

Genetic Algorithms And Genetic Programming Modern Concepts And Practical Applications Numerical Insights

This book offers a basic introduction to genetic algorithms. It provides a detailed explanation of genetic algorithm concepts and examines numerous genetic algorithm optimization problems. In addition, the book presents implementation of optimization problems using C and C++ as well as simulated solutions for genetic algorithm problems using MATLAB 7.0. It also includes application case studies on genetic algorithms in emerging fields.

Please note that the content of this book primarily consists of articles available from Wikipedia or other free sources online. Pages: 40. Chapters: Chromosome (genetic algorithm), Clonal Selection Algorithm, Crossover (genetic algorithm), Cultural algorithm, Defining length, Edge recombination operator, Evolver (software), Fitness approximation, Fitness function, Fitness proportionate selection, Genetic algorithms in economics, Genetic algorithm scheduling, Genetic fuzzy systems, Genetic memory (computer science), Genetic operator, Genetic programming, Gene expression programming, Holland's schema theorem, HyperNEAT, Inheritance (genetic algorithm), List of genetic algorithm applications, Mutation (genetic algorithm), Neuroevolution of augmenting topologies, Parallel metaheuristic, Population-based incremental learning, Premature convergence, Promoter based genetic algorithm, Quality control and genetic algorithms, Reward-based selection, Santa Fe Trail problem, Schema (genetic algorithms), Search-based software engineering, Selection (genetic algorithm), Speciation (genetic algorithm), Stochastic universal sampling, Tournament selection, Truncation selection, Weasel program. Excerpt: In the computer science field of artificial intelligence, a genetic algorithm (GA) is a search heuristic that mimics the process of natural evolution. This heuristic (also sometimes called a metaheuristic) is routinely used to generate useful solutions to optimization and search problems. Genetic algorithms belong to the larger class of evolutionary algorithms (EA), which generate solutions to optimization problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover. Genetic algorithms find application in bioinformatics, phylogenetics, computational science, engineering, economics, chemistry, manufacturing, mathematics, physics, pharmacometrics and other fields. In a genetic algorithm, a population of candidate solutions...

Get a hands-on introduction to machine learning with genetic algorithms using Python. Genetic algorithms are one of the tools you can use to apply machine learning to finding good, sometimes even optimal, solutions to problems that have billions of potential solutions. This book gives you experience making genetic algorithms work for you, using easy-to-follow example projects that you can fall back upon when learning to use other machine learning tools and techniques. The step-by-step tutorials build your skills from Hello World! to optimizing one genetic algorithm with another, and finally genetic programming; thus preparing you to apply genetic algorithms to problems in your own field of expertise. Python is a high-level, low ceremony and powerful language whose code can be easily understood even by entry-level programmers. If you have experience with another programming language then you should have no difficulty learning Python by induction. Source code: <https://github.com/handcraftsman/GeneticAlgorithmsWithPython> Evolutionary Algorithms (EA) are powerful search and optimisation techniques inspired by the mechanisms of natural evolution. They imitate, on an abstract level, biological principles such as a population based approach, the inheritance of information, the variation of information via crossover/mutation, and the selection of individuals based on fitness. The most well-known class of EA are Genetic Algorithms (GA), which have received much attention not only in the scientific community lately. Other variants of EA, in particular Genetic Programming, Evolution Strategies, and Evolutionary Programming are less popular, though very powerful too. Traditionally, most practical applications of EA have appeared in the technical sector. Management problems, for a long time, have been a rather neglected field of EA-research. This is surprising, since the great potential of evolutionary approaches for the business and economics domain was recognised in pioneering publications quite a while ago. John Holland, for instance, in his seminal book *Adaptation in Natural and Artificial Systems* (The University of Michigan Press, 1975) identified economics as one of the prime targets for a theory of adaptation, as formalised in his reproductive plans (later called Genetic Algorithms).

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 include: modularity and scalability; evolvability; human-competitive results; the need for important high-impact GP-solvable problems;; the risks of search stagnation and of cutting off paths to solutions; the need for novelty; empowering GP search with expert knowledge; In addition, GP symbolic regression is thoroughly discussed, addressing such topics as guaranteed reproducibility of SR; validating SR results, measuring and controlling genotypic complexity; controlling phenotypic complexity; identifying, monitoring, and avoiding over-fitting; finding a comprehensive collection of SR benchmarks, comparing SR to machine learning. This text is for all GP explorers. 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.

This book constitutes the refereed proceedings of the 10th European Conference on Genetic Programming, EuroGP 2007, held in Valencia, Spain in April 2007 colocated with EvoCOP 2007. The 21 revised plenary papers and 14 revised poster papers were carefully reviewed and selected from 71 submissions. The papers address fundamental and theoretical issues, along with a wide variety of papers dealing with different application areas.

This study also presents a design of competent genetic programming, where traditional fixed recombination operators are replaced by building and sampling probabilistic models of promising candidate programs. The proposed scalable GP, called extended compact GP (eCGP), combines the ideas from extended compact genetic algorithm (eCGA) and

probabilistic incremental program evolution (PIPE) and adaptively identifies, propagates and exchanges important subsolutions of a search problem. Results show that eCGP scales cubically with problem size on both GP-easy and GP-hard problems.

Genetic programming (GP) is a systematic, domain-independent method for getting computers to solve problems automatically starting from a high-level statement of what needs to be done. Using ideas from natural evolution, GP starts from an ooze of random computer programs, and progressively refines them through processes of mutation and sexual recombination, until high-fitness solutions emerge. All this without the user having to know or specify the form or structure of solutions in advance. GP has generated a plethora of human-competitive results and applications, including novel scientific discoveries and patentable inventions. This unique overview of this exciting technique is written by three of the most active scientists in GP. See www.gp-field-guide.org.uk for more information on the book.

This book constitutes the refereed proceedings of the 14th European Conference on Genetic Programming, EuroGP 2011, held in Torino, Italy, in April 2011 co-located with the Evo* 2011 events. This 20 revised full papers presented together with 9 poster papers were carefully reviewed and selected from 59 submissions. The wide range of topics in this volume reflect the current state of research in the field, including representations, theory, novel operators and techniques, self organization, and applications.

The mathematics employed by genetic algorithms (GAs) are among the most exciting discoveries of the last few decades. But what exactly is a genetic algorithm? A genetic algorithm is a problem-solving method that uses genetics as its model of problem solving. It applies the rules of reproduction, gene crossover, and mutation to pseudo-organism Genetic Algorithms and Genetic Programming: Modern Concepts and Practical Applications discusses algorithmic developments in the context of genetic algorithms (GAs) and genetic programming (GP). It applies the algorithms to significant combinatorial optimization problems and describes structure identification using HeuristicLab as a platform for algorithm development. The book focuses on both theoretical and empirical aspects. The theoretical sections explore the important and characteristic properties of the basic GA as well as main characteristics of the selected algorithmic extensions developed by the authors. In the empirical parts of the text, the authors apply GAs to two combinatorial optimization problems: the traveling salesman and capacitated vehicle routing problems. To highlight the properties of the algorithmic measures in the field of GP, they analyze GP-based nonlinear structure identification applied to time series and classification problems. Written by core members of the HeuristicLab team, this book provides a better understanding of the basic workflow of GAs and GP, encouraging readers to establish new bionic, problem-independent theoretical concepts. By comparing the results of standard GA and GP implementation with several algorithmic extensions, it also shows how to substantially increase achievable solution quality.

The work described in this book was first presented at the Second Workshop on Genetic Programming, Theory and Practice, organized by the Center for the Study of Complex Systems at the University of Michigan, Ann Arbor, 13-15 May 2004. The goal of this workshop series is to promote the exchange of research results and ideas between those who focus on Genetic Programming (GP) theory and those who focus on the application of GP to various re- world problems. In order to facilitate these interactions, the number of talks and participants was small and the time for discussion was large. Further, participants were asked to review each other's chapters before the workshop. Those reviewer comments, as well as discussion at the workshop, are reflected in the chapters presented in this book. Additional information about the workshop, addendums to chapters, and a site for continuing discussions by participants and by others can be found at <http://cscs.umich.edu:8000/GPTP-20041>. We thank all the workshop participants for making the workshop an exciting and productive three days. In particular we thank all the authors, without whose hard work and creative talents, neither the workshop nor the book would be possible. We also thank our keynote speakers Lawrence ("Dave") Davis of NuTech Solutions, Inc., Jordan Pollack of Brandeis University, and Richard Lenski of Michigan State University, who delivered three thought-provoking speeches that inspired a great deal of discussion among the participants.

A gentle introduction to genetic algorithms. Genetic algorithms revisited: mathematical foundations. Computer implementation of a genetic algorithm. Some applications of genetic algorithms. Advanced operators and techniques in genetic search. Introduction to genetics-based machine learning. Applications of genetics-based machine learning. A look back, a glance ahead. A review of combinatorics and elementary probability. Pascal with random number generation for fortran, basic, and cobol programmers. A simple genetic algorithm (SGA) in pascal. A simple classifier system(SCS) in pascal. Partition coefficient transforms for problem-coding analysis.

This book constitutes the refereed proceedings of the 15th European Conference on Genetic Programming, EuroGP 2012, held in Málaga, Spain, in April 2012 co-located with the Evo* 2012 events. The 18 revised full papers presented together with 5 poster papers were carefully reviewed and selected from 46 submissions. The wide range of topics in this volume reflects the current state of research in the field, including different genres of GP (tree-based, grammar-based, Cartesian), theory, novel operators, and applications. The 12th European Conference on Genetic Programming, EuroGP 2009, took place in Tübingen, Germany during April 15–17 at one of the oldest universities in Germany, the Eberhard Karls Universität Tübingen. This volume contains manuscripts of the 21 oral presentations held during the day, and the nine posters that were presented during a dedicated evening session and reception. The topics covered in this volume reflect the current state of the art of genetic programming, including representations, theory, operators and analysis, feature selection, generalization, coevolution, and numerous applications. A rigorous, double-blind peer-review process was used, with each submission reviewed by at least three members of the international Program Committee. In total, 57 papers were submitted with an acceptance rate of 36% for full papers and an overall acceptance rate of 52% including posters. The MyReview management software originally developed by Philippe Rigaux, Bertrand Chardon, and other colleagues from the Université Paris-Sud Orsay, France was used for the reviewing process. We are sincerely grateful to Marc Schoenauer from INRIA, France for his continued assistance in hosting and managing

the software. Paper review assignments were largely done by an optimization process matching paper keywords to keywords of expertise submitted by reviewers.

This book constitutes the refereed proceedings of the 22nd European Conference on Genetic Programming, EuroGP 2019, held as part of Evo* 2019, in Leipzig, Germany, in April 2019, co-located with the Evo* events EvoCOP, EvoMUSART, and EvoApplications. The 12 revised full papers and 6 short papers presented in this volume were carefully reviewed and selected from 36 submissions. They cover a wide range of topics and reflect the current state of research in the field. With a special focus on real-world applications in 2019, the papers are devoted to topics such as the test data design in software engineering, fault detection and classification of induction motors, digital circuit design, mosquito abundance prediction, machine learning and cryptographic function design.

This comprehensive book gives an overview of the latest discussions in the application of genetic algorithms to solve engineering problems. Featuring real-world applications and an accompanying disk, giving the reader the opportunity to use an interactive genetic algorithms demonstration program.

This contributed volume, written by leading international researchers, reviews the latest developments of genetic programming (GP) and its key applications in solving current real world problems, such as energy conversion and management, financial analysis, engineering modeling and design, and software engineering, to name a few. Inspired by natural evolution, the use of GP has expanded significantly in the last decade in almost every area of science and engineering. Exploring applications in a variety of fields, the information in this volume can help optimize computer programs throughout the sciences. Taking a hands-on approach, this book provides an invaluable reference to practitioners, providing the necessary details required for a successful application of GP and its branches to challenging problems ranging from drought prediction to trading volatility. It also demonstrates the evolution of GP through major developments in GP studies and applications. It is suitable for advanced students who wish to use relevant book chapters as a basis to pursue further research in these areas, as well as experienced practitioners looking to apply GP to new areas. The book also offers valuable supplementary material for design courses and computation in engineering.

This book constitutes the refereed proceedings of the 8th workshop on the foundations of genetic algorithms, FOGA 2005, held in Aizu-Wakamatsu City, Japan, in January 2005. The 16 revised full papers presented provide an outstanding source of reference for the field of theoretical evolutionary computation including evolution strategies, evolutionary programming, and genetic programming, as well as the continuing growth in interactions with other fields such as mathematics, physics, and biology.

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.

In recent years, new paradigms have emerged to replace-or augment-the traditional, mathematically based approaches to optimization. The most powerful of these are genetic algorithms (GA), inspired by natural selection, and genetic programming, an extension of GAs based on the optimization of symbolic codes. Robust Control Systems with Genetic Algorithms builds a bridge between genetic algorithms and the design of robust control systems. After laying a foundation in the basics of GAs and genetic programming, it demonstrates the power of these new tools for developing optimal robust controllers for linear control systems, optimal disturbance rejection controllers, and predictive and variable structure control. It also explores the application of hybrid approaches: how to enhance genetic algorithms and programming with fuzzy logic to design intelligent control systems. The authors consider a variety of applications, such as the optimal control of robotic manipulators, flexible links and jet engines, and illustrate a multi-objective, genetic algorithm approach to the design of robust controllers with a gasification plant case study. The authors are all masters in the field and clearly show the effectiveness of GA techniques. Their presentation is your first opportunity to fully explore this cutting-edge approach to robust optimal control system design and exploit its methods for your own applications.

range from solving differential equations, routing problems to ?le type detection, object-oriented testing, agents. This year we received 48 submissions, of which 47 were sent to the reviewers.

This book constitutes the refereed proceedings of the 9th European Conference on Genetic Programming, EuroGP 2006, held in Budapest, Hungary, in April 2006, colocated with EvoCOP 2006. The 21 revised plenary papers and 11 revised poster papers were carefully reviewed and selected from 59 submissions. The papers address fundamental and theoretical issues, along with a wide variety of papers dealing with different application areas.

This book constitutes the refereed proceedings of the 11th European Conference on Genetic Programming, EuroGP 2008, held in Naples, Italy, in March 2008 colocated with EvoCOP 2008. The 21 revised plenary papers and 10 revised poster papers were carefully reviewed and selected from a total of 61 submissions. A great variety of topics are presented reflecting the current state of research in the field of genetic programming, including the latest work on representations, theory, operators and analysis, evolvable hardware, agents and numerous applications.

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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.

Cartesian Genetic Programming (CGP) is a highly effective and increasingly popular form of genetic programming. It represents programs in the form of directed graphs, and a particular characteristic is that it has a highly redundant genotype–phenotype mapping, in that genes can be noncoding. It has spawned a number of new forms, each improving on the efficiency, among them modular, or embedded, CGP, and self-modifying CGP. It has been applied to many problems in both computer science and applied sciences. This book contains chapters written by the leading figures in the development and application of CGP, and it will be essential reading for researchers in genetic programming and for engineers and scientists solving applications using these techniques. It will also be useful for advanced undergraduates and postgraduates seeking to understand and utilize a highly efficient form of genetic programming.

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: gene expression regulation, novel genetic models for glaucoma, inheritable epigenetics, combinatorics in genetic programming, sequential symbolic regression, system dynamics, sliding window symbolic regression, large feature problems, alignment in the error space, HUMIE winners, Boolean multiplexer function, and highly distributed genetic programming systems. Application areas include chemical process control, circuit design, financial data mining and bioinformatics. 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 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.

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. After a decade of development, genetic algorithms and genetic programming have become a widely accepted toolkit for computational finance. Genetic Algorithms and Genetic Programming in Computational Finance is a pioneering volume devoted entirely to a systematic and comprehensive review of this subject. Chapters cover various areas of computational finance, including financial forecasting, trading strategies development, cash flow management, option pricing, portfolio management, volatility modeling, arbitrage, and agent-based simulations of artificial stock markets. Two tutorial chapters are also included to help readers quickly grasp the essence of these tools. Finally, a menu-driven software program, Simple GP, accompanies the volume, which will enable readers without a strong programming background to gain hands-on experience in dealing with much of the technical material introduced in this work.

The contributions in this volume are written by the foremost international researchers and practitioners in the GP arena. They examine the similarities and differences between theoretical and empirical results on real-world problems. The text explores the synergy between theory and practice, producing a comprehensive view of the state of the art in GP application. Topics include: FINCH: A System for Evolving Java, Practical Autoconstructive Evolution, The Rubik Cube and GP Temporal Sequence Learning, Ensemble classifiers: AdaBoost and Orthogonal Evolution of Teams, Self-modifying Cartesian GP, Abstract Expression Grammar Symbolic Regression, Age-Fitness Pareto Optimization, Scalable Symbolic Regression by Continuous Evolution, Symbolic Density Models, GP Transforms in Linear Regression Situations, Protein Interactions in a Computational Evolution System, Composition of Music and Financial Strategies via GP, and Evolutionary Art Using Summed Multi-Objective Ranks. 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 in GP.

Advances in Genetic Programming reports significant results in improving the power of genetic programming, presenting techniques that can be employed immediately in the solution of complex problems in many areas, including machine learning and the simulation of autonomous behavior. Popular languages such as C and C++ are used in many of the applications and experiments, illustrating how genetic programming is not restricted to symbolic computing languages such as LISP. Researchers interested in getting started in genetic programming will find information on how to begin, on what public-domain code is available, and on how to become part of the active genetic programming community via electronic mail.

This is the third in a series of conferences devoted primarily to the theory and applications of artificial neural networks and genetic algorithms. The first such event was held in Innsbruck, Austria, in April 1993, the second in Ales, France, in April 1995. We are pleased to host the 1997 event in the mediaeval city of Norwich, England, and to carry on the fine tradition set by its predecessors of providing a relaxed and stimulating environment for both established and emerging researchers working in these and other, related fields. This series of conferences is unique in recognising the relation between the two main themes of artificial neural networks and genetic algorithms, each having its origin in a natural process fundamental to life on earth, and each now well established as a paradigm fundamental to continuing technological development through the solution of complex, industrial, commercial and financial problems. This is well illustrated in this volume by the numerous applications of both paradigms to new and challenging problems. The third key theme of the series, therefore, is the integration of both technologies, either through the use of the genetic algorithm to construct the most effective network architecture for the problem in hand, or, more recently, the use of neural networks as approximate fitness functions for a genetic algorithm searching for good solutions in an 'incomplete' solution space, i.e. one for which the fitness is not easily established for every possible solution instance.

The last few years have seen important advances in the use of genetic algorithms to address challenging optimization problems in industrial engineering. Genetic Algorithms and Engineering Design is the only book to cover the most recent technologies and their application to manufacturing, presenting a comprehensive and fully up-to-date treatment of genetic algorithms in industrial engineering and operations research. Beginning with a tutorial on genetic algorithm fundamentals and their use in solving constrained and combinatorial optimization problems, the book applies these techniques to problems in specific areas--sequencing, scheduling and production plans, transportation and vehicle routing, facility layout, location-allocation, and more. Each topic features a clearly written problem description, mathematical model, and summary of conventional heuristic algorithms. All algorithms are explained in intuitive, rather than highly-technical,

language and are reinforced with illustrative figures and numerical examples. Written by two internationally acknowledged experts in the field, Genetic Algorithms and Engineering Design features original material on the foundation and application of genetic algorithms, and also standardizes the terms and symbols used in other sources--making this complex subject truly accessible to the beginner as well as to the more advanced reader. Ideal for both self-study and classroom use, this self-contained reference provides indispensable state-of-the-art guidance to professionals and students working in industrial engineering, management science, operations research, computer science, and artificial intelligence. The only comprehensive, state-of-the-art treatment available on the use of genetic algorithms in industrial engineering and operations research . . . Written by internationally recognized experts in the field of genetic algorithms and artificial intelligence, Genetic Algorithms and Engineering Design provides total coverage of current technologies and their application to manufacturing systems. Incorporating original material on the foundation and application of genetic algorithms, this unique resource also standardizes the terms and symbols used in other sources--making this complex subject truly accessible to students as well as experienced professionals. Designed for clarity and ease of use, this self-contained reference:

- * Provides a comprehensive survey of selection strategies, penalty techniques, and genetic operators used for constrained and combinatorial optimization problems
- * Shows how to use genetic algorithms to make production schedules, solve facility/location problems, make transportation/vehicle routing plans, enhance system reliability, and much more
- * Contains detailed numerical examples, plus more than 160 auxiliary figures to make solution procedures transparent and understandable

Genetic Algorithms and Genetic Programming Modern Concepts and Practical Applications CRC Press

Computers that 'program themselves' has long been an aim of computer scientists. Recently genetic programming (GP) has started to show its promise by automatically evolving programs. Indeed in a small number of problems GP has evolved programs whose performance is similar to or even slightly better than that of programs written by people. The main thrust of GP has been to automatically create functions. While these can be of great use they contain no memory and relatively little work has addressed automatic creation of program code including stored data. This issue is the main focus of Genetic Programming, and Data Structures: Genetic Programming + Data Structures = Automatic Programming!. This book is motivated by the observation from software engineering that data abstraction (e.g., via abstract data types) is essential in programs created by human programmers. This book shows that abstract data types can be similarly beneficial to the automatic production of programs using GP. Genetic Programming and Data Structures: Genetic Programming + Data Structures = Automatic Programming! shows how abstract data types (stacks, queues and lists) can be evolved using genetic programming, demonstrates how GP can evolve general programs which solve the nested brackets problem, recognises a Dyck context free language, and implements a simple four function calculator. In these cases, an appropriate data structure is beneficial compared to simple indexed memory. This book also includes a survey of GP, with a critical review of experiments with evolving memory, and reports investigations of real world electrical network maintenance scheduling problems that demonstrate that Genetic Algorithms can find low cost viable solutions to such problems. Genetic Programming and Data Structures: Genetic Programming + Data Structures = Automatic Programming! should be of direct interest to computer scientists doing research on genetic programming, genetic algorithms, data structures, and artificial intelligence. In addition, this book will be of interest to practitioners working in all of these areas and to those interested in automatic programming.

Genetic Programming Theory and Practice V was developed from the fifth workshop at the University of Michigan's Center for the Study of Complex Systems. It aims to facilitate the exchange of ideas and information related to the rapidly advancing field of Genetic Programming (GP). This volume is a unique and indispensable tool for academics, researchers and industry professionals involved in GP, evolutionary computation, machine learning and artificial intelligence.

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