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Multi-Agent Applications with Evolutionary Computation and Biologically Inspired Technologies: Intelligent Techniques for Ubiquity and Optimization - Chen, Shu-Heng 2010-07-31
"This book compiles numerous ongoing projects and research efforts in the design of agents in light of recent development in neurocognitive science and quantum physics, providing readers with interdisciplinary applications of multi-agents systems, ranging from economics to engineering"--Provided by publisher.
Intelligent Systems - Yung C. Shin 2017-12-19
Providing a thorough introduction to the field of soft computing techniques, Intelligent Systems: Modeling, Optimization, and Control covers every major technique in artificial intelligence in a clear and practical style. This book highlights current research and applications, addresses issues encountered in the development of applied systems, and describes a wide range of intelligent systems techniques, including neural networks, fuzzy logic, evolutionary strategy, and genetic algorithms. The book demonstrates concepts through simulation examples and practical experimental results. Case studies are also presented from each field to facilitate understanding.
Genetic Algorithms + Data Structures = Evolution Programs - Zbigniew Michalewicz 2013-03-09
Genetic algorithms are founded upon the principle of evolution, i.e., survival of the fittest. Hence evolution programming techniques, based on genetic algorithms, are applicable to many hard optimization problems, such as optimization of functions with linear and nonlinear constraints, the traveling salesman problem, and problems of scheduling, partitioning, and control. The importance of these techniques is still growing, since evolution programs are parallel in nature, and parallelism is one of the most promising directions in computer science. The book is self-contained and the only prerequisite is basic undergraduate mathematics. This third edition has been substantially revised and extended by three new chapters and by additional appendices containing working material to cover recent developments and a change in the perception of evolutionary computation.

An Introduction to Genetic Algorithms - Melanie Mitchell 1998-03-02
Genetic algorithms have been used in science and engineering as adaptive algorithms for solving practical problems and as computational models of natural evolutionary systems. This brief, accessible introduction describes some of the most interesting research in the field and also enables readers to implement and experiment with genetic algorithms on their own. It focuses in depth on a small set of important and interesting topics—particularly in machine learning, scientific modeling, and artificial life—and reviews a broad span of research, including the work of Mitchell and her colleagues. The descriptions of applications and modeling projects stretch beyond the strict boundaries of computer science to include dynamical systems theory, game theory, molecular biology, ecology, evolutionary biology, and population genetics, underscoring the exciting "general purpose" nature of genetic algorithms as search methods that can be employed across disciplines. An Introduction to Genetic Algorithms is accessible to students and researchers in any scientific discipline. It includes many thought and computer exercises that build on and reinforce the reader's understanding of the text. The first chapter introduces genetic algorithms and their terminology and describes two provocative applications in detail. The second and third chapters look at the use of genetic algorithms in machine learning (computer programs, data analysis and prediction, neural networks) and in scientific models (interactions among learning, evolution, and culture; sexual selection; ecosystems; evolutionary activity). Several approaches to the theory of genetic algorithms are discussed in depth in the fourth chapter. The fifth chapter takes up implementation, and the last chapter poses some currently unanswered questions and surveys prospects for the future of evolutionary computation.

Genetic and Evolutionary Computation - GECCO 2003 - Erick Cantú-Paz 2003-08-03
The set LNCS 2723 and LNCS 2724 constitutes the refereed proceedings of the Genetic and Evolutionaty Computation Conference, GECCO 2003, held in Chicago, IL, USA in July 2003. The 193 revised full papers and 93

poster papers presented were carefully reviewed and selected from a total of 417 submissions. The papers are organized in topical sections on a-life adaptive behavior, agents, and ant colony optimization; artificial immune systems; coevolution; DNA, molecular, and quantum computing; evolvable hardware; evolutionary robotics; evolution strategies and evolutionary programming; evolutionary sheduling routing; genetic algorithms; genetic programming; learning classifier systems; real-world applications; and search based softare engineering.

Evolutionary Computation in Combinatorial Optimization - Günther R. Raidl 2005-02-26
This volume contains the proceedings of EvoCOP 2005, the 5th European Conference on Evolutionary Computation in Combinatorial Optimization. It was held in Lausanne, Switzerland, on 30 March–1 April 2005...

Evolutionary Optimization Algorithms - Dan Simon 2013-06-13
A clear and lucid bottom-up approach to the basic principlesof evolutionary algorithms Evolutionary algorithms (EAs) are a type of artificialintelligence. EAs are motivated by optimization processes that weobserve in nature, such as natural selection, species migration,bird swarms, human culture, and ant colonies. This book discusses the theory, history, mathematics, andprogramming of evolutionary optimization algorithms. Featuredalgorithms include genetic algorithms, genetic programming, antcolony optimization, particle swarm optimization, differentialevolution, biogeography-based optimization, and many others. Evolutionary Optimization Algorithms: Provides a straightforward, bottom-up approach that assists thereader in obtaining a clear—but theoreticallyrigorous—understanding of evolutionary algorithms, with anemphasis on implementation Gives a careful treatment of recently developedEAs—including opposition-based learning, artificial fishswarms, bacterial foraging, and many others— and discussestheir similarities and differences from more well-establishedEAs Includes chapter-end problems plus a solutions manual availableonline for instructors Offers simple examples that provide the reader with anintuitive understanding of the theory Features source code for the examples available on the author'swebsite Provides advanced

mathematical techniques for analyzing EAs,including Markov modeling and dynamic system modeling Evolutionary Optimization Algorithms: Biologically Inspiredand Population-Based Approaches to Computer Intelligence is anideal text for advanced undergraduate students, graduate students,and professionals involved in engineering and computer science.

Genetic Programming Theory and Practice XV - Wolfgang Banzhaf 2018-07-05
These contributions, written by the foremost international researchers and practitioners of Genetic Programming (GP), explore the synergy between theoretical and empirical results on real-world problems, producing a comprehensive view of the state of the art in GP. Topics in this volume include: exploiting subprograms in genetic programming, schema frequencies in GP, Accessible AI, GP for Big Data, lexicase selection, symbolic regression techniques, co-evolution of GP and LCS, and applying ecological principles to GP. It also covers several chapters on best practices and lessons learned from hands-on experience. Readers will discover large-scale, real-world applications of GP to a variety of problem domains via in-depth presentations of the latest and most significant results.

Methods and Models in Artificial and Natural Computation. A Homage to Professor Mira's Scientific Legacy - Jose Mira 2009-06-18
The two-volume set LNCS 5601 and LNCS 5602 constitutes the refereed proceedings of the Third International Work-Conference on the Interplay between Natural and Artificial Computation, IWINAC 2009, held in Santiago de Compostela, Spain, in June 2009. The 108 revised papers presented are thematically divided into two volumes. The first volume includes papers relating the most recent collaborations with Professor Mira and contributions mainly related with theoretical, conceptual and methodological aspects linking AI and knowledge engineering with neurophysiology, clinics and cognition. The second volume contains all the contributions connected with biologically inspired methods and techniques for solving AI and knowledge engineering problems in different application domains.

Parallel Problem Solving from Nature, PPSN XI - Robert Schaefer 2010-09-03
This book constitutes the refereed proceedings of the 11th International Conference on Parallel Problem Solving from Nature - PPSN XI, held in Kraków, Poland, in September 2010. The 131 revised full papers were carefully reviewed and selected from 232 submissions. The conference covers a wide range of topics, from evolutionary computation to swarm intelligence, from bio-inspired computing to real world applications. Machine learning and mathematical games supported by evolutionary algorithms as well as memetic, agent-oriented systems are also represented.

Evolutionary Algorithms in Theory and Practice - Thomas Bäck 1996
A comparison of evolutionary algorithms. Organic evolution and problem solving. Biological background. Evolutionary algorithms and artificial intelligence. Evolutionary algorithms and global optimization. Early approaches. Specific evolutionary algorithms. Evolution strategies. Evolutionary programming. Genetic algorithms. Artificial landscapes. An empirical comparison. Extending genetic algorithms. Selection. Selection mechanisms. Experimental investigation of selection. Mutation. Simplified genetic algorithms. An experiment in meta-evolution. Summary and outlook. Data for the fletcher-powell function. Data from selection experiments. Software. The multiprocessor environment; mathematical symbols.

Applications of Evolutionary Computation in Chemistry - H.M. Cartwright 2004-03-12
H. M. Cartwright: An Introduction to Evolutionary Computation andEvolutionary Algorithms; B. Hartke: Application of Evolutionary Algorithms to Global Cluster Geometry Optimization; K.D.M. Harris, R.L. Johnston, S. Habershon: Application of Evolutionary Computation in Structure Solution from Diffraction Data; S. M.

Genetic Programming Theory and Practice - Rick Riolo 2003-11-30
Genetic Programming Theory and Practice explores the emerging interaction between theory and practice in the cutting-edge, machine learning method of Genetic Programming (GP). The material contained in

this contributed volume was developed from a workshop at the University of Michigan's Center for the Study of Complex Systems where an international group of genetic programming theorists and practitioners met to examine how GP theory informs practice and how GP practice impacts GP theory. The contributions cover the full spectrum of this relationship and are written by leading GP theorists from major universities, as well as active practitioners from leading industries and businesses. Chapters include such topics as John Koza's development of human-competitive electronic circuit designs; David Goldberg's application of "competent GA" methodology to GP; Jason Daida's discovery of a new set of factors underlying the dynamics of GP starting from applied research; and Stephen Freeland's essay on the lessons of biology for GP and the potential impact of GP on evolutionary theory. The book also includes chapters on the dynamics of GP, the selection of operators and population sizing, specific applications such as stock selection in emerging markets, predicting oil field production, modeling chemical production processes, and developing new diagnostics from genomic data. Genetic Programming Theory and Practice is an excellent reference for researchers working in evolutionary algorithms and for practitioners seeking innovative methods to solve difficult computing problems.

Introduction to Evolutionary Computing - Agoston E. Eiben 2013-03-14
The first complete overview of evolutionary computing, the collective name for a range of problem-solving techniques based on principles of biological evolution, such as natural selection and genetic inheritance. The text is aimed directly at lecturers and graduate and undergraduate students. It is also meant for those who wish to apply evolutionary computing to a particular problem or within a given application area. The book contains quick-reference information on the current state-of-the-art in a wide range of related topics, so it is of interest not just to evolutionary computing specialists but to researchers working in other fields.
Evolutionary Algorithms and Chaotic Systems - Ivan Zelinka 2010-02-23

This book discusses the mutual intersection of two fields of research: evolutionary computation, which can handle tasks such as control of various chaotic systems, and deterministic chaos, which is investigated as a behavioral part of evolutionary algorithms.
The Theory of Evolution Strategies - Hans-Georg Beyer 2013-03-09
Evolutionary algorithms, such as evolution strategies, genetic algorithms, or evolutionary programming, have found broad acceptance in the last ten years. In contrast to its broad propagation, theoretical analysis in this subject has not progressed as much. This monograph provides the framework and the first steps toward the theoretical analysis of Evolution Strategies (ES). The main emphasis is deriving a qualitative understanding of why and how these ES algorithms work.
Variants of Evolutionary Algorithms for Real-World Applications - Raymond Chiong 2011-11-13
Evolutionary Algorithms (EAs) are population-based, stochastic search algorithms that mimic natural evolution. Due to their ability to find excellent solutions for conventionally hard and dynamic problems within acceptable time, EAs have attracted interest from many researchers and practitioners in recent years. This book "Variants of Evolutionary Algorithms for Real-World Applications" aims to promote the practitioner's view on EAs by providing a comprehensive discussion of how EAs can be adapted to the requirements of various applications in the real-world domains. It comprises 14 chapters, including an introductory chapter re-visiting the fundamental question of what an EA is and other chapters addressing a range of real-world problems such as production process planning, inventory system and supply chain network optimisation, task-based jobs assignment, planning for CNC-based work piece construction, mechanical/ship design tasks that involve runtime-intense simulations, data mining for the prediction of soil properties, automated tissue classification for MRI images, and database query optimisation, among others. These chapters demonstrate how different types of problems can be successfully solved using variants of EAs and how the solution approaches are constructed, in a way that can be understood and reproduced with little prior knowledge on optimisation.

Evolutionary Intelligence - S. Sumathi 2008-05-15
This book provides a highly accessible introduction to evolutionary computation. It details basic concepts, highlights several applications of evolutionary computation, and includes solved problems using MATLAB software and C/C++. This book also outlines some ideas on when genetic algorithms and genetic programming should be used. The most difficult part of using a genetic algorithm is how to encode the population, and the author discusses various ways to do this.

Genetic and Evolutionary Computation — GECCO 2004 - Kalyanmoy Deb 2004-10-12
The two volume set LNCS 3102/3103 constitutes the refereed proceedings of the Genetic and Evolutionary Computation Conference, GECCO 2004, held in Seattle, WA, USA, in June 2004. The 230 revised full papers and 104 poster papers presented were carefully reviewed and selected from 460 submissions. The papers are organized in topical sections on artificial life, adaptive behavior, agents, and ant colony optimization; artificial immune systems, biological applications; coevolution; evolutionary robotics; evolution strategies and evolutionary programming; evolvable hardware; genetic algorithms; genetic programming; learning classifier systems; real world applications; and search-based software engineering.

Genetic Algorithms: Principles and Perspectives - Colin Reeves 2002-12-31
Genetic Algorithms: Principles and Perspectives: A Guide to GA Theory is a survey of some important theoretical contributions, many of which have been proposed and developed in the Foundations of Genetic Algorithms series of workshops. However, this theoretical work is still rather fragmented, and the authors believe that it is the right time to provide the field with a systematic presentation of the current state of theory in the form of a set of theoretical perspectives. The authors do this in the interest of providing students and researchers with a balanced foundational survey of some recent research on GAs. The scope of the book includes chapter-length discussions of Basic Principles, Schema Theory, "No Free Lunch", GAs and Markov Processes, Dynamical Systems Model, Statistical Mechanics Approximations, Predicting GA Performance, Landscapes and Test Problems.

Exploring Critical Approaches of Evolutionary Computation - Sarfraz, Muhammad 2018-07-13
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. Exploring Critical Approaches of Evolutionary Computation is a vital scholarly publication that explores the latest developments, methods, approaches, and applications of evolutionary models in a variety of fields. It also emphasizes evolutionary models of computation such as genetic algorithms, evolutionary strategies, classifier systems, evolutionary programming, genetic programming, and related fields such as swarm intelligence and other evolutionary computation techniques. Highlighting a range of pertinent topics such as neural networks, data mining, and data analytics, this book is designed for IT developers, IT theorists, computer engineers, researchers, practitioners, and upper-level students seeking current research on enhanced information exchange methods and practical aspects of computational systems.

Encyclopedia of Artificial Intelligence - Juan Ramon Rabunal 2009-01-01
"This book is a comprehensive and in-depth reference to the most recent developments in the field covering theoretical developments, techniques, technologies, among others"--Provided by publisher.

Computational Techniques for Modelling Learning in Economics - Thomas Brenner 2012-12-06
Computational Techniques for Modelling Learning in Economics offers a critical overview of the computational techniques that are frequently used for modelling learning in economics. It is a collection of papers, each of which focuses on a different way of modelling learning, including the techniques of evolutionary algorithms, genetic programming, neural networks, classifier systems, local interaction models, least squares learning, Bayesian learning, boundedly rational models and cognitive learning models. Each paper describes the technique it uses, gives an

example of its applications, and discusses the advantages and disadvantages of the technique. Hence, the book offers some guidance in the field of modelling learning in computation economics. In addition, the material contains state-of-the-art applications of the learning models in economic contexts such as the learning of preference, the study of bidding behaviour, the development of expectations, the analysis of economic growth, the learning in the repeated prisoner's dilemma, and the changes of cognitive models during economic transition. The work even includes innovative ways of modelling learning that are not common in the literature, for example the study of the decomposition of task or the modelling of cognitive learning.

Genetic Programming Theory and Practice XIV - Rick Riolo 2018-10-24
These contributions, written by the foremost international researchers and practitioners of Genetic Programming (GP), explore the synergy between theoretical and empirical results on real-world problems, producing a comprehensive view of the state of the art in GP. Chapters in this volume include: Similarity-based Analysis of Population Dynamics in GP Performing Symbolic Regression Hybrid Structural and Behavioral Diversity Methods in GP Multi-Population Competitive Coevolution for Anticipation of Tax Evasion Evolving Artificial General Intelligence for Video Game Controllers A Detailed Analysis of a PushGP Run Linear Genomes for Structured Programs Neutrality, Robustness, and Evolvability in GP Local Search in GP PRETSL: Distributed Probabilistic Rule Evolution for Time-Series Classification Relational Structure in Program Synthesis Problems with Analogical Reasoning An Evolutionary Algorithm for Big Data Multi-Class Classification Problems A Generic Framework for Building Dispersion Operators in the Semantic Space Assisting Asset Model Development with Evolutionary Augmentation Building Blocks of Machine Learning Pipelines for Initialization of a Data Science Automation Tool Readers will discover large-scale, real-world applications of GP to a variety of problem domains via in-depth presentations of the latest and most significant results.
Genetic Algorithms: Principles and Perspectives - Colin R. Reeves

2006-04-11
Genetic Algorithms: Principles and Perspectives: A Guide to GA Theory is a survey of some important theoretical contributions, many of which have been proposed and developed in the Foundations of Genetic Algorithms series of workshops. However, this theoretical work is still rather fragmented, and the authors believe that it is the right time to provide the field with a systematic presentation of the current state of theory in the form of a set of theoretical perspectives. The authors do this in the interest of providing students and researchers with a balanced foundational survey of some recent research on GAs. The scope of the book includes chapter-length discussions of Basic Principles, Schema Theory, "No Free Lunch", GAs and Markov Processes, Dynamical Systems Model, Statistical Mechanics Approximations, Predicting GA Performance, Landscapes and Test Problems.
Cellular Genetic Algorithms - Enrique Alba 2009-04-05
Cellular Genetic Algorithms defines a new class of optimization algorithms based on the concepts of structured populations and Genetic Algorithms (GAs). The authors explain and demonstrate the validity of these cellular genetic algorithms throughout the book with equal and parallel emphasis on both theory and practice. This book is a key source for studying and designing cellular GAs, as well as a self-contained primary reference book for these algorithms.
Advances in Computation and Intelligence - Zhihua Cai 2010-10-06
Volumes CCIS 107 and LNCS 6382 constitute the proceedings of the 5th International Symposium, ISICA 2010, held in Wuhan, China, in October 2010. ISICA 2010 attracted 267 submissions and through rigorous reviews 53 papers were included in LNCS 6382. The papers are presented in sections on ANT colony and particle swarm optimization, differential evolution, distributed computing, genetic algorithms, multi-agent systems, multi-objective and dynamic optimization, robot intelligence, statistic learning and system design.
Towards Hybrid and Adaptive Computing - Anupam Shukla 2010-09-18
Soft Computing today is a very vast field whose extent is beyond measure. The boundaries of this magnificent field are spreading at an

enormous rate making it possible to build computationally intelligent systems that can do virtually anything, even after considering the hostile practical limitations. Soft Computing, mainly comprising of Artificial Neural Networks, Evolutionary Computation, and Fuzzy Logic may itself be insufficient to cater to the needs of various kinds of complex problems. In such a scenario, we need to carry out amalgamation of same or different computing approaches, along with heuristics, to make fabulous systems for problem solving. There is further an attempt to make these computing systems as adaptable as possible, where the value of any parameter is set and continuously modified by the system itself. This book first presents the basic computing techniques, draws special attention towards their advantages and disadvantages, and then motivates their fusion, in a manner to maximize the advantages and minimize the disadvantages. Conceptualization is a key element of the book, where emphasis is on visualizing the dynamics going inside the technique of use, and hence noting the shortcomings. A detailed description of different varieties of hybrid and adaptive computing systems is given, paying special attention towards conceptualization and motivation. Different evolutionary techniques are discussed that hold potential for generation of fairly complex systems. The complete book is supported by the application of these techniques to biometrics. This not only enables better understanding of the techniques with the added application base, it also opens new dimensions of possibilities how multiple biometric modalities can be fused together to make effective and scalable systems.

EVOLVE- A Bridge between Probability, Set Oriented Numerics and Evolutionary Computation - Emilia Tantar 2012-09-14
The aim of this book is to provide a strong theoretical support for understanding and analyzing the behavior of evolutionary algorithms, as well as for creating a bridge between probability, set-oriented numerics and evolutionary computation. The volume encloses a collection of contributions that were presented at the EVOLVE 2011 international workshop, held in Luxembourg, May 25-27, 2011, coming from invited speakers and also from selected regular submissions. The aim of

EVOLVE is to unify the perspectives offered by probability, set oriented numerics and evolutionary computation. EVOLVE focuses on challenging aspects that arise at the passage from theory to new paradigms and practice, elaborating on the foundations of evolutionary algorithms and theory-inspired methods merged with cutting-edge techniques that ensure performance guarantee factors. EVOLVE is also intended to foster a growing interest for robust and efficient methods with a sound theoretical background. The chapters enclose challenging theoretical findings, concrete optimization problems as well as new perspectives. By gathering contributions from researchers with different backgrounds, the book is expected to set the basis for a unified view and vocabulary where theoretical advancements may echo in different domains.

Genetic Programming Theory and Practice III - Tina Yu 2006-06-18
Genetic Programming Theory and Practice III provides both researchers and industry professionals with the most recent developments in GP theory and practice by exploring the emerging interaction between theory and practice in the cutting-edge, machine learning method of Genetic Programming (GP). The contributions developed from a third workshop at the University of Michigan's Center for the Study of Complex Systems, where leading international genetic programming theorists from major universities and active practitioners from leading industries and businesses meet to examine and challenge how GP theory informs practice and how GP practice impacts GP theory. Applications are from a wide range of domains, including chemical process control, informatics, and circuit design, to name a few.

Introduction to Evolutionary Algorithms - Xinjie Yu 2010-06-10
Evolutionary algorithms are becoming increasingly attractive across various disciplines, such as operations research, computer science, industrial engineering, electrical engineering, social science and economics. Introduction to Evolutionary Algorithms presents an insightful, comprehensive, and up-to-date treatment of evolutionary algorithms. It covers such hot topics as: • genetic algorithms, • differential evolution, • swarm intelligence, and • artificial immune systems. The reader is introduced to a range of applications, as

Introduction to Evolutionary Algorithms demonstrates how to model real world problems, how to encode and decode individuals, and how to design effective search operators according to the chromosome structures with examples of constraint optimization, multiobjective optimization, combinatorial optimization, and supervised/unsupervised learning. This emphasis on practical applications will benefit all students, whether they choose to continue their academic career or to enter a particular industry. Introduction to Evolutionary Algorithms is intended as a textbook or self-study material for both advanced undergraduates and graduate students. Additional features such as recommended further reading and ideas for research projects combine to form an accessible and interesting pedagogical approach to this widely used discipline.

Evolutionary Algorithms in Theory and Practice - Thomas Back 1996-01-11

This book presents a unified view of evolutionary algorithms: the exciting new probabilistic search tools inspired by biological models that have immense potential as practical problem-solvers in a wide variety of settings, academic, commercial, and industrial. In this work, the author compares the three most prominent representatives of evolutionary algorithms: genetic algorithms, evolution strategies, and evolutionary programming. The algorithms are presented within a unified framework, thereby clarifying the similarities and differences of these methods. The author also presents new results regarding the role of mutation and selection in genetic algorithms, showing how mutation seems to be much more important for the performance of genetic algorithms than usually assumed. The interaction of selection and mutation, and the impact of the binary code are further topics of interest. Some of the theoretical results are also confirmed by performing an experiment in meta-evolution on a parallel computer. The meta-algorithm used in this experiment combines components from evolution strategies and genetic algorithms to yield a hybrid capable of handling mixed integer optimization problems. As a detailed description of the algorithms, with practical guidelines for usage and implementation, this work will interest a wide range of researchers in computer science and engineering

disciplines, as well as graduate students in these fields.

Genetic Programming Theory and Practice XVI - Wolfgang Banzhaf 2019-01-23

These contributions, written by the foremost international researchers and practitioners of Genetic Programming (GP), explore the synergy between theoretical and empirical results on real-world problems, producing a comprehensive view of the state of the art in GP. Topics in this volume include: evolving developmental programs for neural networks solving multiple problems, tangled program, transfer learning and outlier detection using GP, program search for machine learning pipelines in reinforcement learning, automatic programming with GP, new variants of GP, like SignalGP, variants of lexicase selection, and symbolic regression and classification techniques. The volume includes several chapters on best practices and lessons learned from hands-on experience. Readers will discover large-scale, real-world applications of GP to a variety of problem domains via in-depth presentations of the latest and most significant results.

Applied Evolutionary Algorithms for Engineers using Python - Leonardo Azevedo Scardua 2021-06-15

Applied Evolutionary Algorithms for Engineers with Python is written for students, scientists and engineers who need to apply evolutionary algorithms to practical optimization problems. The presentation of the theoretical background is complemented with didactical Python implementations of evolutionary algorithms that researchers have recently applied to complex optimization problems. Cases of successful application of evolutionary algorithms to real-world like optimization problems are presented, together with source code that allows the reader to gain insight into the idiosyncrasies of the practical application of evolutionary algorithms. Key Features Includes detailed descriptions of evolutionary algorithm paradigms Provides didactic implementations of the algorithms in Python, a programming language that has been widely adopted by the AI community Discusses the application of evolutionary algorithms to real-world optimization problems Presents successful cases of the application of evolutionary algorithms to complex

optimization problems, with auxiliary source code.

Artificial Immune Systems: A New Computational Intelligence Approach - Leandro Nunes de Castro 2002-09-23
Recently there has been a growing interest in the use of the biological immune system as a source of inspiration for solving complicated computational problems. The immune system involves many information-processing abilities including pattern recognition, learning, memory and inherent distributed parallel processing and for these, and other reasons, it has received a significant amount of interest as a metaphor within computing. This emerging field is known as Artificial Immune Systems (AIS), and applications of AIS include, machine learning, fault diagnosis, computer security, scheduling, virus detection and optimisation.

Evolutionary Computation in Data Mining - Ashish Ghosh 2006-06-22
Data mining (DM) consists of extracting interesting knowledge from re-world, large & complex data sets; and is the core step of a broader process, called the knowledge discovery from databases (KDD) process. In addition to the DM step, which actually extracts knowledge from data, the KDD process includes several preprocessing (or data preparation) and post-processing (or knowledge refinement) steps. The goal of data preprocessing methods is to transform the data to facilitate the application of a (or several) given DM algorithm(s), whereas the goal of knowledge refinement methods is to validate and refine discovered knowledge. Ideally, discovered knowledge should be not only accurate, but also comprehensible and interesting to the user. The total process is highly computation intensive. The idea of automatically discovering knowledge from databases is a very attractive and challenging task, both for academia and for industry. Hence, there has been a growing interest in data mining in several AI-related areas, including evolutionary algorithms (EAs). The main motivation for applying EAs to KDD tasks is that they are robust and adaptive search methods, which perform a global search in the space of candidate solutions (for instance, rules or another form of knowledge representation).

Evolutionary Computation in Combinatorial Optimization - Christine Zarges 2021-03-26

This book constitutes the refereed proceedings of the 21st European Conference on Evolutionary Computation in Combinatorial Optimization, EvoCOP 2021, held as part of Evo*2021, as Virtual Event, in April 2021, co-located with the Evo*2021 events: EvoMUSART, EvoApplications, and EuroGP. The 14 revised full papers presented in this book were carefully reviewed and selected from 42 submissions. They cover a wide spectrum of topics, ranging from the foundations of evolutionary algorithms and other search heuristics to their accurate design and application to combinatorial optimization problems. Fundamental and methodological aspects deal with runtime analysis, the structural properties of fitness landscapes, the study of core components of metaheuristics, the clever design of their search principles, and their careful selection and configuration. Applications cover problem domains such as scheduling, routing, search-based software engineering and general graph problems. The range of topics covered in this volume reflects the current state of research in the fields of evolutionary computation and combinatorial optimization.

Evolutionary Computation - David B. Fogel 2006-01-03
This Third Edition provides the latest tools and techniques thatenable computers to learn The Third Edition of this internationally acclaimed publicationprovides the latest theory and techniques for using simulatedevolution to achieve machine intelligence. As a leading advocatefor evolutionary computation, the author has successfullychallenged the traditional notion of artificial intelligence, whichessentially programs human knowledge fact by fact, but does nothave the capacity to learn or adapt as evolutionary computationdoes. Readers gain an understanding of the history of evolutionarycomputation, which provides a foundation for the author's thoroughpresentation of the latest theories shaping current research.Balancing theory with practice, the author provides readers withthe skills they need to apply evolutionary algorithms that cansolve many of today's intransigent problems by adapting to newchallenges and learning from experience. Several examples areprovided that demonstrate how these evolutionary algorithms learnto solve problems.

In particular, the author provides a detailedexample of how an algorithm is used to evolve strategies forplaying chess and checkers. As readers progress through the publication, they gain anincreasing appreciation and understanding of the relationshipbetween learning and intelligence. Readers familiar with theprevious editions will discover much new and revised material thatbrings the publication thoroughly up to date with the latestresearch, including the latest theories and empirical properties ofevolutionary computation. The Third Edition also features new knowledge-building aids.Readers will find a host of new and revised examples. New questionsat the end of each chapter enable readers to test their knowledge.Intriguing assignments that prepare readers to manage challenges inindustry and research have been added to the end of each chapter aswell. This is a must-have reference for professionals in computer andelectrical engineering; it provides them with the very latesttechniques and applications in machine intelligence. With itsquestion sets and assignments, the publication is also recommendedas a graduate-level textbook.

Differential Evolution - B. Vinoth Kumar 2022
This book addresses and disseminates state-of-the-art research and development of differential evolution (DE) and its recent advances, such as the development of adaptive, self-adaptive and hybrid techniques. Differential evolution is a population-based meta-heuristic technique for global optimization capable of handling non-differentiable, non-linear and multi-modal objective functions. Many advances have been made recently in differential evolution, from theory to applications. This book comprises contributions which include theoretical developments in DE, performance comparisons of DE, hybrid DE approaches, parallel and distributed DE for multi-objective optimization, software implementations, and real-world applications. The book is useful for researchers, practitioners, and students in disciplines such as optimization, heuristics, operations research and natural computing.

Evolutionary Learning: Advances in Theories and Algorithms - Zhi-Hua Zhou 2019-05-22
Many machine learning tasks involve solving complex optimization problems, such as working on non-differentiable, non-continuous, and non-unique objective functions; in some cases it can prove difficult to even define an explicit objective function. Evolutionary learning applies evolutionary algorithms to address optimization problems in machine learning, and has yielded encouraging outcomes in many applications. However, due to the heuristic nature of evolutionary optimization, most outcomes to date have been empirical and lack theoretical support. This shortcoming has kept evolutionary learning from being well received in the machine learning community, which favors solid theoretical approaches. Recently there have been considerable efforts to address this issue. This book presents a range of those efforts, divided into four parts. Part I briefly introduces readers to evolutionary learning and provides some preliminaries, while Part II presents general theoretical tools for the analysis of running time and approximation performance in evolutionary algorithms. Based on these general tools, Part III presents a number of theoretical findings on major factors in evolutionary optimization, such as recombination, representation, inaccurate fitness evaluation, and population. In closing, Part IV addresses the development of evolutionary learning algorithms with provable theoretical guarantees for several representative tasks, in which evolutionary learning offers excellent performance.