Bijaya Ketan Panigrahi
Yuhui Shi
Meng-Hiot Lim (Eds.)

Handbook of Swarm Intelligence

Concepts, Principles and Applications

Handbook Of Swarm Intelligence Concepts Principles And Applications Adaptation Learning And Optimization

Hisao Ishibuchi

Handbook Of Swarm Intelligence Concepts Principles And Applications Adaptation Learning And Optimization:

Handbook of Swarm Intelligence Bijaya Ketan Panigrahi,Yuhui Shi,Meng-Hiot Lim,2011-02-04 From nature we observe swarming behavior in the form of ant colonies bird flocking animal herding honey bees swarming of bacteria and many more It is only in recent years that researchers have taken notice of such natural swarming systems as culmination of some form of innate collective intelligence albeit swarm intelligence SI a metaphor that inspires a myriad of computational problem solving techniques In computational intelligence swarm like algorithms have been successfully applied to solve many real world problems in engineering and sciences This handbook volume serves as a useful foundational as well as consolidatory state of art collection of articles in the field from various researchers around the globe It has a rich collection of contributions pertaining to the theoretical and empirical study of single and multi objective variants of swarm intelligence based algorithms like particle swarm optimization PSO ant colony optimization ACO bacterial foraging optimization algorithm BFOA honey bee social foraging algorithms and harmony search HS With chapters describing various applications of SI techniques in real world engineering problems this handbook can be a valuable resource for researchers and practitioners giving an in depth flavor of what SI is capable of achieving   **Advances in Swarm Intelligence** Anupam Biswas,Can B. Kalayci,Seyedali Mirjalili,2022-10-01 Swarm Intelligence SI has grown significantly both from the perspective of algorithmic development and applications covering almost all disciplines science and technology This book emphasizes the studies of existing SI techniques their variants and applications The book also contains reviews of new developments in SI techniques and hybridizations Algorithm specific studies covering basic introduction and analysis of key components of these algorithms such as convergence balance of solution accuracy computational costs tuning and control of parameters Application specific studies incorporating the ways of designing objective functions solution representation and constraint handling The book also includes studies on application domain specific adaptations in the SI techniques The book will be beneficial for academicians and researchers from various disciplines of engineering and science working in applications of SI and other optimization problems   Handbook of Research on Advancements of Swarm Intelligence Algorithms for Solving Real-World Problems Cheng, Shi,Shi, Yuhui,2020-04-24 The use of optimization algorithms has seen an emergence in various professional fields due to its ability to process data and information in an efficient and productive manner Combining computational intelligence with these algorithms has created a trending subject of research on how much more beneficial intelligent inspired algorithms can be within companies and organizations As modern theories and applications are continually being developed in this area professionals are in need of current research on how intelligent algorithms are advancing in the real world TheHandbook of Research on Advancements of Swarm Intelligence Algorithms for Solving Real World Problems is a pivotal reference source that provides vital research on the development of swarm intelligence algorithms and their implementation into current issues While highlighting topics such as multi agent systems bio inspired computing and evolutionary programming this

publication explores various concepts and theories of swarm intelligence and outlines future directions of development This book is ideally designed for IT specialists researchers academicians engineers developers practitioners and students seeking current research on the real world applications of intelligent algorithms **Computational Intelligence - Volume II** Hisao Ishibuchi,2015-12-30 Computational intelligence is a component of Encyclopedia of Technology Information and Systems Management Resources in the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty one Encyclopedias Computational intelligence is a rapidly growing research field including a wide variety of problem solving techniques inspired by nature Traditionally computational intelligence consists of three major research areas Neural Networks Fuzzy Systems and Evolutionary Computation Neural networks are mathematical models inspired by brains Neural networks have massively parallel network structures with many neurons and weighted connections Whereas each neuron has a simple input output relation a neural network with many neurons can realize a highly non linear complicated mapping Connection weights between neurons can be adjusted in an automated manner by a learning algorithm to realize a non linear mapping required in a particular application task Fuzzy systems are mathematical models proposed to handle inherent fuzziness in natural language For example it is very difficult to mathematically define the meaning of cold in everyday conversations such as It is cold today and Can I have cold water The meaning of cold may be different in a different situation Even in the same situation a different person may have a different meaning Fuzzy systems offer a mathematical mechanism to handle inherent fuzziness in natural language As a result fuzzy systems have been successfully applied to real world problems by extracting linguistic knowledge from human experts in the form of fuzzy IF THEN rules Evolutionary computation includes various population based search algorithms inspired by evolution in nature Those algorithms usually have the following three mechanisms fitness evaluation to measure the quality of each solution selection to choose good solutions from the current population and variation operators to generate offspring from parents Evolutionary computation has high applicability to a wide range of optimization problems with different characteristics since it does not need any explicit mathematical formulations of objective functions For example simulation based fitness evaluation is often used in evolutionary design Subjective fitness evaluation by a human user is also often used in evolutionary art and music These volumes are aimed at the following five major target audiences University and College students Educators Professional practitioners Research personnel and Policy analysts managers and decision makers **Principal Concepts in Applied Evolutionary Computation: Emerging Trends** Hong, Wei-Chiang Samuelson,2012-06-30 Increasingly powerful and diverse computing technologies have the potential to tackle ever greater and more complex problems and dilemmas in engineering and science disciplines Principal Concepts in Applied Evolutionary Computation Emerging Trends provides an introduction to the important interdisciplinary discipline of evolutionary computation an artificial intelligence field that combines the principles of computational intelligence with the mechanisms of the theory of evolution Academics and

practicing field professionals will find this reference useful as they break into the emerging and complex world of evolutionary computation learning to harness and utilize this exciting new interdisciplinary field   Encyclopedia of Information Science and Technology, Third Edition Khosrow-Pour, D.B.A., Mehdi,2014-07-31 This 10 volume compilation of authoritative research based articles contributed by thousands of researchers and experts from all over the world emphasized modern issues and the presentation of potential opportunities prospective solutions and future directions in the field of information science and technology Provided by publisher   **Advances in Nature-Inspired Computing and Applications** Shishir Kumar Shandilya,Smita Shandilya,Atulya K. Nagar,2018-08-29 This book contains research contributions from leading global scholars in nature inspired computing It includes comprehensive coverage of each respective topic while also highlighting recent and future trends The contributions provides readers with a snapshot of the state of the art in the field of nature inspired computing and its application This book has focus on the current researches while highlighting the empirical results along with theoretical concepts to provide a comprehensive reference for students researchers scholars professionals and practitioners in the field of Advanced Artificial Intelligence Nature Inspired Algorithms and Soft Computing   **Handbook of AI-based Metaheuristics** Anand J. Kulkarni,Patrick Siarry,2021-09-01 At the heart of the optimization domain are mathematical modeling of the problem and the solution methodologies The problems are becoming larger and with growing complexity Such problems are becoming cumbersome when handled by traditional optimization methods This has motivated researchers to resort to artificial intelligence AI based nature inspired solution methodologies or algorithms The Handbook of AI based Metaheuristics provides a wide ranging reference to the theoretical and mathematical formulations of metaheuristics including bio inspired swarm based socio cultural and physics based methods or algorithms their testing and validation along with detailed illustrative solutions and applications and newly devised metaheuristic algorithms This will be a valuable reference for researchers in industry and academia as well as for all Master s and PhD students working in the metaheuristics and applications domains   **Future Sustainable Ecosystems** Nathaniel K Newlands,2016-10-03 Future Sustainable Ecosystems Complexity Risk Uncertainty provides an interdisciplinary integrative overview of environmental problem solving using statistics It shows how statistics can be used to solve diverse environmental and socio economic problems involving food water energy scarcity and climate change risks It synthesizes interdisciplinary theory concepts definitions models and findings involved in complex global sustainability problem solving making it an essential guide and reference It includes real world examples and applications making the book accessible to a broader interdisciplinary readership Discussions include a broad integrated perspective on sustainability integrated risk multi scale changes and impacts taking place within ecosystems worldwide State of the art statistical techniques including Bayesian hierarchical spatio temporal agent based and game theoretic approaches are explored The author then focuses on the real world integration of observational and experimental data and its use within statistical models   Advances in

Artificial Intelligence - SBIA 2012 Leliane N. Barros,Marcelo Finger,Aurora T.R. Pozo,Gustavo Alberto Giménez Lugo,Marcos Castilho,2012-10-05 This book constitutes the refereed proceedings of the 21st Brazilian Symposium on Artificial Intelligence SBIA 2012 held in Curitiba Brazil in October 2012 The 23 revised full papers presented were carefully reviewed and selected from 81 submissions The papers cover the following topics knowledge representation machine learning machine learning and computer vision agent based and multi agent systems robotics and language as well as constraints *Brain Storm Optimization Algorithms* Shi Cheng,Yuhui Shi,2019-06-03 Brain Storm Optimization BSO algorithms are a new kind of swarm intelligence method which is based on the collective behavior of human beings i e on the brainstorming process Since the introduction of BSO algorithms in 2011 many studies on them have been conducted They not only offer an optimization method but could also be viewed as a framework of optimization techniques The process employed in the algorithms could be simplified as a framework with two basic operations the converging operation and the diverging operation A good enough optimum could be obtained through recursive solution divergence and convergence The resulting optimization algorithm would naturally have the capability of both convergence and divergence This book is primarily intended for researchers engineers and graduate students with an interest in BSO algorithms and their applications The chapters cover various aspects of BSO algorithms and collectively provide broad insights into what these algorithms have to offer The book is ideally suited as a graduate level textbook whereby students may be tasked with the study of the rich variants of BSO algorithms that involves a hands on implementation to demonstrate the utility and applicability of BSO algorithms in solving optimization problems **Biotechnology: Concepts, Methodologies, Tools, and Applications** Management Association, Information Resources,2019-06-07 Biotechnology can be defined as the manipulation of biological process systems and organisms in the production of various products With applications in a number of fields such as biomedical chemical mechanical and civil engineering research on the development of biologically inspired materials is essential to further advancement Biotechnology Concepts Methodologies Tools and Applications is a vital reference source for the latest research findings on the application of biotechnology in medicine engineering agriculture food production and other areas It also examines the economic impacts of biotechnology use Highlighting a range of topics such as pharmacogenomics biomedical engineering and bioinformatics this multi volume book is ideally designed for engineers pharmacists medical professionals practitioners academicians and researchers interested in the applications of biotechnology Critical Developments and Applications of Swarm Intelligence Shi, Yuhui,2018-02-28 Artificial intelligence is a constantly advancing field that requires models in order to accurately create functional systems The use of natural acumen to create artificial intelligence creates a field of research in which the natural and the artificial meet in a new and innovative way Critical Developments and Applications of Swarm Intelligence is a critical academic publication that examines developing research technologies and function regarding natural and artificial acumen specifically in regards to self organized systems Featuring coverage on a broad range of topics such as evolutionary

algorithms optimization techniques and computational comparison this book is geared toward academicians students researchers and engineers seeking relevant and current research on the progressive research based on the implementation of swarm intelligence in self organized systems **Quantitative Methods in Transportation** Dušan Teodorović,Miloš Nikolić,2020-08-20 Quantitative Methods in Transportation provides the most useful simple and advanced quantitative techniques for solving real life transportation engineering problems It aims to help transportation engineers and analysts to predict travel and freight demand plan new transportation networks and develop various traffic control strategies that are safer more cost effective and greener Transportation networks can be exceptionally large and this makes many transportation problems combinatorial and the challenges are compounded by the stochastic and independent nature of trip planners decision making Methods outlined in this book range from linear programming multi attribute decision making data envelopment analysis probability theory and simulation to computer techniques such as genetic algorithms simulated annealing tabu search ant colony optimization and bee colony optimization The book is supported with problems and has a solutions manual to aid course instructors *Solving with Bees* Khalid Raza,2024-12-01 This book is a comprehensive volume which delves into the versatile world of Artificial Bee Colony ABC algorithms their variants and myriad applications in a wide range of fields This book is designed to be an essential resource for researchers practitioners students and anyone intrigued by the fascinating realm of swarm intelligence and optimization This book serves as a bridge between the theoretical foundations of ABC algorithms and their practical implementations across diverse domains The book offers a deep understanding of these algorithms and how they can be harnessed to tackle complex real world challenges

Manufacturing Scheduling Systems Jose M. Framinan,Rainer Leisten,Rubén Ruiz García,2014-02-19 The book is devoted to the problem of manufacturing scheduling which is the efficient allocation of jobs orders over machines resources in a manufacturing facility It offers a comprehensive and integrated perspective on the different aspects required to design and implement systems to efficiently and effectively support manufacturing scheduling decisions Obtaining economic and reliable schedules constitutes the core of excellence in customer service and efficiency in manufacturing operations Therefore scheduling forms an area of vital importance for competition in manufacturing companies However only a fraction of scheduling research has been translated into practice due to several reasons First the inherent complexity of scheduling has led to an excessively fragmented field in which different sub problems and issues are treated in an independent manner as goals themselves therefore lacking a unifying view of the scheduling problem Furthermore mathematical brilliance and elegance has sometimes taken preference over practical general purpose hands on approaches when dealing with these problems Moreover the paucity of research on implementation issues in scheduling has restricted translation of valuable research insights into industry Manufacturing Scheduling Systems An Integrated View on Models Methods and Tools presents the different elements constituting a scheduling system along with an analysis the manufacturing context in which

the scheduling system is to be developed Examples and case studies from real implementations of scheduling systems are presented in order to drive the presentation of the theoretical insights The book is intended for an ample readership including industrial engineering operations post graduate students and researchers business managers and readers seeking an introduction to the field *Data Mining and Knowledge Discovery Handbook* Oded Maimon,Lior Rokach,2010-09-10 Knowledge Discovery demonstrates intelligent computing at its best and is the most desirable and interesting end product of Information Technology To be able to discover and to extract knowledge from data is a task that many researchers and practitioners are endeavoring to accomplish There is a lot of hidden knowledge waiting to be discovered this is the challenge created by today s abundance of data Data Mining and Knowledge Discovery Handbook Second Edition organizes the most current concepts theories standards methodologies trends challenges and applications of data mining DM and knowledge discovery in databases KDD into a coherent and unified repository This handbook first surveys then provides comprehensive yet concise algorithmic descriptions of methods including classic methods plus the extensions and novel methods developed recently This volume concludes with in depth descriptions of data mining applications in various interdisciplinary industries including finance marketing medicine biology engineering telecommunications software and security Data Mining and Knowledge Discovery Handbook Second Edition is designed for research scientists libraries and advanced level students in computer science and engineering as a reference This handbook is also suitable for professionals in industry for computing applications information systems management and strategic research management **Hybrid Competitive Learning Method Using the Fireworks Algorithm and Artificial Neural Networks** Fevrier Valdez,Juan Barraza,Patricia Melin,2023-11-25 This book focuses on the fields of neural networks swarm optimization algorithms clustering and fuzzy logic This book describes a hybrid method with three different techniques of intelligence computation neural networks optimization algorithms and fuzzy logic Within the neural network techniques competitive neural networks CNNs are used for the optimization algorithms technique we used the fireworks algorithm FWA and in the area of fuzzy logic the Type 1 Fuzzy Inference Systems T1FIS and the Interval Type 2 Fuzzy Inference Systems IT2FIS were used with their variants of Mamdani and Sugeno type respectively FWA was adapted for data clustering with the goal to help of competitive neural network to find the optimal number of neurons It is important to mention that two variants were applied to the FWA dynamically adjust of parameters with Type 1 Fuzzy Logic FFWA as the first one and Interval Type 2 F2FWA as the second one Subsequently based on the outputs of the CNN and with the goal of classification data we designed Type 1 and Interval Type 2 Fuzzy Inference Systems of Mamdani and Sugeno type This book is intended to be a reference for scientists and engineers interested in applying a different metaheuristic or an artificial neural network in order to solve optimization and applied fuzzy logic techniques for solving problems in clustering and classification data This book is also used as a reference for graduate courses like the following soft computing swarm optimization algorithms clustering data fuzzy classify and

similar ones We consider that this book can also be used to get novel ideas for new lines of research new techniques of optimization or to continue the lines of the research proposed by the authors of the book **Machine Learning and Metaheuristic Computation** Erik Cuevas,Jorge Galvez,Omar Avalos,Fernando Wario,2024-12-24 Learn to bridge the gap between machine learning and metaheuristic methods to solve problems in optimization approaches Few areas of technology have greater potential to revolutionize the globe than artificial intelligence Two key areas of artificial intelligence machine learning and metaheuristic computation have an enormous range of individual and combined applications in computer science and technology To date these two complementary paradigms have not always been treated together despite the potential of a combined approach which maximizes the utility and minimizes the drawbacks of both Machine Learning and Metaheuristic Computation offers an introduction to both of these approaches and their joint applications Both a reference text and a course it is built around the popular Python programming language to maximize utility It guides the reader gradually from an initial understanding of these crucial methods to an advanced understanding of cutting edge artificial intelligence tools The text also provides Treatment suitable for readers with only basic mathematical training Detailed discussion of topics including dimensionality reduction clustering methods differential evolution and more A rigorous but accessible vision of machine learning algorithms and the most popular approaches of metaheuristic optimization Machine Learning and Metaheuristic Computation is ideal for students researchers and professionals looking to combine these vital methods to solve problems in optimization approaches **Fundamentals of Natural Computing** Leandro Nunes de Castro,2006-06-02 Natural computing brings together nature and computing to develop new computational tools for problem solving to synthesize natural patterns and behaviors in computers and to potentially design novel types of computers Fundamentals of Natural Computing Basic Concepts Algorithms and Applications presents a wide ranging survey of novel techniques and important applications of nature based computing This book presents theoretical and philosophical discussions pseudocodes for algorithms and computing paradigms that illustrate how computational techniques can be used to solve complex problems simulate nature explain natural phenomena and possibly allow the development of new computing technologies The author features a consistent and approachable textbook style format that includes lucid figures tables real world examples and different types of exercises that complement the concepts while encouraging readers to apply the computational tools in each chapter Building progressively upon core concepts of nature inspired techniques the topics include evolutionary computing neurocomputing swarm intelligence immunocomputing fractal geometry artificial life quantum computing and DNA computing Fundamentals of Natural Computing is a self contained introduction and a practical guide to nature based computational approaches that will find numerous applications in a variety of growing fields including engineering computer science biological modeling and bioinformatics

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