# Artificial Bee Colony Based Fuzzy Clustering Algorithms

This book includes introduction of several algorithms which are exclusively for graph based problems, namely combinatorial optimization problems, path formation problems, etc. Each chapter includes the introduction of the basic traditional nature inspired algorithm and discussion of the modified version for discrete algorithms including problems pertaining to discussed algorithms.

The three-volume set LNAI 7196, LNAI 7197 and LNAI 7198 constitutes the refereed proceedings of the 4th Asian Conference on Intelligent Information and Database Systems, ACIIDS 2012, held in Kaohsiung, Taiwan in March 2012. The 161 revised papers presented were carefully reviewed and selected from more than 472 submissions. The papers included cover the following topics: intelligent database systems, data warehouses and data mining, natural language processing and computational linguistics, semantic Web, social networks and recommendation systems, collaborative systems and applications, e-bussiness and e-commerce systems, e-learning systems, information modeling and requirements engineering, information retrieval systems, intelligent agents and multi-agent systems, intelligent information systems, intelligent internet systems, intelligent optimization techniques, object-relational DBMS, ontologies and knowledge sharing, semi-structured and XML database systems, unified modeling language and unified processes, Web services and semantic Web, computer networks and communication systems.

This book provides comprehensive details of all Swarm Intelligence based Techniques available till date in a comprehensive manner along with their mathematical proofs. It will act as a foundation for authors, researchers and industry professionals. This monograph will present the latest state of the art research being done on varied Intelligent Technologies like sensor networks, machine learning, optical fiber communications, digital signal processing, image processing and many more.

Optimization of Type-2 Fuzzy Controllers Using the Bee Colony AlgorithmSpringer

The book, gathering the proceedings of the Future of Information and Communication Conference (FICC) 2018, is a remarkable collection of chapters covering a wide range of topics in areas of information and communication technologies and their applications to the real world. It includes 104 papers and posters by pioneering academic researchers, scientists, industrial engineers, and students from all around the world, which contribute to our understanding of relevant trends of current research on communication, data science, ambient intelligence, networking, computing, security and Internet of Things. This book collects state of the art chapters on all aspects of information science and communication technologies, from classical to intelligent, and covers both theory and applications of the latest technologies and methodologies. Presenting state-of-the-art intelligent methods and techniques for solving real-world problems along with a vision of the future research, this book is an interesting and useful resource. The chapter “Emergency Departments” is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com.

This book is a printed edition of the Special Issue "Kernel Methods and Hybrid Evolutionary Algorithms in Energy Forecasting" that was published in Energies

This book offers practical as well as conceptual knowledge of the latest trends, tools, techniques and methodologies of data analytics in smart cities. The smart city is an advanced technological area that is capable of understanding the environment by examining the data to improve the livability. The smart cities allow different kinds of wireless sensors to gather massive amounts, full speed and a broad range of city data. The smart city has a focus on data analytics facilitated through the IoT platforms. There is a need to customize the IoT architecture and infrastructures to address needs in application of specific domains of smart cities such as transportation, traffic, health and, environment. The smart cities will provide next generation development technologies for urbanization that includes the need of environmental sustainability, personalization, mobility, optimum energy utilization, better administrative services and higher quality of life. Each chapter presents the reader with an in-depth investigation regarding the possibility of data analytics perspective in smart cities. The book presents cutting-edge and future perspectives of smart cities, where industry experts, scientists, and scholars exchange ideas and experience about surrounding frontier technologies, breakthrough and innovative solutions and applications.

Metaheuristic algorithms are considered as generic optimization tools that can solve very complex problems characterized by having very large search spaces. Metaheuristic methods reduce the effective size of the search space through the use of effective search strategies. Book Features: Provides a unified view of the most popular metaheuristic methods currently in use Includes the necessary concepts to enable readers to implement and modify already known metaheuristic methods to solve problems Covers design aspects and implementation in MATLAB® Contains numerous examples of problems and solutions that demonstrate the power of these methods of optimization The material has been written from a teaching perspective and, for this reason, this book is primarily intended for undergraduate and postgraduate students of artificial intelligence, metaheuristic methods, and/or evolutionary computation. The objective is to bridge the gap between metaheuristic techniques and complex optimization problems that profit from the convenient properties of metaheuristic approaches. Therefore, engineer practitioners who are not familiar with metaheuristic computation will appreciate that the techniques discussed are beyond simple theoretical tools, since they have been adapted to solve significant problems that commonly arise in such areas.

This volume of Advances in Intelligent Systems and Computing contains accepted papers presented at WSC17, the 17th Online World Conference on Soft Computing in Industrial Applications, held from December 2012 to January 2013 on the Internet. WSC17 continues a successful series of scientific events started over a decade ago by the World Federation of Soft Computing. It brought together researchers from over the world interested in the ever advancing state of the art in the field. Continuous technological improvements make this online forum a viable gathering format for a world class conference. The aim of WSC17 was to disseminate excellent research results and contribute to building a global network of scientists interested in both theoretical foundations and practical applications of soft

computing. The 2012 edition of the Online World Conference on Soft Computing in Industrial Applications consisted of general track and special session on Continuous Features Discretization for Anomaly Intrusion Detectors Generation and special session on Emerging Theories and Applications in Transportation Science. A total of 33 high quality research papers were accepted after a rigorous review process and are provided in this book.

Modern optimization approaches have attracted an increasing number of scientists, decision makers, and researchers. As new issues in this field emerge, different optimization methodologies must be developed and implemented. The Handbook of Research on Emergent Applications of Optimization Algorithms is an authoritative reference source for the latest scholarly research on modern optimization techniques for solving complex problems of global optimization and their applications in economics and engineering. Featuring coverage on a broad range of topics and perspectives such as hybrid systems, non-cooperative games, and cryptography, this publication is ideally designed for students, researchers, and engineers interested in emerging developments in optimization algorithms.

This book describes recent advances on fuzzy logic, neural networks and optimization algorithms, as well as their hybrid combinations, and their application in areas such as intelligent control and robotics, pattern recognition, medical diagnosis, time series prediction and optimization of complex problems. The book contains a collection of papers focused on hybrid intelligent systems based on soft computing. There are some papers with the main theme of type-1 and type-2 fuzzy logic, which basically consists of papers that propose new concepts and algorithms based on type-1 and type-2 fuzzy logic and their applications. There are also some papers that present theory and practice of meta-heuristics in different areas of application. Another group of papers describes diverse applications of fuzzy logic, neural networks and hybrid intelligent systems in medical applications. There are also some papers that present theory and practice of neural networks in different areas of application. In addition, there are papers that present theory and practice of optimization and evolutionary algorithms in different areas of application. Finally, there are some papers describing applications of fuzzy logic, neural networks and meta-heuristics in pattern recognition problems.

The two-volume set LNAI 6591 and LNCS 6592 constitutes the refereed proceedings of the Third International Conference on Intelligent Information and Database Systems, ACIIDS 2011, held in Daegu, Korea, in April 2011. The 110 revised papers presented together with 2 keynote speeches were carefully reviewed and selected from 310 submissions. The papers are thematically divided into two volumes; they cover the following topics: intelligent database systems, data warehouses and data mining, natural language processing and computational linguistics, semantic Web, social networks and recommendation systems, technologies for intelligent information systems, collaborative systems and applications, e-business and e-commerce systems, e-learning systems, information modeling and requirements engineering, information retrieval systems, intelligent agents and multi-agent systems, intelligent information systems, intelligent internet systems, intelligent optimization techniques, object-relational DBMS, ontologies and knowledge sharing, semi-structured and XML database systems, unified modeling language and unified processes, Web services and semantic Web, computer networks and communication systems.

This book provides glimpses into contemporary research in information systems & technology, learning, artificial intelligence (AI), machine learning, and security and how it applies to the real world, but the ideas presented also span the domains of telehealth, computer vision, the role and use of mobile devices, brain–computer interfaces, virtual reality, language and image processing and big data analytics and applications. Great research arises from asking pertinent research questions. This book reveals some of the authors' "beautiful questions" and how they develop the subsequent "what if" and "how" questions, offering readers food for thought and whetting their appetite for further research by the same authors.

This book constitutes the proceedings of the First International Conference on Mining Intelligence and Knowledge Exploration, MIKE 2013, held in Tamil Nadu, India on December 2013. The 82 papers presented were carefully reviewed and selected from 334 submissions. The papers cover the topics such as feature selection, classification, clustering, image processing, network security, speech processing, machine learning, information retrieval, recommender systems, natural language processing, language, cognition and computation and other certain problems in dynamical systems.

EEG Brain Signal Classification for Epileptic Seizure Disorder Detection provides the knowledge necessary to classify EEG brain signals to detect epileptic seizures using machine learning techniques. Chapters present an overview of machine learning techniques and the tools available, discuss previous studies, present empirical studies on the performance of the NN and SVM classifiers, discuss RBF neural networks trained with an improved PSO algorithm for epilepsy identification, and cover ABC algorithm optimized RBFNN for classification of EEG signal. Final chapter present future developments in the field. This book is a valuable source for bioinformaticians, medical doctors and other members of the biomedical field who need the most recent and promising automated techniques for EEG classification. Explores machine learning techniques that have been modified and validated for the purpose of EEG signal classification using Discrete Wavelet Transform for the identification of epileptic seizures Encompasses machine learning techniques, providing an easily understood resource for both non-specialized readers and biomedical researchers Provides a number of experimental analyses, with their results discussed and appropriately validated

This book includes original research findings in the field of memetic algorithms for image processing applications. It gathers contributions on theory, case studies, and design methods pertaining to memetic algorithms for image processing applications ranging from defence, medical image processing, and surveillance, to computer vision, robotics, etc. The content presented here provides new directions for future research from both theoretical and practical viewpoints, and will spur further advances in the field.

This book gathers state-of-the-art research in computational engineering and bioengineering to facilitate knowledge exchange between various scientific communities. Computational engineering (CE) is a relatively new discipline that addresses the development and application of computational models and simulations often coupled with high-performance computing to solve complex physical problems arising in engineering analysis and design in the context of natural phenomena. Bioengineering (BE) is an important aspect of computational biology, which aims to develop and use efficient algorithms, data structures, and visualization and communication tools to model biological systems. Today, engineering approaches are essential for biologists, enabling them to analyse complex physiological processes, as well as for the pharmaceutical industry to support drug discovery and development programmes.

In this book, a new optimization technique for Interval Type-2 Fuzzy Logic Controller is introduced which is called "Optimal Defuzzification." This method uses an optimization algorithm instead of the Defuzzification stage to choose the best value inside the Type-1 Fuzzy interval set according to an objective function rather than averaging the borders of that set. The optimization algorithms used in this method are the Particle Swarm Optimizatin (PSO) presented by (Kennedy and Eberhart, 1998) and the Artificial Bee Colony (ABC) presented by (Karabo a, 2005). This optimized fuzzy controller was used to control a group of nonholonomic differential-drive mobile robots in different completely unknown 2-D environments with obstacles. A dynamic mathematical model was used to simulate the robots along with a collision avoidance technique between the moving agents through Velocity Obstacle Algorithm (VO) presented by (Fiorini and Shiller, 1993). Results show that using the Defuzzification-optimized fuzzy controller helps in choosing the collision-free path for every mobile robot to reach its target and avoid colliding with

other robots than using the ordinary defuzzified fuzzy controller."
Presents current developments in the field of evolutionary scheduling and demonstrates the applicability of evolutionary computational techniques to solving scheduling problems This book provides insight into the use of evolutionary computations (EC) in real-world scheduling, showing readers how to choose a specific evolutionary computation and how to validate the results using metrics and statistics. It offers a spectrum of real-world optimization problems, including applications of EC in industry and service organizations such as healthcare scheduling, aircraft industry, school timetabling, manufacturing systems, and transportation scheduling in the supply chain. It also features problems with different degrees of complexity, practical requirements, user constraints, and MOEC solution approaches. Evolutionary Computation in Scheduling starts with a chapter on scientometric analysis to analyze scientific literature in evolutionary computation in scheduling. It then examines the role and impacts of ant colony optimization (ACO) in job shop scheduling problems, before presenting the application of the ACO algorithm in healthcare scheduling. Other chapters explore task scheduling in heterogeneous computing systems and truck scheduling using swarm intelligence, application of sub-population scheduling algorithm in multi-population evolutionary dynamic optimization, task scheduling in cloud environments, scheduling of robotic disassembly in remanufacturing using the bees algorithm, and more. This book: Provides a representative sampling of real-world problems currently being tackled by practitioners Examines a variety of single-, multi-, and many-objective problems that have been solved using evolutionary computations, including evolutionary algorithms and swarm intelligence Consists of four main parts: Introduction to Scheduling Problems, Computational Issues in Scheduling Problems, Evolutionary Computation, and Evolutionary Computations for Scheduling Problems Evolutionary Computation in Scheduling is ideal for engineers in industries, research scholars, advanced undergraduates and graduate students, and faculty teaching and conducting research in Operations Research and Industrial Engineering.
This book presents a collection of the most recent hybrid methods for image processing. The algorithms included consider evolutionary, swarm, machine learning and deep learning. The respective chapters explore different areas of image processing, from image segmentation to the recognition of objects using complex approaches and medical applications. The book also discusses the theory of the methodologies used to provide an overview of the applications of these tools in image processing. The book is primarily intended for undergraduate and postgraduate students of science, engineering and computational mathematics, and can also be used for courses on artificial intelligence, advanced image processing, and computational intelligence. Further, it is a valuable resource for researchers from the evolutionary computation, artificial intelligence and image processing communities.
Neutrosophy (1995) is a new branch of philosophy that studies triads of the form (, , ), where  is an entity {i.e. element, concept, idea, theory, logical proposition, etc.}, is the opposite of , while is the neutral (or indeterminate) between them, i.e., neither  nor . Based on neutrosophy, the neutrosophic triplets were founded, which have a similar form (x, neut(x), anti(x)), that satisfy several axioms, for each element x in a given set. This collective book presents original research papers by many neutrosophic researchers from around the world, that report on the state-of-the-art and recent advancements of neutrosophic triplets, neutrosophic duplets, neutrosophic multisets and their algebraic structures – that have been defined recently in 2016 but have gained interest from world researchers. Connections between classical algebraic structures and neutrosophic triplet / duplet / multiset structures are also studied. And numerous neutrosophic applications in various fields, such as: multi-criteria decision making, image segmentation, medical diagnosis, fault diagnosis, clustering data, neutrosophic probability, human resource management, strategic planning, forecasting model, multi-granulation, supplier selection problems, typhoon disaster evaluation, skin lesson detection, mining algorithm for big data analysis, etc.
This book discusses the supervision of hybrid systems and presents models for control, optimization and storage. It provides a guide for practitioners as well as graduate and postgraduate students and researchers in both renewable energy and modern power systems, enabling them to quickly gain an understanding of stand-alone and grid-connected hybrid renewable systems. The book is accompanied by an online MATLAB package, which offers examples of each application to help readers understand and evaluate the performance of the various hybrid renewable systems cited. With a focus on the different configurations of hybrid renewable energy systems, it offers those involved in the field of renewable energy solutions vital insights into the control, optimization and supervision strategies for the different renewable energy systems.
This book and its companion volume, LNCS vol. 8794 and 8795 constitute the proceedings of the 5th International Conference on Swarm Intelligence, ICSI 2014, held in Hefei, China in October 2014. The 107 revised full papers presented were carefully reviewed and selected from 198 submissions. The papers are organized in 18 cohesive sections, 3 special sessions and one competitive session covering all major topics of swarm intelligence research and development such as novel swarm-based search methods; novel optimization algorithm; particle swarm optimization; ant colony optimization for travelling salesman problem; artificial bee colony algorithms; artificial immune system; evolutionary algorithms; neural networks and fuzzy methods; hybrid methods; multi-objective optimization; multi-agent systems; evolutionary clustering algorithms; classification methods; GPU-based methods; scheduling and path planning; wireless sensor networks; power system optimization; swarm intelligence in image and video processing; applications of swarm intelligence to management problems; swarm intelligence for real-world application.
This book is open access under a CC BY 4.0 license. This open access book offers comprehensive coverage on Ordered Fuzzy Numbers, providing readers with both the basic information and the necessary expertise to use them in a variety of real-world applications. The respective chapters, written by leading researchers, discuss the main techniques and applications, together with the advantages and shortcomings of these tools in comparison to other fuzzy number representation models. Primarily intended for engineers and researchers in the field of fuzzy arithmetic, the book also offers a valuable source of basic information on fuzzy models and an easy-to-understand reference guide to their applications for advanced undergraduate students, operations researchers, modelers and managers alike.

Frontiers of Higher Order Fuzzy Sets, provides a unified representation theorem for higher order fuzzy sets. The book elaborates on the concept of gradual elements and their integration with the higher order fuzzy sets. This book also is devoted to the introduction of new frameworks based on general T2FSs, IT2FSs, Gradual elements, Shadowed sets and rough sets. Such new frameworks will provide more

capable frameworks for real applications. Applications of higher order fuzzy sets in various fields will be discussed. In particular, the properties and characteristics of the new proposed frameworks would be studied. Such frameworks that are the result of the integration of general T2FSs, IT2FSs, gradual elements, shadowed sets and rough sets will be shown to be suitable to be applied in the fields of bioinformatics, business, management, ambient intelligence, medicine, cloud computing and smart grids.

This proceedings volume contains selected papers presented at the 2014 International Conference on Informatics, Networking and Intelligent Computing, held in Shenzhen, China. Contributions cover the latest developments and advances in the field of Informatics, Networking and Intelligent Computing.

This book offers a collection of high-quality peer-reviewed research papers presented at the Second International Conference on Communication and Computational Technologies (ICCCT 2019), held at Rajasthan Institute of Engineering and Technology, Jaipur, Rajasthan, India, on 30–31 August 2019. In contributions prepared by researchers from academia and industry alike, the book discusses a wide variety of industrial, engineering and scientific applications of emerging techniques.

Artificial Intelligence Techniques in IoT Sensor Networks is a technical book which can be read by researchers, academicians, students and professionals interested in artificial intelligence (AI), sensor networks and Internet of Things (IoT). This book is intended to develop a shared understanding of applications of AI techniques in the present and near term. The book maps the technical impacts of AI technologies, applications and their implications on the design of solutions for sensor networks. This text introduces researchers and aspiring academicians to the latest developments and trends in AI applications for sensor networks in a clear and well-organized manner. It is mainly useful for research scholars in sensor networks and AI techniques. In addition, professionals and practitioners working on the design of real-time applications for sensor networks may benefit directly from this book. Moreover, graduate and master’s students of any departments related to AI, IoT and sensor networks can find this book fascinating for developing expert systems or real-time applications. This book is written in a simple and easy language, discussing the fundamentals, which relieves the requirement of having early backgrounds in the field. From this expectation and experience, many libraries will be interested in owning copies of this work.

Different with the plain flexible job-shop scheduling problem (FJSP), the FJSP with routing flexibility is more complex and it can be deemed as the integrated process planning and (job shop) scheduling (IPPS) problem, where the process planning and the job shop scheduling two important functions are considered as a whole and optimized simultaneously to utilize the flexibility in a flexible manufacturing system. Although, many novel meta-heuristics have been introduced to address this problem and corresponding fruitful results have been observed; the dilemma in real-life applications of resultant scheduling schemes stems from the uncertainty or the nondeterminacy in processing times, since the uncertainty in processing times will disturb the predefined scheduling scheme by influencing unfinished operations. As a result, the performance of the manufacturing system will also be deteriorated. Nevertheless, research on such issue has seldom been considered before. This research focuses on the modeling and optimization method of the IPPS problem with uncertain processing times. The neutrosophic set is first introduced to model uncertain processing times. Due to the complexity in the math model, we developed an improved teaching-learning-based optimization(TLBO) algorithm to capture more robust scheduling schemes.

Nowadays, voluminous textbooks and monographs in fuzzy logic are devoted only to separate or some combination of separate facets of fuzzy logic. There is a lack of a single book that presents a comprehensive and self-contained theory of fuzzy logic and its applications. Written by world renowned authors, Lofti Zadeh, also known as the Father of Fuzzy Logic, and Rafik Aliev, who are pioneers in fuzzy logic and fuzzy sets, this unique compendium includes all the principal facets of fuzzy logic such as logical, fuzzy-set-theoretic, epistemic and relational. Theoretical problems are prominently illustrated and illuminated by numerous carefully worked-out and thought-through examples. This invaluable volume will be a useful reference guide for academics, practitioners, graduates and undergraduates in fuzzy logic and its applications.

Bio-inspired Computation in Unmanned Aerial Vehicles focuses on the aspects of path planning, formation control, heterogeneous cooperative control and vision-based surveillance and navigation in Unmanned Aerial Vehicles (UAVs) from the perspective of bio-inspired computation. It helps readers to gain a comprehensive understanding of control-related problems in UAVs, presenting the latest advances in bio-inspired computation. By combining bio-inspired computation and UAV control problems, key questions are explored in depth, and each piece is content-rich while remaining accessible. With abundant illustrations of simulation work, this book links theory, algorithms and implementation procedures, demonstrating the simulation results with graphics that are intuitive without sacrificing academic rigor. Further, it pays due attention to both the conceptual framework and the implementation procedures. The book offers a valuable resource for scientists, researchers and graduate students in the field of Control, Aerospace Technology and Astronautics, especially those interested in artificial intelligence and Unmanned Aerial Vehicles. Professor Haibin Duan and Dr. Pei Li, both work at Beihang University (formerly Beijing University of Aeronautics & Astronautics, BUAA). Prof Duan's academic website is: http://hbduan.buaa.edu.cn

This book focuses on the fields of fuzzy logic, bio-inspired algorithm; especially bee colony optimization algorithm and also considering the fuzzy control area. The main idea is that this areas together can to solve various control problems and to find better results. In this book we test the proposed method using two benchmark problems; the problem for filling a water tank and the problem for controlling the trajectory in an autonomous mobile robot. When Interval Type-2 Fuzzy Logic System is implemented to model the behavior of systems, the results show a better stabilization, because the analysis of uncertainty is better. For this reason we consider in this book the proposed method using fuzzy systems, fuzzy controllers, and bee colony optimization algorithm improve the behavior of the complex control problems.

Reliability technology plays an important role in the present era of industrial growth, optimal efficiency, and reducing hazards. This book provides insights into current advances and developments in reliability engineering, and the research presented is spread across all branches. It discusses interdisciplinary solutions to complex problems using different approaches to save money, time, and manpower. It presents methodologies of coping with uncertainty in reliability optimization through the usage of various techniques such as soft computing, fuzzy optimization, uncertainty, and maintenance scheduling. Case studies and real-world examples are presented along with applications that can be used in practice. This book will be useful to researchers, academicians, and practitioners working in the area of reliability and systems assurance engineering. Provides current advances and developments across different branches of engineering. Reviews and analyses case studies and real-world examples. Presents applications to be used in practice. Includes numerous examples to illustrate theoretical results.

This volume constitutes the proceedings of the 6th CCF Conference, Big Data 2018, held in Xi'an, China, in October 2018. The 32 revised full papers presented in this volume were carefully reviewed and selected from 880 submissions. The papers are organized in topical sections on natural language processing and text mining; big data analytics and smart computing; big data applications; the application of big data in machine learning; social networks and recommendation systems; parallel computing and storage of big data; data quality control and data governance; big data system and management.

This book gathers the refereed proceedings of the Artificial Intelligence and Industrial Applications (A2IA2020), the first installment of an annual international conference organized by the ENSAM-Meknes at Moulay Ismail University, Morocco. The 30 papers presented here were carefully reviewed and selected from 141 submissions by an international scientific committee. They address various aspects of artificial intelligence such as smart manufacturing, smart maintenance, smart supply chain management, supervised learning, unsupervised learning, reinforcement learning, graph-based and semi-supervised learning, neural networks, deep learning, planning and optimization, and other AI applications. The book is intended for AI experts, offering them a valuable overview of the status quo and a global outlook for the future, with many new and innovative ideas and recent important developments in AI applications, both of a foundational and practical nature. It will also appeal to non-experts who are curious about this timely and important subject.

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.

Soft computing and nature-inspired computing both play a significant role in developing a better understanding to machine learning. When studied together, they can offer new perspectives on the learning process of machines. The Handbook of Research on Soft Computing and Nature-Inspired Algorithms is an essential source for the latest scholarly research on applications of nature-inspired computing and soft computational systems. Featuring comprehensive coverage on a range of topics and perspectives such as swarm intelligence, speech recognition, and electromagnetic problem solving, this publication is ideally designed for students, researchers, scholars, professionals, and practitioners seeking current research on the advanced workings of intelligence in computing systems.

This book introduces readers to innovative bio-inspired computing techniques for image processing applications. It demonstrates how a significant drawback of image processing – not providing the simultaneous benefits of high accuracy and less complexity – can be overcome, proposing bio-inspired methodologies to help do so. Besides computing techniques, the book also sheds light on the various application areas related to image processing, and weighs the pros and cons of specific methodologies. Even though several such methodologies are available, most of them do not provide the simultaneous benefits of high accuracy and less complexity, which explains their low usage in connection with practical imaging applications, such as the medical scenario. Lastly, the book illustrates the methodologies in detail, making it suitable for newcomers to the field and advanced researchers alike.