

# Preface

Sustainable computing has been extended to become a significant research area that covers the fields of computer science and engineering, electrical engineering, and other engineering disciplines. Recently, we have been witnessing from adequate literature of sustainable computing that includes energy efficiency and natural resource preservation and emphasize the role of ICT (information and communication technology) in achieving system design and operation objectives. The energy impact/design of more efficient IT infrastructure is a key challenge for organizations to realize new computing paradigms.

On the other hand, the uses of computational intelligence (CI) techniques for intelligent decision support can be exploited to originate effectual computing systems. CI consists of various branches that are not limited to expert systems (ES), artificial neural networks (ANN), genetic algorithms (GA) and fuzzy logic (FL), knowledge-based systems, and various hybrid systems, which are combinations of two or more of the branches. The intention of this book is to explore sustainability problems in computing and information processing environments and technologies at the different levels of CI paradigms. Moreover, this edited volume is to address the comprehensive nature of sustainability and to emphasize the character of CI in modeling, identification, optimization, prediction, forecasting, and control of complex systems.

The chapters included in this book focus on addressing latest research, innovative ideas, challenges, and CI solutions in sustainable computing. Moreover, these chapters specify novel in-depth fundamental research contributions from a methodological/application perspective in accomplishing sustainable lifestyle for society. This book provides a comprehensive overview of constituent paradigms underlying evolutionary computational intelligence methods, which are illustrating more attention to sustainability computing problems as they evolve. Hence, the main objective of the book is to facilitate a forum to a large variety of researchers, where decision-making approaches under CI paradigms are adapted to demonstrate how the proposed procedures as well as sustainability computing problems can be handled in practice.

## Need for a Book on the Proposed Topics

Over the recent decades, many of useful methods have been proposed to solve organizational decision-making problems. Computational Intelligence paradigm in intelligence decision support systems has fostered a broad research area, and their significance has also been clearly justified at many applications. This volume addresses a wide spectrum of CI paradigms, making decisions of an industry or organization happened at all the levels of sustainable challenges.

This volume aims to provide relevant theoretical frameworks and the latest empirical research findings in the area. The CI approaches applied to sustainable computing decision-making systems usually have received more attention in recently published volumes. Based on this context, there is need envisioning for a key perspective into current state of practice of computational intelligence techniques. Consequently, to address the predicative analysis of sustainable computing problems including energy efficiency and natural resource preservation, load distribution strategy has been addressed in this book.

Solutions for these problems have been effectively handled through wide range of algorithmic and computational intelligence frameworks, such as optimization, machine learning, decision support systems, and meta-heuristics. The main contributions to this volume address sustainability problems in computing and information processing environments and technologies, and at various levels of the computational intelligence process.

## Organization of the Book

This volume is organized into 14 chapters. A brief description of each chapter is given as follows:

Chapter “[Intelligent Decision Support Systems for Sustainable Computing](#)” gives an overview of computational intelligence paradigms in intelligent decision support and analytics for sustainable computing.

The editors briefly describe the various sustainability problems in computing and information processing environments and technologies, and at various levels of the computational intelligence process. The overall aim of the chapter is to address the convergence of CI methodologies in sustainable computing.

Chapter “[A Genetic Algorithm Based Efficient Static Load Distribution Strategy for Handling Large-Scale Workloads on Sustainable Computing Systems](#)” covers an efficient processor availability-aware scheduling model to optimize the energy efficiency of heterogeneous sustainable computing systems. Using this model, the authors design a genetic algorithm-based global optimization strategy to derive an optimal load partition together with an optimal distribution sequence.

Chapter “[Efficiency in Energy Decision Support Systems Using Soft Computing Techniques](#)” presents the problem of energy demand forecasting, and decision

making has been investigated. The authors propose an integrated decision support system that involves Adaptive Neuro-Fuzzy Systems (ANFIS), Neural Networks (NN), and Fuzzy Cognitive Maps (FCM), along with Econometric Models (EM) in a hybrid fashion to predict energy consumption and prices.

Chapter “[Computational Intelligence Based Heuristic Approach for Maximizing Energy Efficiency in Internet of Things](#)” presents computational intelligence-based heuristic approach for maximizing energy efficiency in the Internet of Things (IoT). The authors present the Modified Multi-objective Particle Swarm Optimization (MMOPSO) algorithm based on the concept of dominance to solve the mobile cloud task scheduling problem. Overall, this chapter explores IoT and cloud computing as well as their symbiosis based on the common environment of distributed processing.

Chapter “[Distributed Algorithm with Inherent Intelligence for Multi-cloud Resource Provisioning](#)” illustrates distributed algorithms with inherent intelligence for multi-cloud resource provisioning. The authors introduce the substantial ranking method for elastic and inelastic tasks scheduler to support the heterogeneous requests and resources in multi-cloud environments.

Chapter “[Parameter Optimization methods Based on Computational Intelligence Techniques in Context of Sustainable Computing](#)” provides a comprehensive study of parameter optimization. Accuracy of any computational intelligence (CI) algorithm is highly dependent on optimal settings of parameters. The authors have discussed how parameter setting affects the performance and robustness of evolutionary algorithms.

Chapter “[The Maximum Power Point Tracking Using Fuzzy Logic Algorithm for DC Motor Based Conveyor System](#)” presents to design a conveyor belt system driven by DC motor whose speed is controlled by solar-powered converter operating at maximum power point (MPPT). In this chapter, the authors have compared the proposed MPPT algorithm and fuzzy approach with existing algorithms such as perturb, observe and incremental conductance.

Chapter “[Differential Evolution Based Significant Data Region Identification on Large Storage Drives](#)” emphasizes on the identification of data relevant sector regions in digital hard disk drives (HDD) using computationally intelligent differential evolution (DE) algorithm to accelerate the overall digital forensic (DF) process. In this chapter, the authors have presented a new trade-off rectangle to reveal present requirements toward the development of existing DF facilities. The chapter also proposes a methodology that extract data storage pattern using storage drive’s structural information and DE algorithm that can help investigator in planning further course of action.

Chapter “[A Fuzzy Based Power Switching Selection for Residential Application to Beat Peak Time Power Demand](#)” introduces a fuzzy-based power switching selection for residential application to beat peak time power demand. The authors have designed the hybrid system using solar and main power as sources. The fuzzy logic algorithm has been used to select the power source based on the peak and off peak time, and utilized power level and availability of power source to meet the power demand during the peak time and off peak time.

Chapter “Energy Saving Using Memorization: A Novel Energy Efficient and Fault Tolerant Cluster Tree Algorithm for WSN” proposes Energy Saving Using Memorization (ESUM)—a novel energy-efficient and fault tolerant algorithm for cluster tree-based routing—that uses energy conservation to enhance network longevity, by using saved results and avoiding re-elections after each round. The authors presents a comparison of various cluster tree protocols and proposes a novel algorithm ESUM that leads to increase in network lifetime by reducing the communication overhead in cluster heads (CH) re-election.

The main objective of this Chapter “Analyzing Slavic Textual Sentiment Using Deep Convolutional Neural Networks” is to give a clear understanding of the position of low-resource languages and propose a direction for sustainable development of language technologies illustrated using convolutional neural networks for textual sentiment analysis. The authors have proposed a system which is based on supervised learning and can be quickly adapted to use simple text, circumventing the need for more intricate features.

Chapter “Intelligent Decision Support System for an Integrated Pest Management in Apple Orchard” presents hybrid case-based reasoning computational intelligence for pest management in apple production. In agriculture, intelligent decision support systems (IDSSs) have been used for the optimization of a number of planning and decision-making challenges under variable constraints based on noisy data. This chapter describes an IDSS to implement and optimize pest and disease protection decision-making processes within temperate regions of India; develops hybrid algorithm using case-based reasoning (CBR) and database technology, and implements the same using Web-based client server architecture.

Chapter “Analysis of Error Propagation in Safety Critical Software Systems: An Approach Based on UGF” presents a computational intelligence (CI)-based approach to compute the error inclusion in the output of the selected safety critical system. The authors address a novel Error Propagation Metric called Safety Metric  $SM_{EP}$ , which can be characterized depending on the performance rate of the software module. Through this, the performance distribution of system modules and the system with respect to safety metric  $SM_{EP}$  has been quantified.

Chapter “A Framework for Analyzing Uncertainty in Data Using Computational Intelligence Techniques” presents the design of an efficient classifier that handles ambiguity and vagueness in medical datasets for better diagnosis of illness. Moreover, the chapter authors investigate a rule-based fuzzy-rough classifier for analyzing uncertainty in medical dataset.

## Audience

The intended audience of this book includes scientists, professionals, researchers, and academicians, who deal with the new challenges and advances in the specific areas mentioned above. Designers and developers of applications in these fields can learn from other experts and colleagues through studying this book. Many

universities have started to offer courses on computational intelligence (CI), sustainable computing on the graduate/postgraduate level in information technology and management disciplines. This book starts with an introduction to sustainable computing and CI paradigms, hence suitable for university level courses as well as research scholars. Their insightful discussions and knowledge, based on references and research work, will lead to an excellent book and a great knowledge source.

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