also describe the IT2FNN models (IT2FNN-1, IT2FNN-2, and IT2FNN-3). The development of the structure of the chromosome (in GA) and particles (in PSO) for the optimization of fuzzy integrators is also presented.

Chapter 4 presents the results of the proposed method for all study cases: ensemble of IT2FNN models with optimization of the fuzzy integrators used GA and PSO algorithms for time series prediction, ensemble of the IT2FNN models for the Mexican Stock Exchange, Dow Jones, and NASDAQ time series with which we work during the development of this work.

Chapter 5 presents the Conclusion of this research work, and future work is suggested.

We end this Preface of the book by giving thanks to all the people who have helped or encouraged us during the writing of this book. First of all, we would like to thank our colleagues and friends, namely Prof. Patricia Melin, Prof. Oscar Castillo, and Prof. Janusz Kacprzyk for always supporting our work and for motivating us to report this research work. We would also like to thank our families for their continuous support during the time that we spent in this project. Of course, we have to thank our institution, Tijuana Institute of Technology, for always supporting our projects. We must thank our supporting agencies, CONACYT and TNM, in our country for their help during this project. Finally, we thank our colleagues working in Soft Computing, who are too many to mention all by name.

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