
Book Review

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Swarm Intelligence and Bio-Inspired Computation: Theory and Applications

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I am truly impressed by the state-of-art information presented in this book. It links the present developments to the past as well as the predictions for the future trends. The contents are well-organised, beneficial to both beginners and experts in this field. Readers can gain in-depth knowledge as well as insight into many nature-inspired algorithms from this book, which may help them to improve their own research work. Having read through a few chapters, I can honestly say that they are professionally written, easy-to-understand and self-contained. I believe that this book can serve well as a good starting point for graduates and novice researchers to venture into a new horizon in bio-inspired computation and optimisation. The 420-page book has 19 chapters, contributed by 49 authors around the world who are actively working at the forefront of the research areas. I deeply admire the dedication and effort by the editors in assuring the success of this book, published by well-known publisher, Elsevier Inc.

In the past decades, swarm intelligence (SI) has gained its popularity through the introduction of many prominent algorithms such as particle swarm optimisation and ant colony optimisation (ACO). Recently, we see a new wave of algorithm developments. Majority of these algorithms adopted their concepts from nature. Thus, we have the so-called nature-inspired algorithms, or bio-inspired computation. To my understanding, the editors have given a perfect title with respect to the contents in this book. This book is divided into two main parts. Part 1 focuses on bio-inspired algorithms, whereas Part 2 discusses many challenging applications solved by these algorithms.

By reading this book, it comes to my mind that nature has been an abundant source of inspiration in producing ingenious solutions to many challenging real-world problems. These solutions are sought through the algorithms developed by appreciating and contemplating many wonderful things happening in nature, especially biological systems. New algorithms developed in this decade that can be categorised in this field are: artificial bee colony algorithm (ABC), bat algorithm (BA), cuckoo search (CS), firefly algorithm (FA), flower pollination algorithm (FPA),

glowworm swarm algorithm (GlowSA), hunting search algorithm (HSA), eagle strategy (ES), roach infestation optimisation (RIO), gravitational search algorithm (GravSA), artificial fish school algorithm (AFS), bacterial evolutionary algorithm (BEA), artificial plant optimisation algorithm (APO), and krill herd algorithm (KHA). Without doubt, many of these algorithms are developed by extracting the implicit or explicit behaviours of bacteria (BEA), insects (FA, ABC, RIO, GlowSA), birds (CS, ES, BA), fish (AFS), plants (FPA, APO), and nature's phenomena (GravSA, HAS, KHA). The majority of these algorithms are presented in the first part of the book (Chapters 1 to 8).

One common question that most readers will ask is 'Which one is the best algorithm?' Readers should read the first two chapters for the clue to this answer. In general, algorithms perform differently on different problems. An algorithm may perform well on one problem but not on the other problem, and vice versa. For example, from Chapter 2, ACO obtained the best solution for the constrained minimisation problem (see Table 2.2) while for constrained maximisation problem, hunting search (HS) algorithm performs the best. Basically, the performance of an algorithm depends on the nature of the problem; whether it is static or dynamic, constrained or unconstrained, single-objective or multi-objective, low or high dimensional, continuous or discontinuous, binary or real-valued, unimodal or multimodal, and separable or non-separable. In fact, there is no ideal algorithm. I believe that the chief-editor has made substantial remarks on this in the first chapter of this book and I totally agree with his viewpoints.

This book is further enlightened by many challenging real-world applications in its second part (Chapters 9 to 19). The feature selection, an essential component in classification and clustering is presented in Chapter 9. This is followed by intelligent music composition in Chapter 10. The applications in machine learning and design are discussed in Chapter 11. The realisation of semantic web (common structured format for the entire web pages) through bio-inspired algorithms is discussed in Chapter 12. The well-known travelling salesman problem is presented in

Chapter 13. The modelling to generate alternatives, relevant to waste management facilities is available in Chapter 14. The structural optimisation in civil engineering is presented and solved using KHA in Chapter 15. In Chapter 16, we see how APO is applied in two applications (NN training and protein folding). In Chapter 17, a dynamic problem known as Berth allocation problem is discussed together with concrete results. Another interesting application, namely data mining is demonstrated in Chapter 18. Finally, the last chapter, Chapter 19 highlights the application in the field of inventory management.

There are two additional features which I found to be profoundly interesting in this book. The first one is the comprehensive list of the application of swarm algorithms in tackling discrete optimisation problems, given in Chapter 7. In many real-world problems, binary problem often exists as a part of the whole problem. This is called combinatorial optimisation problem. This poses a greater challenge to the existing problem. In many cases, we have no choice but to apply some heuristic rules for better performance. The survey in this chapter aims to categorise the prominent discretisation methods in handling binary problem. The

second feature that is worth mentioning is the comprehensive survey of benchmark functions that involves 24 unimodal functions and 116 multimodal functions. These functions act as important test beds for comparison and validation on the efficiency of any bio-inspired algorithms found in this book. Most of these functions are scalable, which means that they can be extended to any number of dimensions when needed.

Life, after all is full of givings and takings. To date, we have taken many substantial ideas and inspiration from nature. I guess it is time to pay back our mother nature in a proper way. It would be my profound hope to see more real-world applications of these bio-inspired algorithms in the area of energy efficient systems, cost-saving manufacturing, low-cost transportation, efficient management and many other areas. Let this book be an inspiration for many to contribute in the five main areas, as highlighted at the end of Chapter 1 of this book. We all aim towards an ultimate goal; better cost for a better living. Last but not least, I believe this book will serve perfectly as a state-of-the-art reference for graduate students, researchers and experts in computer science, engineering, industry and all areas of sciences.