

Intelligent Optimisation Techniques

Genetic Algorithms,
Tabu Search,
Simulated Annealing
and Neural Networks

D.T. Pham and D. Karaboga



Springer

Intelligent Optimisation Techniques

Duc Pham, D. Karaboga



Intelligent Optimisation Techniques:

Intelligent Optimisation Techniques Duc Pham,D. Karaboga,2012-12-06 This book covers four optimisation techniques loosely classified as intelligent genetic algorithms tabu search simulated annealing and neural networks Genetic algorithms GAs locate optima using processes similar to those in natural selection and genetics Tabu search is a heuristic procedure that employs dynamically generated constraints or tabus to guide the search for optimum solutions Simulated annealing finds optima in a way analogous to the reaching of minimum energy configurations in metal annealing Neural networks are computational models of the brain Certain types of neural networks can be used for optimisation by exploiting their inherent ability to evolve in the direction of the negative gradient of an energy function and to reach a stable minimum of that function Aimed at engineers the book gives a concise introduction to the four techniques and presents a range of applications drawn from electrical electronic manufacturing mechanical and systems engineering The book contains listings of C programs implementing the main techniques described to assist readers wishing to experiment with them The book does not assume a previous background in intelligent optimisation techniques For readers unfamiliar with those techniques Chapter 1 outlines the key concepts underpinning them To provide a common framework for comparing the different techniques the chapter describes their performances on simple benchmark numerical and combinatorial problems More complex engineering applications are covered in the remaining four chapters of the book

Intelligent Optimisation with the Bees Algorithm Duc Truong Pham,Marco Castellani,Luca Baronti,2025-08-01 This book offers an extensive guide to understanding implementing and applying the Bees Algorithm a powerful nature inspired optimisation metaheuristic that mimics the foraging behaviour of honey bees In today s highly interconnected world systems have become more difficult to optimise This book addresses the challenge of solving complex optimisation problems efficiently and effectively by drawing inspiration from the remarkable problem solving abilities observed in nature The Bees Algorithm provides an elegant simple robust and adaptable approach to navigate the complexities of high dimensional multimodal or time varying problems that often stymie traditional optimisation methods This book offers an in depth exploration of the algorithm providing a thorough understanding of its underlying principles and mechanisms It establishes a mathematical framework for the algorithm facilitating a clearer insight into its behaviour and performance Through empirical studies and benchmarks the book demonstrates the algorithm s effectiveness across a range of optimisation problems Additionally it showcases practical applications of the Bees Algorithm in diverse fields such as engineering design robotics and manufacturing Finally it discusses the latest developments and variants of the algorithm highlighting its potential for future research and innovation With its accessible style and step by step guidance this book equips readers be they researchers practitioners or students in computer science engineering or optimisation with the knowledge and tools to leverage the principles of swarm intelligence and biomimicry to solve the real world optimisation challenges of the new industrial age

Artificial Intelligence

Techniques in Power Systems Operations and Analysis Nagendra Singh, Sitendra Tamrakar, Arvind Mewada, Sanjeev Kumar Gupta, 2023-08-16 An electrical power system consists of a large number of generation transmission and distribution subsystems. It is a very large and complex system; hence its installation and management are very difficult tasks. An electrical system is essentially a very large network with very large data sets. Handling these data sets can require much time to analyze and subsequently implement. An electrical system is necessary but also potentially very dangerous if not operated and controlled properly. The demand for electricity is ever increasing, so maintaining load demand without overloading the system poses challenges and difficulties. Thus, planning, installing, operating, and controlling such a large system requires new technology. Artificial intelligence (AI) applications have many key features that can support a power system and handle overall power system operations. AI-based applications can manage the large data sets related to a power system. They can also help design power plants, model installation layouts, optimize load dispatch, and quickly respond to control apparatus. These applications and their techniques have been successful in many areas of power system engineering. Artificial Intelligence Techniques in Power Systems Operations and Analysis focuses on the various challenges arising in power systems and how AI techniques help to overcome these challenges. It examines important areas of power system analysis and the implementation of AI-driven analysis techniques. The book helps academicians and researchers understand how AI can be used for more efficient operation. Multiple AI techniques and their application are explained. Also featured are relevant data sets and case studies. Highlights include: Power quality enhancement by PV UPQC for non-linear load; Energy management of a nanogrid through the use of deep learning from IoT environments; Role of artificial intelligence and machine learning in power systems with fault detection and diagnosis; AC power optimization techniques; Artificial intelligence and machine learning techniques in power systems automation.

Intelligent Computational Optimization in Engineering Mario Köppen, Gerald Schaefer, Ajith Abraham, 2011-07-15

We often come across computational optimization virtually in all branches of engineering and industry. Many engineering problems involve heuristic search and optimization, and once discretized may become combinatorial in nature, which gives rise to certain difficulties in terms of solution procedure. Some of these problems have enormous search spaces, are NP-hard, and hence require heuristic solution techniques. Another difficulty is the lack of ability of classical solution techniques to determine appropriate optima of non-convex problems. Under these conditions, recent advances in computational optimization techniques have been shown to be advantageous and successful compared to classical approaches. This Volume presents some of the latest developments with a focus on the design of algorithms for computational optimization and their applications in practice. Through the chapters of this book, researchers and practitioners share their experience and newest methodologies with regard to intelligent optimization and provide various case studies of the application of intelligent optimization techniques in real-world applications. This book can serve as an excellent reference for researchers and graduate students in computer science, various engineering disciplines, and the

industry Multidisciplinary Computational Intelligence Techniques: Applications in Business, Engineering, and Medicine Ali, Shawkat,Abbadeni, Nouredine,Batouche, Mohamed,2012-06-30 This book explores the complex world of computational intelligence which utilizes computational methodologies such as fuzzy logic systems neural networks and evolutionary computation for the purpose of managing and using data effectively to address complicated real world problems

Intelligent Engineering Optimisation with the Bees Algorithm D. T. Pham,Natalia Hartono,2024-11-10 This book presents new and advanced results and developments related to the Bees Algorithm along with its application to a wide range of engineering problems Modern complex processes and systems are difficult to optimise using conventional mathematical tools as they require models that often cannot be obtained with accuracy or certainty Optimising such systems demands efficient model free optimisation tools The Bees Algorithm a swarm based technique inspired by the foraging behaviour of honeybees is an ideal tool for tackling challenging optimisation problems The algorithm is conceptually elegant and extremely easy to apply All it needs to solve an optimisation problem is a means to evaluate the quality of potential solutions While the covered applications belong to diverse engineering fields this book s focus is on advanced manufacturing and industrial engineering The book comprises two parts The first part explores different enhancements made to the original Bees Algorithm to improve its performance The second part delves into the algorithm s applications in design manufacturing production ergonomics logistics transportation and electrical and electronic engineering By showcasing the variety of optimisation tasks successfully handled using the Bees Algorithm the book aims to inspire and motivate engineers and researchers worldwide to adopt the algorithm as a powerful and versatile tool for conquering complex engineering problems in the Industry 4 0 era and beyond Intelligent Control Systems Using Computational Intelligence Techniques A.E.

Ruano,2005-07-18 Intelligent Control techniques are becoming important tools in both academia and industry Methodologies developed in the field of soft computing such as neural networks fuzzy systems and evolutionary computation can lead to accommodation of more complex processes improved performance and considerable time savings and cost reductions Intelligent Control Systems using Computational Intelligence Techniques details the application of these tools to the field of control systems Each chapter gives an overview of current approaches in the topic covered with a set of the most important references in the field and then details the author s approach examining both the theory and practical applications

Safety, Reliability and Applications of Emerging Intelligent Control Technologies T.S. Ng,Y.S. Hung,2014-06-28 Increasingly over the last few years intelligent controllers have been incorporated into control systems Presently the numbers and types of intelligent controllers that contain variations of fuzzy logic neural network genetic algorithms or some other forms of knowledge based reasoning technology are dramatically rising However considering the stability of the system when such controllers are included it is difficult to analyse and predict system behaviour under unexpected conditions Leading researchers and industrial practitioners were able to discuss and evaluate current development and future research

directions at the first IFAC International Workshop on safety reliability and applications on emerging intelligent control technology This publication contains the papers covering a wide range of topics presented at the workshop **Methods and Applications of Artificial Intelligence** George A. Vouros,Themistoklis Panayiotopoulos,2004-04-22 Artificial intelligence has attracted a renewed interest from distinguished scientists and has again raised new more realistic this time expectations for future advances regarding the development of theories models and techniques and the use of them in applications pervading many areas of our daily life The borders of human level intelligence are still very far away and possibly unknown Nevertheless recent scientific work inspires us to work even harder in our exploration of the unknown lands of intelligence This volume contains papers selected for presentation at the 3rd Hellenic Conference on Artificial Intelligence SETN 2004 the official meeting of the Hellenic Society for Artificial Intelligence EETN The first meeting was held in the University of Piraeus 1996 and the second in the Aristotle University of Thessaloniki AUTH 2002 SETN conferences play an important role in the dissemination of the innovative and high quality scientific results in artificial intelligence which are being produced mainly by Greek scientists in institutes all over the world However the most important effect of SETN conferences is that they provide the context in which people meet and get to know each other as well as a very good opportunity for students to get closer to the results of innovative artificial intelligence research **Computational Intelligence and Optimization**

Methods for Control Engineering Maude Josée Blondin,Panos M. Pardalos,Javier Sanchis Sáez,2019-09-20 This volume presents some recent and principal developments related to computational intelligence and optimization methods in control Theoretical aspects and practical applications of control engineering are covered by 14 self contained contributions Additional gems include the discussion of future directions and research perspectives designed to add to the reader's understanding of both the challenges faced in control engineering and the insights into the developing of new techniques With the knowledge obtained readers are encouraged to determine the appropriate control method for specific applications

Artificial Intelligence Techniques for a Scalable Energy Transition Moamar Sayed-Mouchaweh,2020-06-19 This book presents research in artificial techniques using intelligence for energy transition outlining several applications including production systems energy production energy distribution energy management renewable energy production cyber security industry 4.0 and internet of things etc The book goes beyond standard application by placing a specific focus on the use of AI techniques to address the challenges related to the different applications and topics of energy transition The contributions are classified according to the market and actor interactions service providers manufacturers customers integrators utilities etc to the SG architecture model physical layer infrastructure layer and business layer to the digital twin of SG business model operational model fault transient model and asset model and to the application domain demand side management load monitoring micro grids energy consulting residents utilities energy saving dynamic pricing revenue management and smart meters etc **Biologically-Inspired Optimisation Methods** Andrew Lewis,Sanaz Mostaghim,Marcus Randall,2009-05-25

This book covers the latest theories applications and techniques in Biologically Inspired Optimisation Methods Many chapters derive from studies presented at workshops and international conferences on e Science Grid Computing and Evolutionary computation *Computational Intelligence and Quantitative Software Engineering* Witold Pedrycz,Giancarlo Succi,Alberto Sillitti,2016-01-14 In a down to the earth manner the volume lucidly presents how the fundamental concepts methodology and algorithms of Computational Intelligence are efficiently exploited in Software Engineering and opens up a novel and promising avenue of a comprehensive analysis and advanced design of software artifacts It shows how the paradigm and the best practices of Computational Intelligence can be creatively explored to carry out comprehensive software requirement analysis support design testing and maintenance Software Engineering is an intensive knowledge based endeavor of inherent human centric nature which profoundly relies on acquiring semiformal knowledge and then processing it to produce a running system The knowledge spans a wide variety of artifacts from requirements captured in the interaction with customers to design practices testing and code management strategies which rely on the knowledge of the running system This volume consists of contributions written by widely acknowledged experts in the field who reveal how the Software Engineering benefits from the key foundations and synergistically existing technologies of Computational Intelligence being focused on knowledge representation learning mechanisms and population based global optimization strategies This book can serve as a highly useful reference material for researchers software engineers and graduate students and senior undergraduate students in Software Engineering and its sub disciplines Internet engineering Computational Intelligence management operations research and knowledge based systems *Encyclopedia of Business Analytics and Optimization* Wang, John,2014-02-28 As the age of Big Data emerges it becomes necessary to take the five dimensions of Big Data volume variety velocity volatility and veracity and focus these dimensions towards one critical emphasis value The Encyclopedia of Business Analytics and Optimization confronts the challenges of information retrieval in the age of Big Data by exploring recent advances in the areas of knowledge management data visualization interdisciplinary communication and others Through its critical approach and practical application this book will be a must have reference for any professional leader analyst or manager interested in making the most of the knowledge resources at their disposal *Medical Applications of Artificial Intelligence* Arvin Agah,2013-11-06 Enhanced more reliable and better understood than in the past artificial intelligence AI systems can make providing healthcare more accurate affordable accessible consistent and efficient However AI technologies have not been as well integrated into medicine as predicted In order to succeed medical and computational scientists must develop hybrid systems that can effectively and efficiently integrate the experience of medical care professionals with capabilities of AI systems After providing a general overview of artificial intelligence concepts tools and techniques Medical Applications of Artificial Intelligence reviews the research focusing on state of the art projects in the field The book captures the breadth and depth of the medical applications of artificial intelligence exploring new developments

and persistent challenges Optimizing Decision Making in the Apparel Supply Chain Using Artificial Intelligence (AI)
 Calvin Wong,Z. X. Guo,S Y S Leung,2013-01-24 Practitioners in apparel manufacturing and retailing enterprises in the fashion industry ranging from senior to front line management constantly face complex and critical decisions There has been growing interest in the use of artificial intelligence AI techniques to enhance this process and a number of AI techniques have already been successfully applied to apparel production and retailing Optimizing decision making in the apparel supply chain using artificial intelligence AI From production to retail provides detailed coverage of these techniques outlining how they are used to assist decision makers in tackling key supply chain problems Key decision points in the apparel supply chain and the fundamentals of artificial intelligence techniques are the focus of the opening chapters before the book proceeds to discuss the use of neural networks genetic algorithms fuzzy set theory and extreme learning machines for intelligent sales forecasting and intelligent product cross selling systems Helps the reader gain an understanding of the key decision points in the apparel supply chain Discusses the fundamentals of artificial intelligence techniques for apparel management techniques Considers the use of neural networks in selecting the location of apparel manufacturing plants Metaheuristic Algorithms and Optimizing Neural Networks for Biomedical Image Processing Balaji, Prasanalakshmi,Martin Sagayam, K.,Sharma, Aditi,Cengiz, Korhen,2025-08-06 Metaheuristic algorithms emerge as powerful tools for optimizing complex systems particularly in neural networks where traditional methods may cause challenges In biomedical image processing the integration of metaheuristics like genetic algorithms particle swarm optimization and differential evolution offers promising improvements in neural network performance These algorithms help improve hyperparameters and optimize architectures enhancing the accuracy of tasks like disease detection image segmentation and classification Further research into this convergence between metaheuristic optimization and deep learning may help advance medical diagnostics and healthcare technologies Metaheuristic Algorithms and Optimizing Neural Networks for Biomedical Image Processing explores the optimization of neural networks for biomedical image analysis It provides valuable insights into advanced image processing for improved healthcare advanced technology and potential scientific and computational breakthroughs This book covers topics such as medical imaging genetics and psychology and is a useful resource for business owners computer engineers medical professionals academicians researchers and data scientists *Advances on Computational Intelligence in Energy* Tutut Herawan,Haruna Chiroma,Jemal H. Abawajy,2019-07-12 Addressing the applications of computational intelligence algorithms in energy this book presents a systematic procedure that illustrates the practical steps required for applying bio inspired meta heuristic algorithms in energy such as the prediction of oil consumption and other energy products Contributions include research findings projects surveying work and industrial experiences that describe significant advances in the applications of computational intelligence algorithms in energy For easy understanding the text provides practical simulation results convergence and learning curves as well as illustrations and tables Providing a valuable resource

for undergraduate and postgraduate students alike it is also intended for researchers in the fields of computational intelligence and energy

Condition Monitoring Using Computational Intelligence Methods Tshilidzi

Marwala,2012-01-23 Condition Monitoring Using Computational Intelligence Methods promotes the various approaches gathered under the umbrella of computational intelligence to show how condition monitoring can be used to avoid equipment failures and lengthen its useful life minimize downtime and reduce maintenance costs The text introduces various signal processing and pre processing techniques wavelets and principal component analysis for example together with their uses in condition monitoring and details the development of effective feature extraction techniques classified into frequency time frequency and time domain analysis Data generated by these techniques can then be used for condition classification employing tools such as fuzzy systems rough and neuro rough sets neural and Bayesian networks hidden Markov and Gaussian mixture models and support vector machines

Intelligent Systems and Applications Yaxin Bi,Supriya

Kapoor,Rahul Bhatia,2016-06-30 This book is a remarkable collection of chapters covering a wider range of topics including unsupervised text mining anomaly and Intrusion Detection Self reconfiguring Robotics application of Fuzzy Logic to development aid Design and Optimization Context Aware Reasoning DNA Sequence Assembly and Multilayer Perceptron Networks The twenty one chapters present extended results from the SAI Intelligent Systems Conference IntelliSys 2015 and have been selected based on high recommendations during IntelliSys 2015 review process This book presents innovative research and development carried out presently in fields of knowledge representation and reasoning machine learning and particularly in intelligent systems in a more broad sense It provides state of the art intelligent methods and techniques for solving real world problems along with a vision of the future research

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Table of Contents Intelligent Optimisation Techniques

1. Understanding the eBook Intelligent Optimisation Techniques
 - The Rise of Digital Reading Intelligent Optimisation Techniques
 - Advantages of eBooks Over Traditional Books
2. Identifying Intelligent Optimisation Techniques
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Intelligent Optimisation Techniques
 - User-Friendly Interface
4. Exploring eBook Recommendations from Intelligent Optimisation Techniques

- Personalized Recommendations
- Intelligent Optimisation Techniques User Reviews and Ratings
- Intelligent Optimisation Techniques and Bestseller Lists
- 5. Accessing Intelligent Optimisation Techniques Free and Paid eBooks
 - Intelligent Optimisation Techniques Public Domain eBooks
 - Intelligent Optimisation Techniques eBook Subscription Services
 - Intelligent Optimisation Techniques Budget-Friendly Options
- 6. Navigating Intelligent Optimisation Techniques eBook Formats
 - ePub, PDF, MOBI, and More
 - Intelligent Optimisation Techniques Compatibility with Devices
 - Intelligent Optimisation Techniques Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Intelligent Optimisation Techniques
 - Highlighting and Note-Taking Intelligent Optimisation Techniques
 - Interactive Elements Intelligent Optimisation Techniques
- 8. Staying Engaged with Intelligent Optimisation Techniques
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Intelligent Optimisation Techniques
- 9. Balancing eBooks and Physical Books Intelligent Optimisation Techniques
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Intelligent Optimisation Techniques
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Intelligent Optimisation Techniques
 - Setting Reading Goals Intelligent Optimisation Techniques
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Intelligent Optimisation Techniques

- Fact-Checking eBook Content of Intelligent Optimisation Techniques
- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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