

Studies in Fuzziness and Soft Computing

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Pritpal Singh

Applications of Soft Computing in Time Series Forecasting

Simulation and Modeling Techniques

 Springer

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*Everything that comes to us that belongs
to us if we create the capacity
to receive it*

By Rabindranath Tagore

*I would like to dedicate this book
to my loving parents, brother, sister,
wife and baby, who make me whole*

Foreword

Applications of Soft Computing in Time Series Forecasting: Simulation and Modeling Techniques is an excellent piece of work done by Dr. Pritpal Singh. It is an up-to-date and authoritative exposition of applications of soft computing in time series forecasting. Any good book must be easy-to-read and should include a balanced mixture of both theoretical and practical issues. This book can boast of having these features.

The book contains eight chapters. Among them, five chapters are dedicated for designing time series forecasting models using soft computing techniques. This book would be useful to anyone who wants to develop an understanding of soft computing techniques, such as fuzzy sets, artificial neural network and evolutionary computing, and use them in time series forecasting. I feel this book is quite useful for advance researchers in this domain. Easy-to-read approach, easy-to-understand explanation of the models, and presence of their architectures will definitely benefit the readers. All these features place this book in a unique position.

Dr. Singh has produced a masterwork and deserves our thanks and congratulations for his effort.

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Preface

Applications of Soft Computing in Time Series Forecasting: Simulation and Modeling Techniques is written primarily for researchers in business, government, and research organizations. There are several excellent books in time series forecasting, written from very elementary to advance levels. The writers of these books have their intended audiences. This book is different from those in that it deals with practical applications of soft computing techniques (especially fuzzy sets, artificial neural network, and evolutionary computing) in time series forecasting. This book generally discusses basic theory of these techniques and their applications with various examples without complicated mathematics.

In this book, I analyze significant problems of time series forecasting in depth, starting with model formulation, architecture, basic steps, empirical analyzes, and performance measures in terms of statistical parameters to see how well the proposed models performs.

The present book has been accomplished at the Tezpur University (Tezpur, India) and Thapar University (Patiala, India). Valuable suggestions and comments were provided by Dr. B. Borah, Department of Computer Science and Engineering, Tezpur University.

All experiments were conducted at the Department of Computer Science and Engineering, School of Engineering, Tezpur University. The empirical results presented in the book were published by esteemed journals.

Patiala
April 2015

Pritpal Singh

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I take this opportunity to express my appreciations to all of the Department faculty members for their help and support. I am also thankful to all my friends, especially Hasin A. Ahmed, Krishna Das, J. Binong, and Navajit Hazarika for their direct or indirect help, inspiration, and motivation. I am grateful to all the technical and non-technical members of the department for their support.

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Abbreviations and Symbols

ACF	Autocorrelation Function
AFER	Average Forecasting Error Rate
ANN	Artificial Neural Network
BPNN	Backpropagation Neural Network
CN	Composite Neuron
EBP	Error Backpropagation
EC	Evolutionary Computing
FCM	Fuzzy C-Mean
FFNN	Feed-forward Neural Network
FL	Fuzzy Logic
FLR	Fuzzy Logical Relationship
FLRG	Fuzzy Logical Relationship Group
FTS	Fuzzy Time Series
FWDT	Frequency-Weighing Defuzzification Technique
GA	Genetic Algorithm
GP	Genetic Programming
GR	Generalizes Regression
IBDT	Index-Based Defuzzification Technique
IMD	Indian Meteorological Department
ISMR	Indian Summer Monsoon Rainfall
LEM2	Learning From Example Module 2
LPA	Long Period Average
MBD	Mean-Based Discretization
MLFF	Multi-Layer Feed-Forward
MLR	Multiple Linear Regression
MSE	Mean Square Error
PNN	Probabilistic Neural Network
PSO	Particle Swarm Optimization
RBF	Radial Basis Function
RMSE	Root Mean Square Error
RPD	Re-partitioning Discretization

RS	Rough Set
SC	Soft Computing
SLFF	Single-Layer Feed-Forward
SOFM	Self-Organizing Feature Maps
SPI	Standardized Precipitation Index
TAIEX	Taiwan Stock Exchange Capitalization Weighted Stock Index
TAIFEX	Taiwan Futures Exchange
\bar{A}	Mean
U	Theil's Statistic
TS	Tracking Signal
DA	Directional Accuracy
δ_r	Evaluation Parameter
R	Correlation Coefficient
R^2	Coefficient of Determination
PP	Performance Parameter

About the Author



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