

Oscar Castillo
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Hybrid Intelligent Systems Based on Extensions of Fuzzy Logic, Neural Networks and Metaheuristics

Hybrid Metaheuristics Studies In Computational Intelligence

Michel Gendreau, Jean-Yves Potvin



Hybrid Metaheuristics Studies In Computational Intelligence:

Hybrid Metaheuristics Christian Blum,Andrea Roli,Michael Sampels,2008-06-24 Optimization problems are of great importance in many fields They can be tackled for example by approximate algorithms such as metaheuristics Examples of metaheuristics are simulated annealing tabu search evolutionary computation iterated local search variable neighborhood search and ant colony optimization In recent years it has become evident that a skilled combination of a metaheuristic with other optimization techniques a so called hybrid metaheuristic can provide a more efficient behavior and a higher flexibility This is because hybrid metaheuristics combine their advantages with the complementary strengths of for example more classical optimization techniques such as branch and bound or dynamic programming The authors involved in this book are among the top researchers in their domain The book is intended both to provide an overview of hybrid metaheuristics to novices of the field and to provide researchers from the field with a collection of some of the most interesting recent developments

Recent Advances in Computational Optimization Stefka Fidanova,2025-03-03 This book presents recent advances in computational optimization The book includes important real problems like modelling of physical processes workforce planning problem transportation problems machine scheduling air pollution modelling optimization of fast food restaurant chain solving engineering and financial problems Our everyday life is unthinkable without optimization We try to minimize our effort and maximize the achieved profit Many real world and industrial problems arising in engineering economics medicine and other domains can be formulated as optimization tasks The book is a comprehensive collection of extended contributions from the Workshops on Computational Optimization 2023 It shows how to develop algorithms for them based on new intelligent methods like evolutionary computations ant colony optimization constrain programming Monte Carlo method and others This research demonstrates how some real world problems arising in engineering economics and other domains can be formulated as optimization problems

Handbook of Metaheuristics Michel Gendreau,Jean-Yves Potvin,2018-09-20 The third edition of this handbook is designed to provide a broad coverage of the concepts implementations and applications in metaheuristics The book s chapters serve as stand alone presentations giving both the necessary underpinnings as well as practical guides for implementation The nature of metaheuristics invites an analyst to modify basic methods in response to problem characteristics past experiences and personal preferences and the chapters in this handbook are designed to facilitate this process as well This new edition has been fully revised and features new chapters on swarm intelligence and automated design of metaheuristics from flexible algorithm frameworks The authors who have contributed to this volume represent leading figures from the metaheuristic community and are responsible for pioneering contributions to the fields they write about Their collective work has significantly enriched the field of optimization in general and combinatorial optimization in particular Metaheuristics are solution methods that orchestrate an interaction between local improvement procedures and higher level strategies to create a process capable of escaping from

local optima and performing a robust search of a solution space In addition many new and exciting developments and extensions have been observed in the last few years Hybrids of metaheuristics with other optimization techniques like branch and bound mathematical programming or constraint programming are also increasingly popular On the front of applications metaheuristics are now used to find high quality solutions to an ever growing number of complex ill defined real world problems in particular combinatorial ones This handbook should continue to be a great reference for researchers graduate students as well as practitioners interested in metaheuristics

Hybrid Optimization Pascal van Hentenryck, Michela

Milano, 2010-11-05 Hybrid Optimization focuses on the application of artificial intelligence and operations research techniques to constraint programming for solving combinatorial optimization problems This book covers the most relevant topics investigated in the last ten years by leading experts in the field and speculates about future directions for research This book includes contributions by experts from different but related areas of research including constraint programming decision theory operations research SAT artificial intelligence as well as others These diverse perspectives are actively combined and contrasted in order to evaluate their relative advantages This volume presents techniques for hybrid modeling integrated solving strategies including global constraints decomposition techniques use of relaxations and search strategies including tree search local search and metaheuristics Various applications of the techniques presented as well as supplementary computational tools are also discussed

Intelligence Enabled Research Siddhartha

Bhattacharyya, Sushmita Mitra, Paramartha Dutta, 2020-01-04 This book gathers extended versions of papers presented at DoSIER 2019 the First Doctoral Symposium on Intelligence Enabled Research organized by RCC Institute of Information Technology Kolkata India The papers address the rapidly expanding research area of computational intelligence which no longer limited to specific computational fields has since made inroads in signal processing smart manufacturing predictive control robot navigation smart cities and sensor design to name but a few Presenting chapters written by experts active in these areas the book offers a valuable reference guide for researchers and industrial practitioners alike and will inspire future studies

Recent Advances in Hybrid Metaheuristics for Data Clustering Sourav De, Sandip Dey, Siddhartha

Bhattacharyya, 2020-06-02 An authoritative guide to an in depth analysis of various state of the art data clustering approaches using a range of computational intelligence techniques Recent Advances in Hybrid Metaheuristics for Data Clustering offers a guide to the fundamentals of various metaheuristics and their application to data clustering Metaheuristics are designed to tackle complex clustering problems where classical clustering algorithms have failed to be either effective or efficient The authors noted experts on the topic provide a text that can aid in the design and development of hybrid metaheuristics to be applied to data clustering The book includes performance analysis of the hybrid metaheuristics in relationship to their conventional counterparts In addition to providing a review of data clustering the authors include in depth analysis of different optimization algorithms The text offers a step by step guide in the build up of hybrid

metaheuristics and to enhance comprehension In addition the book contains a range of real life case studies and their applications This important text Includes performance analysis of the hybrid metaheuristics as related to their conventional counterparts Offers an in depth analysis of a range of optimization algorithms Highlights a review of data clustering Contains a detailed overview of different standard metaheuristics in current use Presents a step by step guide to the build up of hybrid metaheuristics Offers real life case studies and applications Written for researchers students and academics in computer science mathematics and engineering Recent Advances in Hybrid Metaheuristics for Data Clustering provides a text that explores the current data clustering approaches using a range of computational intelligence techniques

Women in Computational Intelligence Alice E Smith, 2022-04-13 This book provides a breadth of innovative and impactful research in the field computational intelligence led by women investigators Topics include intelligent data analytics optimization of complex systems approximation of human reasoning robotic path planning and intelligent control systems These topics touch on many of the technological challenges facing the world today and these solutions by women researcher teams are valuable for their excellence and their non traditional perspective As an important part of the Women in Science and Engineering book series the work highlights the contribution of women leaders in computational intelligence inspiring women and men girls and boys to enter and apply themselves to this exciting multi disciplinary field

Computational Management Science Raquel J. Fonseca, Gerhard-Wilhelm Weber, João Telhada, 2015-12-22 This volume contains contributions from the 11th International Conference on Management Science CMS 2014 held at Lisbon Portugal on May 29 31 2014 Its contents reflect the wide scope of Management Science covering different theoretical aspects for a quite diverse set of applications Computational Management Science provides a unique perspective in relevant decision making processes by focusing on all its computational aspects These include computational economics finance and statistics energy scheduling supply chains design analysis and applications of optimization algorithms deterministic dynamic stochastic robust and combinatorial optimization models solution algorithms learning and forecasting such as neural networks and genetic algorithms models and tools of knowledge acquisition such as data mining and all other topics in management science with the emphasis on computational paradigms

Meta-Heuristics Optimization Algorithms in Engineering, Business, Economics, and Finance Vasant, Pandian M., 2012-09-30 Optimization techniques have developed into a significant area concerning industrial economics business and financial systems With the development of engineering and financial systems modern optimization has played an important role in service centered operations and as such has attracted more attention to this field Meta heuristic hybrid optimization is a newly development mathematical framework based optimization technique Designed by logicians engineers analysts and many more this technique aims to study the complexity of algorithms and problems Meta Heuristics Optimization Algorithms in Engineering Business Economics and Finance explores the emerging study of meta heuristics optimization algorithms and methods and their role in innovated real world practical applications

This book is a collection of research on the areas of meta heuristics optimization algorithms in engineering business economics and finance and aims to be a comprehensive reference for decision makers managers engineers researchers scientists financiers and economists as well as industrialists

Evolutionary Computation in Combinatorial

Optimization Peter I. Cowling, Peter Merz, 2010-03-25 This book constitutes the refereed proceedings of the 10th European Conference on Evolutionary Computation in Combinatorial Optimization EvoCOP 2010 held in Istanbul Turkey in April 2010 The 24 revised full papers presented were carefully reviewed and selected from 69 submissions The papers present the latest research and discuss current developments and applications in metaheuristics a paradigm to effectively solve difficult combinatorial optimization problems appearing in various industrial economical and scientific domains Prominent examples of metaheuristics are evolutionary algorithms simulated annealing tabu search scatter search memetic algorithms variable neighborhood search iterated local search greedy randomized adaptive search procedures estimation of distribution algorithms and ant colony optimization

Modeling, Analysis, and Applications in Metaheuristic Computing:

Advancements and Trends Yin, Peng-Yeng, 2012-03-31 This book is a collection of the latest developments models and applications within the transdisciplinary fields related to metaheuristic computing providing readers with insight into a wide range of topics such as genetic algorithms differential evolution and ant colony optimization Provided by publisher

Metaheuristic and Machine Learning Optimization Strategies for Complex Systems R., Thanigaivelan, M., Suchithra, S., Kaliappan, Mothilal, T., 2024-07-17 In contemporary engineering domains optimization and decision making issues are crucial Given the vast amounts of available data processing times and memory usage can be substantial Developing and implementing novel heuristic algorithms is time consuming yet even minor improvements in solutions can significantly reduce computational costs In such scenarios the creation of heuristics and metaheuristic algorithms has proven advantageous The convergence of machine learning and metaheuristic algorithms offers a promising approach to address these challenges Metaheuristic and Machine Learning Optimization Strategies for Complex Systems covers all areas of comprehensive information about hyper heuristic models hybrid meta heuristic models nature inspired computing models and meta heuristic models The key contribution of this book is the construction of a hyper heuristic approach for any general problem domain from a meta heuristic algorithm Covering topics such as cloud computing internet of things and performance evaluation this book is an essential resource for researchers postgraduate students educators data scientists machine learning engineers software developers and engineers policy makers and more

Recent Metaheuristic Computation Schemes in Engineering Erik Cuevas, Alma Rodríguez, Avelina Alejo-Reyes, Carolina

Del-Valle-Soto, 2021-02-04 This book includes two objectives The first goal is to present advances and developments which have proved to be effective in their application to several complex problems The second objective is to present the performance comparison of various metaheuristic techniques when they face complex optimization problems The material

has been compiled from a teaching perspective Most of the problems in science engineering economics and other areas can be translated as an optimization or a search problem According to their characteristics some problems can be simple that can be solved by traditional optimization methods based on mathematical analysis However most of the problems of practical importance in engineering represent complex scenarios so that they are very hard to be solved by using traditional approaches Under such circumstances metaheuristic has emerged as the best alternative to solve this kind of complex formulations This book is primarily intended for undergraduate and postgraduate students Engineers and application developers can also benefit from the book contents since it has been structured so that each chapter can be read independently from the others and therefore only potential interesting information can be quickly available for solving an industrial problem at hand

Autonomic Computing in Cloud Resource Management in Industry 4.0 Tanupriya Choudhury, Bhupesh Kumar Dewangan, Ravi Tomar, Bhupesh Kumar Singh, Teoh Teik Toe, Nguyen Gia Nhu, 2021-08-04 This book describes the next generation of industry Industry 4 0 and how it holds the promise of increased flexibility in manufacturing along with automation better quality and improved productivity The authors discuss how it thus enables companies to cope with the challenges of producing increasingly individualized products with a short lead time to market and higher quality The authors posit that intelligent cloud services and resource sharing play an important role in Industry 4 0 anticipated Fourth Industrial Revolution This book serves the different issues and challenges in cloud resource management CRM techniques with proper propped solution for IT organizations The book features chapters based on the characteristics of autonomic computing with its applicability in CRM Each chapter features the techniques and analysis of each mechanism to make better resource management in cloud

Advances in Multi-Objective Nature Inspired Computing Carlos Coello Coello, Clarisse Dhaenens, Laetitia Jourdan, 2010-02-04 The purpose of this book is to collect contributions that deal with the use of nature inspired metaheuristics for solving multi objective combinatorial optimization problems Such a collection intends to provide an overview of the state of the art developments in this field with the aim of motivating more researchers in operations research engineering and computer science to do research in this area As such this book is expected to become a valuable reference for those wishing to do research on the use of nature inspired metaheuristics for solving multi objective combinatorial optimization problems

Hagenberg Research Bruno Buchberger, Michael Affenzeller, Alois Ferscha, Michael Haller, Tudor Jebelean, Erich Peter Klement, Peter Paule, Gustav Pomberger, Wolfgang Schreiner, Robert Stubenrauch, Roland Wagner, Gerhard Weiß, Wolfgang Windsteiger, 2009-05-29 Bruno Buchberger This book is a synopsis of basic and applied research done at the various research institutions of the Softwarepark Hagenberg in Austria Starting with 15 coworkers in my Research Institute for Symbolic Computation RISC I initiated the Softwarepark Hagenberg in 1987 on request of the Upper Austrian Government with the objective of creating a scientific technological and economic impulse for the region and the international community In the meantime in a joint effort the Softwarepark Hagenberg has grown to the

current 2009 size of over 1000 R D employees and 1300 students in six research institutions 40 companies and 20 academic study programs on the bachelor master s and PhD level The goal of the Softwarepark Hagenberg is innovation of economy in one of the most important current technologies software It is the message of this book that this can only be achieved and guaranteed long term by watering the root namely emphasis on research both basic and applied In this book we summarize what has been achieved in terms of research in the various research institutions in the Softwarepark Hagenberg and what research vision we have for the imminent future When I founded the Softwarepark Hagenberg in addition to the watering the root principle I had the vision that such a technology park can only prosper if we realize the magic triangle i e the close interaction of research academic education and business applications at one site see Figure 1

Handbook of Research on Novel Soft Computing Intelligent Algorithms: Theory and Practical Applications Vasant, Pandian M.,2013-08-31 This book explores emerging technologies and best practices designed to effectively address concerns inherent in properly optimizing advanced systems demonstrating applications in areas such as bio engineering space exploration industrial informatics information security and nuclear and renewable energies Provided by publisher

Facets of Combinatorial Optimization Michael Jünger, Gerhard Reinelt,2013-07-03 Martin Gr tsel is one of the most influential mathematicians of our time He has received numerous honors and holds a number of key positions in the international mathematical community He celebrated his 65th birthday on September 10 2013 Martin Gr tsel s doctoral descendant tree 1983 2012 i e the first 30 years features 39 children 74 grandchildren 24 great grandchildren and 2 great great grandchildren a total of 139 doctoral descendants This book starts with a personal tribute to Martin Gr tsel by the editors Part I a contribution by his very special predecessor Manfred Padberg on Facets and Rank of Integer Polyhedra Part II and the doctoral descendant tree 1983 2012 Part III The core of this book Part IV contains 16 contributions each of which is coauthored by at least one doctoral descendant The sequence of the articles starts with contributions to the theory of mathematical optimization including polyhedral combinatorics extended formulations mixed integer convex optimization super classes of perfect graphs efficient algorithms for subtree telecenters junctions in acyclic graphs and preemptive restricted strip covering as well as efficient approximation of non preemptive restricted strip covering Combinations of new theoretical insights with algorithms and experiments deal with network design problems combinatorial optimization problems with submodular objective functions and more general mixed integer nonlinear optimization problems Applications include VLSI layout design systems biology wireless network design mean risk optimization and gas network optimization Computational studies include a semidefinite branch and cut approach for the max k cut problem mixed integer nonlinear optimal control and mixed integer linear optimization for scheduling and routing of fly in safari planes The two closing articles are devoted to computational advances in general mixed integer linear optimization the first by scientists working in industry the second by scientists working in academia These articles reflect the scientific facets of Martin Gr tsel who has set standards in theory computation and

applications *Into a Deeper Understanding of Evolutionary Computing: Exploration, Exploitation, and Parameter Control* Abdul Hanif Abdul Halim, Swagatam Das, Idris Ismail, 2025-01-17 This book delves into fundamental and advanced strategies for enhancing evolutionary and metaheuristic algorithms focusing on the crucial balance between exploration and exploitation in search mechanisms As technological advancements increase optimization complexity effectively managing this balance becomes essential for achieving optimal solutions within reasonable computational resources The book s distinctive structure organizes content according to optimization stages and processes offering a comprehensive discussion of various approaches supported by extensive literature The authors note a scarcity of literature addressing the trade offs between exploration and exploitation with contemporary references making this work particularly valuable It aims to deepen the reader s understanding of evolutionary computing emphasizing exploration exploitation and parameter control It is relevant not only to algorithm developers and the evolutionary computation community but also to students and researchers across scientific disciplines The book is designed to be accessible to those without extensive algorithm development backgrounds providing theoretical and practical insights into optimization methods Modern Artificial Intelligence Based on Soft Computing Techniques Patricia Melin, Oscar Castillo, 2025-07-05 This book describes what we can call modern artificial intelligence that includes the theoretical developments and applications of soft computing techniques Soft computing includes fuzzy logic neural networks and meta heuristic algorithms as well as their hybrid combinations There are papers with the main topics from type 1 to type 3 fuzzy logic which basically consists of a group of papers that propose new concepts and algorithms based on type 1 type 2 and type 3 fuzzy logic and their applications There are also papers that present theory and practice of meta heuristics in diverse application areas There are interesting papers on different applications of fuzzy logic neural networks and hybrid intelligent systems in medical problems In addition we can find papers describing applications of fuzzy logic neural networks and meta heuristics in robotics problems

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