Preface

INTRODUCTION

Recently, researchers have attracted to study the nature laws as a good source for inspiration of effective meta-heuristic algorithms to provide optimal solutions to develop intelligent systems and complicated problems. Meta-heuristic algorithms have long history back to evolutionary computing and genetic algorithms. Natural phenomena as well as animal behaviors inspired nature-inspired algorithms, such as genetic algorithms, particle swarm optimization algorithms, artificial bee colony algorithms, ant colony optimization algorithms and differential evolution algorithms that have been widely applied in various domains. The living creatures' ways, such as interaction, movement, and adaption to their environments offer ideas for meta-heuristic designs. Due to their established competence and merits in realizing novel and optimal solutions for complex problems, nature-inspired algorithms have fascinated engineers' and researchers' attention in numerous engineering fields.

The meta-heuristic algorithms prevalence is established in several applications for different domains, such as financial optimisation, engineering design, computer network routing and scheduling. These applications are carried out to solve several types of problems, including large-scaled, continuous/discrete/ mixed, combinatorial, multimodal optimisation problems. Different concepts and components in different meta-heuristics algorithms in order to analyze their similarities and differences are considered in this book. In addition, this book includes up-to-date approaches in the domain of nature-inspired algorithms and their engineering applications. It intends a set of high-quality and leading contributions on proposed algorithms, technologies and concepts that use meta-heuristic algorithm algorithms in several research areas. The book focuses on exploring different applications for the meta-heuristics optimization algorithms in several applications.

OBJECTIVE OF THE BOOK

This book considers the foremost optimization algorithms in several applications. It deals primarily with methods and approaches that include meta-heuristics for further systems improvements. This book grants substantial frameworks and the most contemporary empirical research outcomes in employing optimization algorithms. It is edited for researchers, academicians, advanced-level students, and technology developers and professionals working in various disciplines.

ORGANIZATION OF THE BOOK

The book contains 11 chapters that are organized in two sections as shown below. The first eight chapters outline the various meta-heuristic optimization algorithms in different applications. The second section includes three chapters focusing on the genetic algorithms concept and applications in several domains.

Section 1: Meta-Heuristic Optimization-Algorithms-Based Advanced Applications (Chapters 1-8)

This section elaborated different meta-heuristic algorithms for solving multi-objective problems. Another context is introduced related to predicting the traffic quality of services in WiMAX network supported by optimization algorithms. Contrast enhancement is also proposed using modified Chaotic Differential Evolution along with Fractal Dimension and Quality Index based on Local Variance objective function. In the medical domain, the role of the intelligent computing and the optimization algorithms is also covered.

Chapter 1

This chapter included meta-heuristic optimization algorithms have been conducted to solve multi- objective optimal power flow problem in the presence of Unified power flow controller. The results demonstrated the proposed approach robustness with the Unified power flow controller. Firefly algorithm, BAT algorithm, and cuckoo search algorithm provided less total generation cost compared to differential evaluation algorithm based optimal power flow.

Chapter 2

The real and non-real time multimedia applications have a significant role in the WiMAX network. This chapter is carried out to develop a mathematical expression for the network throughput by considering average end-to-end delay, bandwidth, and average jitter. An efficient traffic QoS prediction mechanism for the WiMAX networks is proposed based on Gene Expression Programming technique.

Chapter 3

This current chapter introduced parameterized Bi-histogram fuzzy contrast stretching method to enhance the image crucially by preserving its original brightness based on associated three parameters with diverse ranges.

Chapter 4

In biological systems, protein motifs have a significant role to study their characteristics. For the unsupervised protein sequences data, clustering approaches are proposed for protein motif prediction in this chapter. The bio-inspired computing models, such as the particle swarm optimization and genetic algorithms based k-means are proposed.

Chapter 5

In industry automation, tool wear prediction is imperative to achieve higher productivity and acceptable product quality. This chapter developed the genetic equation in machining process, where the variation of chip radius at different stages of progressive tool wear for the inter-relationships is measured. The chip radius reduction with tool wear progression shows a consistent pattern for the flat faced tool under all used cutting conditions.

Chapter 6

Intelligent computing methods have great impact in the biomedical image analysis and healthcare. In this chapter, different artificial intelligence based automated biomedical image analysis. Different diagnostic analysis using feed-forward back propagation neural network are considered. Various optimization techniques, such as ant colony optimization, genetic algorithm, particle swarm optimization and other bio-inspired procedures are also frequently conducted for feature extraction/ selection and classification.

Chapter 7

The Proportional-Integral-Derivative (PID) controller is used as a secondary controller in addition to the Superconducting Magnetic Energy Storage (SMES) unit. This chapter proposed an Ant Colony Optimization (ACO) algorithm to tune PID controller gain values of multi-interconnected thermal power system. A comparative study is conducted to compare the system response with and without considering SMES unit in the system.

Chapter 8

Artificial intelligence is the core of computer science apprehensive with creating computers that perform as humans. Accurate diseases analysis, magnetic resonance imaging, computed tomography images and images of other modalities segmentation remains a challenging problem. Image segmentation is employed for abnormalities volumetric analysis in medical images to identify the disease nature. Recently, meta-heuristic algorithms are conducted to support the segmentation techniques. This chapter addresses different segmentation procedures. Several meta-heuristic approaches are reported with highlights on their procedures. Finally, several medical applications using meta-heuristic based-approaches for segmentation are discussed.

Section 2: Genetic Algorithm Applications (Chapters 9-11)

Genetic algorithms have various applications in several domains. This section reports the Genetic algorithms fundamental algorithm as applied in several real-life applications. It highlights the use of multi-objective genetic algorithm as well for water quality prediction. In addition, this section discussed the financial time series prediction using the genetic algorithm to support the adaptive second order neural network.

Chapter 9

This chapter proposed a new crossover operator called Jump Crossover (JMPX) to solve the travelling salesmen problem using a genetic algorithm for near-optimal solutions. The path representation technique for the chromosome which is the most direct representation and a low mutation rate to isolate the search space exploration ability of each crossover is adopted.

Chapter 10

Financial time series forecasting is a challenging issue that requires efficient prediction system. In this chapter, the performance of an adaptive single layer second order neural network based on the genetic algorithm is evaluated. The efficiency of the propose model is evaluated by forecasting one-step-ahead closing prices.

Chapter 11

Polluted water is a major reason behind several community diseases, mainly in undeveloped and developing countries. Measuring and detecting the drinking water quality can prevent such scenarios prior to the critical stage. In this chapter, a multi-objective genetic algorithm is used to train the artificial neural network to improve its performance over its traditional counterparts. The proposed model gradually minimizes two different objective functions; namely root mean square error and maximum error in order for finding the optimal weight vector for the neural network.

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