Models And Algorithms For Global Optimization Essays Dedicated To Antanas Zilinskas On The Occasion Of His 60th Birthday Springer Optimization And Its Applications

This valuable source for graduate students and researchers provides a comprehensive introduction to current theories and applications in optimization methods and network models. Contributions to this book are focused on new efficient algorithms and rigorous mathematical theories, which can be used to optimize and analyze mathematical graph structures with massive size and high density induced by natural or artificial complex networks. Applications to social networks, power transmission grids, telecommunication networks, stock market networks, and human brain networks are presented. Chapters in this book cover the following topics: Linear max min fairness Heuristic approaches for high-quality solutions Efficient approaches for complex multi-criteria optimization problems Comparison of heuristic algorithms New heuristic iterative local search Power in network structures Clustering nodes in random graphs Power transmission grid structure Network decomposition problems Homogeneity hypothesis testing Network analysis of international migration Social networks with node attributes Testing hypothesis on degree distribution in the market graphs Machine learning applications to human brain network studies This proceeding is a result of The

6th International Conference on Network Analysis held at the Higher School of Economics, Nizhny Novgorod in May 2016. The conference brought together scientists and engineers from industry, government, and academia to discuss the links between network analysis and a variety of fields.

This research develops and applies new algorithms for the global optimization of computationally expensive functions using radial basis function (RBF) models. The first contribution is CORS-RBF, an iterative RBF method where the next function evaluation point is a global minimum of the RBF model satisfying some distance constraints. CORS-RBF converges to the global minimum of an arbitrary continuous function defined over a compact set. Computational experiments indicate that two implementations of CORS-RBF are better than alternative methods on a nonlinearly constrained test problem and are comparable to alternatives on some box-constrained test problems. The second contribution is Stochastic RBF (Stoch-RBF), another iterative method where the next evaluation point is the best point from a set of randomly generated points which are ranked according to a weighted score based on an RBF criterion and a distance criterion. If the global minimizer of a continuous function is unique, Stoch-RBF converges almost surely to this point. Computational experiments indicate that two implementations of Stoch-RBF are superior to the RBF method by Gutmann (2001) (Gutmann-RBF) on several test functions and on a 12-dimensional groundwater bioremediation problem (GWB12). The third contribution includes some strategies for improving the performance of

Gutmann-RBF and CORS-RBF when initialized by symmetric Latin hypercube designs. These strategies are complete restart and the restricted global minimization of the bumpiness function in Gutmann-RBF in some iterations. The fourth contribution is a framework for using local function approximation to enhance evolutionary optimization algorithms when applied to expensive functions. Computational experiments on several test functions and on GWB12 demonstrate that an evolution strategy can be enhanced by using local RBF models. The fifth contribution is the parallelization of Gutmann-RBF and CORS-RBF which resulted in good speedups on test problems when using up to 6 processors. The results show that neither Parallel Gutmann-RBF nor Parallel CORS-RBF dominates the other on all test problems and processor settings considered. The last contribution is MAPO-RBF, a parallel algorithm that uses a committee of RBF methods to generate several distinct points for simultaneous evaluation on multiple processors. Promising results for MAPO-RBF were obtained on several test functions and on GWB12.

The ability of parallel computing to process large data sets and handle time-consuming operations has resulted in unprecedented advances in biological and scientific computing, modeling, and simulations. Exploring these recent developments, the Handbook of Parallel Computing: Models, Algorithms, and Applications provides comprehensive coverage on a

17th International Workshop, WAW 2020, Warsaw, Poland, September 21–22, 2020, Proceedings

Multi-Model Algorithms for Optimization

NET 2016, Nizhny Novgorod, Russia, May 2016

Dynamics of Disasters—Key Concepts, Models, Algorithms, and Insights

Thinking with Examples for Effective Learning

The first book to integrate the decision-making process through mathematical modelling. Using the concept of a decision framework, the ideas of decision making, models, and algorithms are introduced to the reader by way of realistic and entertaining problems. The structure, form, illustrations, problems, and challenges in this book provide a unique presentation of the subject matter.

A recent approach for the construction of nonlinear optimization software has been to allow an algorithm to choose between two possible models to the objective function at each iteration. The model switching algorithm NL2SOL of Dennis, Qay and Welsch and the hybrid algorithms of Al-Baali and Fletcher have proven highly effective in practice. Although not explicitly formulated as multi-model methods, many other algorithms implicitly perform a model switch under certain circumstances (e.g., resetting a secant model to the exact value of the Hessian). We present a trust region formulation for multi-model methods which allows the efficient incorporation of an arbitrary number of models. Global convergence can be shown for three classes of algorithms under different assumptions on the

models. First, essentially any multi-model algorithm is globally convergent if each of the models is sufficiently well behaved. Second, algorithms based on the central feature of the NL2SOL switching system are globally convergent if one model is well behaved and each other model obeys a "sufficient predicted decrease" condition. No requirement is made that these alternate models be quadratic. Third, algorithms of the second type which directly enforce the "sufficient predicted decrease" condition are globally convergent if a single model is sufficiently well behaved.

This book constitutes the refereed proceedings of the Third International Workshop on Algorithms and Models for the Web-Graph, WAW 2004, held in Rome, Italy in October 2004. The 14 revised full papers presented together with an invited paper were carefully reviewed and selected from 31 submissions. The papers address a variety of topics related to the study of the Web-graph including random graphs, local network flow, network models, traffic driven Web-graph modeling, embedded communities, Web data mining, personalization, page rank computation, hierarchical information networks, Web crawling, community detection, and network communities.

Artificial Intelligence: Models, Algorithms and Applications

Models and Algorithms

Investigations on Models and Algorithms in

Variational Approaches for Image Restoration
Theory, Models, Algorithms and Applications
Models, Algorithms, and Technologies for Network Analysis
Global Optimization of Computationally Expensive Functions Using Serial and Parallel Radial Basis Function Algorithms

This book offers detailed surveys and systematic discussion of models, algorithms and applications for link mining, focusing on theory and technique, and related applications: text mining, social network analysis, collaborative filtering and bioinformatics.

Large-Scale Simulation: Models, Algorithms, and Applications gives you firsthand insight on the latest advances in large-scale simulation techniques. Most of the research results are drawn from the authors' papers in top-tier, peer-reviewed, scientific conference proceedings and journals. The first part of the book presents the fundamentals of large-scale simulation, including high-level architecture and runtime infrastructure. The second part covers middleware and software architecture for large-scale simulations, such as decoupled federate architecture, fault tolerant mechanisms, grid-enabled simulation, and federation communities. In the third part, the authors explore mechanisms—such as simulation cloning methods and algorithms—that support quick evaluation of alternative scenarios. The final part describes how distributed computing technologies and many-core architecture are used to study social phenomena. Reflecting the latest research in the field, this book guides

you in using and further researching advanced models and algorithms for large-scale distributed simulation. These simulation tools will help you gain insight into large-scale systems across many disciplines.

This volume results from the “Second International Conference on Dynamics of Disasters” held in Kalamata, Greece, June 29-July 2, 2015. The conference covered particular topics involved in natural and man-made disasters such as war, chemical spills, and wildfires. Papers in this volume examine the finer points of disasters through: Critical infrastructure protection Resiliency Humanitarian logistic Relief supply chains Cooperative game theory Dynamical systems Decision making under risk and uncertainty Spread of diseases Contagion Funding for disaster relief Tools for emergency preparedness Response, and risk mitigation Multi-disciplinary theories, tools, techniques and methodologies are linked with disasters from mitigation and preparedness to response and recovery. The interdisciplinary approach to problems in economics, optimization, government, management, business, humanities, engineering, medicine, mathematics, computer science, behavioral studies, emergency services, and environmental studies will engage readers from a wide variety of fields and backgrounds.

Decision Making, Models and Algorithms

Stochastic Global Optimization

Models, Algorithms, and Applications

Proceedings of the Second International Conference on Network Analysis

5th International Conference, LION 5, Rome, Italy, January 17-21, 2011, Selected Papers

Third International Workshop, WAW 2004, Rome, Italy, October 16, 2004. Proceedings

This book examines the main methodological and theoretical developments in stochastic global optimization. It is designed to inspire readers to explore various stochastic methods of global optimization by clearly explaining the main methodological principles and features of the methods. Among the book ' s features is a comprehensive study of probabilistic and statistical models underlying the stochastic optimization algorithms.

"Cluster analysis deals with the problem of organization of a collection of patterns into clusters based on a similarity measure. Various distance functions can be used to define this measure. Clustering problems with the similarity measure defined by the squared Euclidean distance have been studied extensively over the last five decades. However, problems with other Minkowski norms have attracted significantly less attention. The use of different similarity measures may help to identify different cluster structures of a data set. This in turn may help to significantly improve the decision making process. High dimensional data visualization is

another important task in the field of data mining and pattern recognition. To date, the principal component analysis and the self-organizing maps techniques have been used to solve such problems. In this thesis we develop algorithms for solving clustering problems in large data sets using various similarity measures. Such similarity measures are based on the squared L2 as well as L1 and L {infinity symbol} norms. In all cases the clustering problem is a global optimization problem with nonsmooth nonconvex objective functions. In many datasets these problems are large scale and the conventional global optimization algorithms are not efficient for solving such problems. Therefore we propose to apply local search methods for solving clustering problems, however the success of these methods strongly depends on the choice of starting cluster centers. To deal with the nonconvexity of the clustering problems we propose incremental algorithms for their solution which helps us to design a special procedure to generate starting points for cluster centers. Such an approach allows one to find global or near global solutions to the clustering problem. In order to solve nonsmooth clustering problems we apply both efficient nonsmooth optimization algorithms as

well as smoothing techniques. To test the proposed algorithms we apply them to solve clustering problems in small, medium size and large data sets. Furthermore, these algorithms are compared with many other clustering algorithms using results of numerical experiments. The Self Organizing Maps (SOM) is one of the topology visualizing tool that contains a set of neurons that gradually adapt to input data space by competitive learning and form clusters. The topology preservation of the SOM strongly depends on the learning process. Due to this limitation one cannot guarantee the convergence of the SOM in data sets with clusters of arbitrary shape. Therefore it is important to develop more accurate data visualization and clustering algorithms. In this thesis, Constrained SOM (CSOM) is proposed as the new version of the SOM by modifying the learning algorithm. The idea is to introduce an adaptive constraint parameter to the learning process to improve the topology preservation and mapping quality of the basic SOM. The computational complexity of the CSOM is less than that of the SOM. Mapping quality of the SOM is sensitive to the map topology and initialization of neurons. Thus in this research, a modified version of the SOM (MSOM) is proposed to improve the convergence of the

SOM. An initialization algorithm based on split and merge of clusters is introduced to initialize neurons of the SOM. The initialization algorithm speeds up the learning process in large high dimensional data sets. A topology based on this initialization is developed to minimize the vector quantization error and topology preservation of the self organizing maps. The CSOM and MSOM algorithms are tested on small to large size real-world datasets. Finally, a convolutional structure of the Recursive Modified SOM is proposed to cope with the diversity of styles and shapes in digits recognition. The proposed recursive structure can learn various behaviors of incoming images. The numerical results on the well-known MNIST dataset demonstrate the superiority of the proposed algorithm over existing SOM-based approaches." -- Abstract.

The theory of modern dynamical systems dates back to 1890 with studies by Poincaré on celestial mechanics. The tradition was continued by Birkhoff in the United States with his pivotal work on periodic orbits, and by the Moscow School in Russia (Liapunov, Andronov, Pontryagin). In the 1960s the field was revived by the emergence of the theory of chaotic attractors, and in modern years by accurate computer simulations. This book provides an

overview of recent developments in the theory of dynamical systems, presenting some significant advances in the definition of new models, computer algorithms, and applications. Researchers, engineers and graduate students in both pure and applied mathematics will benefit from the chapters collected in this volume.

Applications of Multi-objective, Mixed-integer and Hybrid Global Optimization Algorithms for Computationally Expensive Groundwater Problems

Integrating Surrogate Modeling to Improve DIRECT, DE and BA Global Optimization Algorithms for Computationally Intensive Problems

Handbook of Parallel Computing

Theory, Algorithms, Software, and Applications

International Journal of E-Adoption, Volume 3

Machine Learning Models and Algorithms for Big Data Classification

The paper proposes and approves new criteria for proximity of statistical and computational economic indexes, their convolution, which are used in indirect estimation of parameters of economic models. Parallel algorithms of global optimization to identify the parameters of these models are developed and tested. This book contains 112 papers selected from about 250 submissions to the 6th World Congress on Global

Optimization (WCGO 2019) which takes place on July 8 – 10, 2019 at University of Lorraine, Metz, France. The book covers both theoretical and algorithmic aspects of Nonconvex Optimization, as well as its applications to modeling and solving decision problems in various domains. It is composed of 10 parts, each of them deals with either the theory and/or methods in a branch of optimization such as Continuous optimization, DC Programming and DCA, Discrete optimization & Network optimization, Multiobjective programming, Optimization under uncertainty, or models and optimization methods in a specific application area including Data science, Economics & Finance, Energy & Water management, Engineering systems, Transportation, Logistics, Resource allocation & Production management. The researchers and practitioners working in Nonconvex Optimization and several application areas can find here many inspiring ideas and useful tools & techniques for their works.

Current research results in stochastic and deterministic global optimization including single and multiple objectives are explored and presented in this book by leading specialists from various fields. Contributions include applications to multidimensional data visualization, regression, survey calibration, inventory management, timetabling, chemical engineering, energy systems, and competitive facility location. Graduate students, researchers, and scientists in computer science, numerical analysis, optimization, and applied

mathematics will be fascinated by the theoretical, computational, and application-oriented aspects of stochastic and deterministic global optimization explored in this book. This volume is dedicated to the 70th birthday of Antanas Žilinskas who is a leading world expert in global optimization. Professor Žilinskas's research has concentrated on studying models for the objective function, the development and implementation of efficient algorithms for global optimization with single and multiple objectives, and application of algorithms for solving real-world practical problems.

Models and Algorithms for Global Optimization

Optimization of Complex Systems

Algorithms for Optimization

Simulation-based Algorithms for Markov Decision Processes

International Journal of Computational Models and Algorithms in Medicine (IJCMAM)

Models, Algorithms and Applications

Artificial Intelligence: Models, Algorithms and Applications presents focused information about applications of artificial intelligence (AI) in different areas to solve complex problems. The book presents 8 chapters that demonstrate AI based systems for vessel tracking, mental health assessment, radiology, instrumentation, business intelligence, education and criminology. The book concludes with a chapter on mathematical models of neural networks. The book serves as an introductory book about AI applications at undergraduate and graduate levels and as a reference for industry professionals working with AI based systems.

This book deals with the estimation of natural resources using the Monte Carlo methodology. It includes a set of tools to describe the morphological, statistical and stereological properties of spatial random models. Furthermore, the author presents a wide range of spatial models, including random sets and functions, point processes and object populations applicable to the geosciences. The text is based on a series of courses given in the USA and Latin America to civil, mining and petroleum engineers as well as graduate students in statistics. It is the first book to discuss the geostatistical simulation techniques in such a specific way.

The concept of 'shape' is at the heart of image processing and computer vision, yet researchers still have some way to go to replicate the human brain's ability to extrapolate meaning from the most basic of outlines. This volume reflects the advances of the last decade, which have also opened up tough new challenges in image processing. Today's applications require flexible models as well as efficient, mathematically justified algorithms that allow data processing within an acceptable timeframe. Examining important topics in continuous-scale and discrete modeling, as well as in modern algorithms, the book is the product of a key seminar focused on innovations in the field. It is a thorough introduction to the latest technology, especially given the tutorial style of a number of chapters. It also succeeds in identifying promising avenues for future research. The topics covered include mathematical morphology, skeletonization, statistical shape modeling, continuous-scale shape models such as partial differential equations and the theory of discrete shape descriptors. Some authors highlight new areas of enquiry such as partite skeletons, multi-component shapes, deformable shape models, and the use of distance fields. Combining the latest theoretical analysis with cutting-edge applications, this book will attract both academics and engineers.

Optimization in Engineering

Advances in Dynamical Systems Theory, Models, Algorithms and

Applications

Optimization of Complex Systems: Theory, Models, Algorithms and Applications

Algorithms and Models for the Web Graph

Large-Scale Simulation

Convexification and Global Optimization in Continuous and Mixed-Integer Nonlinear Programming

This textbook covers the fundamentals of optimization, including linear, mixed-integer linear, nonlinear, and dynamic optimization techniques, with a clear engineering focus. It carefully describes classical optimization models and algorithms using an engineering problem-solving perspective, and emphasizes modeling issues using many real-world examples related to a variety of application areas. Providing an appropriate blend of practical applications and optimization theory makes the text useful to both practitioners and students, and gives the reader a good sense of the power of optimization and the potential difficulties in applying optimization to modeling real-world systems. The book is intended for undergraduate and graduate-level teaching in industrial engineering and other engineering specialties. It is also of use to industry practitioners, due to the inclusion of real-world applications, opening the door to advanced courses on both modeling and algorithm development within the industrial engineering and operations research fields. Variational methods, which have proven to be very useful to solve the ill-posed inverse problems, have been generating a lot of research interest in the image restoration problem. It transforms the restoration problem into the optimization of a well-designed variational model. While the designed model is convex, the recovered image is the global solution found by an appropriate numerical algorithm and the quality of the restored image depends on the accuracy of the designed model. Thus, a lot of efforts have been put to propose a more

precise model that can produce a result with more pleasing visual quality. Besides, due to the high- dimension and the nonsmoothness of the imaging model, an efficient algorithm to find the exact solution of the variational model, is also of the research interest, since it influences the efficiency of the restoration techniques in the practical applications. In this thesis, we are interested in the designing of both the variational models for image restoration problems and the numerical algorithms to solve these models. The first objective of this thesis is to make improvements on two models for image denoising. For the multiplicative noise removal, we designed a regularizer based on the statistical property of the speckle noise, which can transform the traditional model (named by AA) into a convex one. Therefore, a global solution can be found independent of the initialization of the numerical algorithm. Moreover, the regularization term added on the AA model can help produce a sharper result. The second model is improved on the traditional ROF model by adding an edge regularization which incorporates an edge prior obtained from the observed image. Extensive experiments show that designed edge regularization has superiority to increase the texture of the recovered result and remove the staircase artifacts in the meanwhile. It is also presented that the edge regularization designed can be easily adapted into other restoration task, such as image deblurring. The second objective of this thesis is to study the numerical algorithms for a general nonsmooth imaging restoration model. As the imaging models are usually high-dimensional, the existing algorithms usually only use the first-order information of the image. Differently, a novel numerical algorithm based on the inexact Lagrangian function is proposed in this thesis, which exploits the second-order information to reach a superlinear convergence rate. Experiments show that the proposed algorithm is able to

efficiently reach the solution with higher accuracy compared to the state-of-the-art algorithm

Models and Algorithms for Global OptimizationEssays Dedicated to Antanas Žilinskas on the Occasion of His 60th BirthdaySpringer Science & Business Media

Innovations for Shape Analysis

Learning and Intelligent Optimization

Parallel Algorithms of Global Optimization in Identification of an Economic Model

Geostatistical Simulation

Algorithms and Models for the Web-Graph

International Journal of Computational Models and Algorithms in Medicine

Interest in constrained optimization originated with the simple linear pro gramming model since it was practical and perhaps the only computationally tractable model at the time. Constrained linear optimization models were soon adopted in numerous application areas and are perhaps the most widely used mathematical models in operations research and management science at the time of this writing. Modelers have, however, found the assumption of linearity to be overly restrictive in expressing the real-world phenomena and problems in economics, finance, business, communication, engineering design, computational biology, and other areas that frequently demand the use of nonlinear expressions and discrete variables in optimization models. Both of these extensions of the linear programming model are NP-hard, thus representing very challenging problems. On the brighter side,

recent advances in algorithmic and computing technology make it possible to re visit these problems with the hope of solving practically relevant problems in reasonable amounts of computational time. Initial attempts at solving nonlinear programs concentrated on the de velopment of local optimization methods guaranteeing globality under the assumption of convexity. On the other hand, the integer programming liter ature has concentrated on the development of methods that ensure global optima. The aim of this book is to marry the advancements in solving nonlinear and integer programming models and to develop new results in the more general framework of mixed-integer nonlinear programs (MINLPs) with the goal of devising practically efficient global optimization algorithms for MINLPs.

This book constitutes the proceedings of the 17th International Workshop on Algorithms and Models for the Web Graph, WAW 2020, held in Warsaw, Poland, in September 2020. The 12 full papers presented in this volume were carefully reviewed and selected from 19 submissions. The aim of the workshop was to further the understanding of graphs that arise from the Web and various user activities on the Web, and stimulate the development of high-performance algorithms and applications that exploit these graphs. Due to the corona pandemic the conference was postponed from June 2020 to September 2020. Rapid advances of computer modeling and

simulation tools and computing hardware have turned Model Based Design (MBD) a more viable technology. However, using a computationally intensive, "black-box" form MBD software tool to carry out design optimization leads to a number of key challenges. The non-unimodal objective function and/or non-convex feasible search region of the implicit numerical simulations in the optimization problems are beyond the capability of conventional optimization algorithms. In addition, the computationally intensive simulations used to evaluate the objective and/or constraint functions during the MBD process also make conventional stochastic global optimization algorithms unusable due to their requirement of a huge number of objective and constraint function evaluations. Surrogate model, or metamodeling-based global optimization techniques have been introduced to address these issues. Various surrogate models, including kriging, radial basis functions (RBF), multivariate adaptive regression splines (MARS), and polynomial regression (PR), are built using limited samplings on the original objective/constraint functions to reduce needed computation in the search of global optimum. In many real-world design optimization applications, computationally expensive numerical simulation models are used as objective and/or constraint functions. To solve these problems, enormous fitness function evaluations are required during the evolution based search process

when advanced Global Optimization algorithms, such as DIRECT search, Differential Evolution (DE), and Bat Algorithm (BA) are used. In this work, improvements have been made to three widely used global optimization algorithms, Divided Rectangles (DIRECT), Differential Evolution (DE), and Bat Algorithm (BA) by integrating appropriate surrogate modeling methods to increase the computation efficiency of these algorithms to support MBD. The superior performance of these new algorithms in comparison with their original counterparts are shown using commonly used optimization algorithm testing benchmark problems. Integration of the surrogate modeling methods have considerably improved the search efficiency of the DIRECT, DE, and BA algorithms with significant reduction on the Number of Function Evaluations (NFEs). The newly introduced algorithms are then applied to a complex engineering design optimization problem, the design optimization of floating wind turbine platform, to test its effectiveness in real-world applications. These newly improved algorithms were able to identify better design solutions using considerably lower NFEs on the computationally expensive performance simulation model of the design. The methods of integrating surrogate modeling to improve DIRECT, DE and BA global optimization searches and the resulting algorithms proved to be effective for solving complex and computationally intensive global

optimization problems, and formed a foundation for future research in this area.

A First Course

Kalamata, Greece, June–July 2015

Fast and Parallel Spectral Transform Algorithms for Global Shallow Water Models

Network and Discrete Location

Interpretable Machine Learning

Modeling Parallel, Distributed Computations Using ParaDiGM - a Case Study: the Adaptive Global Optimization Algorithm

This book constitutes the thoroughly refereed post-conference proceedings of the 5th International Conference on Learning and Intelligent Optimization, LION 5, held in Rome, Italy, in January 2011. The 32 revised regular and 3 revised short papers were carefully reviewed and selected from a total of 99 submissions. In addition to the contributions to the general track there are 11 full papers and 3 short papers presented at the following four special sessions; IMON: Intelligent Multiobjective OptimizatioN, LION-PP: Performance Prediction Self EAs: Self-tuning, self-configuring and self-generating evolutionary algorithms LION-SWAP: Software and Applications.*

This research focuses on the development and implementation of e cient optimization algorithms that can solve a range of computationally expensive groundwater simulationoptimization problems. Because groundwater model evaluations are expensive, it is important to find accurate solutions with relatively few function evaluations. As a result, all the algorithms tested in this research are evaluated on a limited computation budget. The first contribution to the thesis is a comparative evaluation of a novel multi-objective optimization algorithm, GOMORS, to three other popular multi-objective optimization methods on applications to groundwater management problems within a limited number of objective function evaluations. GOMORS involves surrogate modeling via Radial Basis

Function approximation and evolutionary strategies. The primary aim of the analysis is to assess the effectiveness of multi-objective algorithms in groundwater remediation management through multi-objective optimization within a limited evaluation budget. Three sets of dual objectives are evaluated. The objectives include minimization of cost, pollution mass remaining/pollution concentration, and cleanup time. Our results indicate that the overall performance of GOMORS is better than three other algorithms, AMALGAM, BORG and NSGA-II, in identifying good trade-off solutions. Furthermore, GOMORS incorporates modest parallelization to make it even more e cient. The next contribution is application of SO-MI, a surrogate model-based algorithm designed for computationally expensive nonlinear and multimodal mixed-integer black-box optimization problems, to solve groundwater remediation design problems (NL-MIP). SO-MI utilizes surrogate models to guide the search thus save the expensive function evaluation budget, and is able to find accurate solutions with relatively few function evaluations. We present numerical results to show the effectiveness and e ciency of SO-MI in comparison to Genetic Algorithm and NOMAD, which are two popular mixed-integer optimization algorithms. The results indicate that SO-MI is statistically better than GA and NOMAD in both study cases. Chapter 4 describes DYCORS-PEST, a novel method developed for high dimensional, computationally expensive, multimodal calibration problems when the computation budget is limited. This method integrates a local optimizer PEST into a global optimization framework DYCORS. The novelty of DYCORS-PEST is that it uses a memetic approach to improve the accuracy of the solution in which DYCORS selects the point at which the search switches to use of the local method PEST and when it switches back to the global phase. Since PEST is a very e cient and widely used local search algorithm for groundwater model calibration, incorporating PEST into DYCORS-PEST is a good enhancement for PEST and easy for PEST users to learn. DYCORS-PEST achieves the goal of solving the computationally expensive black-box problem by forming a response surface of the expensive function,

thus reducing the number of required expensive function evaluations for finding accurate solutions. The key feature of the global search method in DYCORS-PEST is that the number of decision variables being perturbed is dynamically adjusted in each iteration in order to be more effective for higher dimensional problems. Application of DYCORS-PEST to two 28parameter groundwater calibration problems indicate this new method outperforms PEST by a large margin for high dimensional, computationally expensive, groundwater calibration problems.

Markov decision process (MDP) models are widely used for modeling sequential decision-making problems that arise in engineering, economics, computer science, and the social sciences. This book brings the state-of-the-art research together for the first time. It provides practical modeling methods for many real-world problems with high dimensionality or complexity which have not hitherto been treatable with Markov decision processes.

Volume 2, issue 1, January-March 2011

Essays Dedicated to Antanas Žilinskas on the Occasion of His 60th Birthday

Link Mining: Models, Algorithms, and Applications

Advances in Stochastic and Deterministic Global Optimization

Nonsmooth Optimization Models and Algorithms for Data Clustering and Visualization

The research of Antanas Zilinskas has focused on developing models for global optimization, implementing and investigating the corresponding algorithms, and applying those algorithms to practical problems. This volume, dedicated to Professor Zilinskas on the occasion of his 60th birthday, contains new survey papers in which leading researchers from the field present various models and algorithms for solving global optimization problems.

This book presents machine learning models and

algorithms to address big data classification problems. Existing machine learning techniques like the decision tree (a hierarchical approach), random forest (an ensemble hierarchical approach), and deep learning (a layered approach) are highly suitable for the system that can handle such problems. This book helps readers, especially students and newcomers to the field of big data and machine learning, to gain a quick understanding of the techniques and technologies; therefore, the theory, examples, and programs (Matlab and R) presented in this book have been simplified, hardcoded, repeated, or spaced for improvements. They provide vehicles to test and understand the complicated concepts of various topics in the field. It is expected that the readers adopt these programs to experiment with the examples, and then modify or write their own programs toward advancing their knowledge for solving more complex and challenging problems. The presentation format of this book focuses on simplicity, readability, and dependability so that both undergraduate and graduate students as well as new researchers, developers, and practitioners in this field can easily trust and grasp the concepts, and learn them effectively. It has been written to reduce the mathematical complexity and help the vast majority of readers to understand the topics and get interested in the field. This book consists of four parts, with the total of 14 chapters. The first part mainly focuses on the topics that are needed to help analyze and understand data and big data. The second part covers the topics that can explain the systems required for processing big data. The third part presents the topics required to understand and

select machine learning techniques to classify big data. Finally, the fourth part concentrates on the topics that explain the scaling-up machine learning, an important solution for modern big data problems.

A comprehensive introduction to optimization with a focus on practical algorithms for the design of engineering systems. This book offers a comprehensive introduction to optimization with a focus on practical algorithms. The book approaches optimization from an engineering perspective, where the objective is to design a system that optimizes a set of metrics subject to constraints. Readers will learn about computational approaches for a range of challenges, including searching high-dimensional spaces, handling problems where there are multiple competing objectives, and accommodating uncertainty in the metrics. Figures, examples, and exercises convey the intuition behind the mathematical approaches. The text provides concrete implementations in the Julia programming language. Topics covered include derivatives and their generalization to multiple dimensions; local descent and first- and second-order methods that inform local descent; stochastic methods, which introduce randomness into the optimization process; linear constrained optimization, when both the objective function and the constraints are linear; surrogate models, probabilistic surrogate models, and using probabilistic surrogate models to guide optimization; optimization under uncertainty; uncertainty propagation; expression optimization; and multidisciplinary design optimization. Appendixes offer an introduction to the Julia language, test functions for evaluating algorithm performance, and

mathematical concepts used in the derivation and analysis of the optimization methods discussed in the text. The book can be used by advanced undergraduates and graduate students in mathematics, statistics, computer science, any engineering field, (including electrical engineering and aerospace engineering), and operations research, and as a reference for professionals.