

Genetic Programming Iii Darwinian Invention And Problem Solving Vol 3

This volume records the proceedings of the 7th European Conference on Genetic Programming (EuroGP2002) which took place in Kinsale, Ireland on April 3–5, 2002, continuing an established tradition of yearly meetings among the most prominent researchers on Genetic Programming in Europe and beyond; their proceedings have always been published in the LNCS series by Springer-Verlag. EuroGP began life in Paris in 1998 as an international workshop (April 14– 15, LNCS 1391); a second workshop took place in Göteborg in 1999 (May 26– 27, LNCS 1598). Its first appearance as a conference was in the year 2000 in Edinburgh (April 15–16, LNCS 1802), followed by last year's conference held at Lake Como (April 18–19, LNCS 2038). Since the beginning, EuroGP has been co-located with a series of specialist workshops on applications of evolutionary algorithms (LNCS 1468, 1596, 1803, and 2037). In keeping with that tradition, the EvoWorkshops were also held in Kinsale this year at the same time (LNCS 2279). Genetic Programming (GP) is a branch of Evolutionary Computation in which populations of computer programs are made to evolve and adapt to so- ing a particular problem or task by a process that draws its inspiration from Biology and Darwinian evolution. GP is a very versatile technique, which has been applied to a wide range of tasks, as a quick inspection of the 32 papers in these proceedings will easily reveal: economics, robotics, engineering, statistics, pharmacology, electronics, and many areas in which they have been employed. Although the rate of application of GP to problems is steadily growing, this conference is characterized by its concern with the theoretical foundations of GP: investigation of these issues is attaining an ever increasing depth and maturity.

In this ground-breaking book, John Koza shows how this remarkable paradigm works and provides substantial empirical evidence that solutions to a great variety of problems from many different fields can be found by genetically breeding populations of computer programs. Genetic programming may be more powerful than neural networks and other machine learning techniques, able to solve problems in a wider range of disciplines. In this ground-breaking book, John Koza shows how this remarkable paradigm works and provides substantial empirical evidence that solutions to a great variety of problems from many different fields can be found by genetically breeding populations of computer programs. Genetic Programming contains a great many worked examples and includes a sample computer code that will allow readers to run their own programs. In getting computers to solve problems without being explicitly programmed, Koza stresses two points: that seemingly different problems from a variety of fields can be reformulated as problems of program induction, and that the recently developed genetic programming paradigm provides a way to search the space of possible computer programs for a highly fit individual computer program to solve the problems of program induction. Good programs are found by evolving them in a computer against a fitness measure instead of by sitting down and writing them.

This book brings together some of the most influential pieces of research undertaken around the world in design synthesis. It is the first comprehensive work of this kind and covers all three aspects of research in design synthesis: - understanding what constitutes and influences synthesis; - the major approaches to synthesis; - the diverse range of tools that are created to support this crucial design task. With its range of tools and methods covered, it is an ideal introduction to design synthesis for those intending to research in this area as well as being a valuable source of ideas for educators and practitioners of engineering design.

There are more than one billion documents on the Web, with the count continually rising at a pace of over one million new documents per day. As information increases, the motivation and interest in data warehousing and mining research and practice remains high in organizational interest. The Encyclopedia of Data Warehousing and Mining, Second Edition, offers thorough exposure to the issues of importance in the rapidly changing field of data warehousing and mining. This essential reference source informs decision makers, problem solvers, and data mining specialists in business, academia, government, and other settings with over 300 entries on theories, methodologies, functionalities, and applications.

Emerging Research and Opportunities

Genetic Programming Theory and Practice XVI

Encyclopedia of Data Warehousing and Mining, Second Edition

Genetic Programming Theory and Practice XIV

Evolvable Hardware

This book provides a collection of forty articles containing new material on both theoretical aspects of Evolutionary Computing (EC), and demonstrating the usefulness/success of it for various kinds of large-scale real world problems. Around 23 articles deal with various theoretical aspects of EC and 17 articles demonstrate the success of EC methodologies. These articles are written by leading experts of the field from different countries all over the world.

In this volume we present the contributions for the 18th European Conference on Genetic Programming (EuroGP 2005). The conference took place from 30 March to 1 April in Lausanne, Switzerland. EuroGP is a well-established conference and the only one exclusively devoted to genetic programming. All previous proceedings were published by Springer in the LNCS series. From the outset, EuroGP has been co-located with the EvoWorkshops focusing on applications of evolutionary computation. Since 2004, EvoCOP, the conference on evolutionary combinatorial optimization, has also been co-located with EuroGP, making this year's combined events one of the largest dedicated to evolutionary computation in Europe. Genetic programming (GP) is evolutionary computation that solves complex problems or tasks by evolving and adapting a population of computer programs, using Darwinian evolution and Mendelian genetics as its sources of inspiration. Some of the 34 papers included in these proceedings address foundational and theoretical issues and there is also a wide variety of papers dealing with different application areas, such as computer science, engineering, language processing, biology and computational design, demonstrating that GP is a powerful and practical problem-solving paradigm.

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.

The use of evolution for creative problem solving is one of the most exciting and potentially significant areas in computer science today. Evolutionary computation is a way of solving problems, or generating designs, using mechanisms derived from natural evolution. This book concentrates on applying important ideas in evolutionary computation to creative areas, such as art, music, architecture, and design. It shows how human interaction, new representations, and approaches such as open-ended evolution can extend the capabilities of evolutionary computation from optimization of existing solutions to innovation and the generation of entirely new and original solutions. This book takes a fresh look at creativity, exploring what it is and how the actions of evolution can resemble it. Examples of novel evolved solutions are presented in a variety of creative disciplines. The editors have compiled contributions by leading researchers in each discipline. If you are a savvy and curious computing professional, a computer-literate artist, musician or designer, or a specialist in evolutionary computation and its applications, you will find this a fascinating survey of the most interesting work being done in the area today. * Explores the use of evolutionary computation to generate novel creations including contemporary melodies, photo-realistic faces, jazz music in collaboration with a human composer, architectural designs, working electronic circuits, novel aircraft maneuvers, two- and three-dimensional art, and original proteins. * Presents resulting designs in black-and-white and color illustrations. * Includes a twin-format audio/CD-ROM with evolved music and hands-on activities for the reader, including evolved images, animations, and source-code related to the text. * Describes in full the methods used so that readers with sufficient skill and interest can replicate the work and extend it. * Is written for a general computer science audience, providing coherent and unified treatment across multiple disciplines.

On the Programming of Computers by Means of Natural Selection

Engineering Design Synthesis

Real-World Applications of Evolutionary Computing

Genetic Programming IV

Routine Human-Competitive Machine Intelligence

Introduction: Adaptation, Evolution, and Intelligence, Lashon Booker, Stephanie Forrest, Melanie Mitchell, and Rick Riolo. PART 1: GENETIC ALGORITHMS AND BEYOND. 1. Genetic Algorithms: A 30 Year Perspective, Kenneth DeJong. 2. Human-Competitive Machine Intelligence by Means of Genetic Algorithms, John R. Koza. 3. John Holland, Facetwise models, and Economy of Thought, David E. Goldberg. PART 2: COMPUTATION, ARTIFICIAL INTELLIGENCE, AND BEYOND. 4. An Early Graduate Program in Computers and Communications, Arthur W. Burks. 5. Had We But World Enough and Time, Oliver G. Selfridge. 6. Discrete Eve.

The increasingly active field of Evolutionary Computation (EC) provides valuable tools, inspired by the theory of natural selection and genetic inheritance, to problem solving, machine learning, and optimization in many real-world applications. Despite some early intuitions about EC, that can be dated back to the invention of computers, and a better formal definition of EC, made in the 1960s, the quest for real-world applications of EC only began in the late 1980s. The dramatic increase in computer performances in the last decade of the 20th century gave rise to a positive feedback process: EC techniques became more and more applicable, stimulating the growth of interest in their study, and allowing, in turn, new powerful EC paradigms to be devised. In parallel with new theoretical results, the number of fields to which EC is being applied is increasing day by day, along with the complexity of applications and application domains. In particular, industrially relevant fields, such as signal and image processing, computer vision, pattern recognition, industrial control, telecommunication, scheduling and timetabling, and aerospace engineering are employing EC techniques to solve complex real-world problems.

Evolvable hardware (EHW) refers to hardware whose architecture/structure and functions change dynamically and autonomously in order to improve its performance in carrying out tasks. The only single resource presenting both the fundamentals, and the latest advances in the field, this book teaches the basics of reconfigurable devices, why they are necessary and how they are designed.

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.

11th European Conference, EuroGP 2008, Naples, Italy, March 26-28, 2008, Proceedings

Search Methodologies

Automatic Re-engineering of Software Using Genetic Programming

A Field Guide to Genetic Programming

Advances in Genetic Programming

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 real-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.

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.

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 lexibase 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.

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.

5th International Conference, ICES 2003, Trondheim, Norway, March 17-20, 2003, Proceedings

Creative Evolutionary Systems

Genetic Programming II

Introduction to Evolutionary Algorithms

Perspectives on Adaptation in Natural and Artificial Systems

Automatic Quantum Computer Programming provides an introduction to quantum computing for non-physicists, as well as an introduction to genetic programming for non-computer-scientists. The book explores several ways in which genetic programming can support automatic quantum computer programming and presents detailed descriptions of specific techniques, along with several examples of their human-competitive performance on specific problems. Source code for the author's QGAME quantum computer simulator is included as an appendix, and pointers to additional online resources furnish the reader with an array of tools for automatic quantum computer programming.

Data mining involves the non-trivial extraction of implicit, previously unknown, and potentially useful information from databases. Genetic Programming (GP) and Inductive Logic Programming (ILP) are two of the approaches for data mining. This book first sets the necessary backgrounds for the reader, including an overview of data mining, evolutionary algorithms and inductive logic programming. It then describes a framework, called GGP (Generic Genetic Programming), that integrates GP and ILP based on a formalism of logic grammars. The formalism is powerful enough to represent context-sensitive information and domain-dependent knowledge. This knowledge can be used to accelerate the learning speed and/or improve the quality of the knowledge induced. A grammar-based genetic programming system called LOGENPRO (The LOGic grammar based GENetic PROgramming system) is detailed and tested on many problems in data mining. It is found that LOGENPRO outperforms some ILP systems. We have also illustrated how to apply LOGENPRO to emulate Automatically Defined Functions (ADFs) to discover problem representation primitives automatically. By employing various knowledge about the problem being solved, LOGENPRO can find a solution much faster than ADFs and the computation required by LOGENPRO is much smaller than that of ADFs. Moreover, LOGENPRO can emulate the effects of Strongly Type Genetic Programming and ADFs simultaneously and effortlessly. Data Mining Using Grammar Based Genetic Programming and Applications is appropriate for researchers, practitioners and clinicians interested in genetic programming, data mining, and the extraction of data from databases.

Genetic Programming IV: Routine Human-Competitive Machine Intelligence presents the application of GP to a wide variety of problems involving automated synthesis of controllers, circuits, antennas, genetic networks, and metabolic pathways. The book describes fifteen instances where GP has created an entity that either infringes or duplicates the functionality of a previously patented 20th-century invention, six instances where it has done the same with respect to post-2000 patented inventions, two instances where GP has created a patentable new invention, and thirteen other human-competitive results. The book additionally establishes: GP now delivers routine human-competitive machine intelligence GP is an automated invention machine GP can create general solutions to problems in the form of parameterized topologies GP has delivered qualitatively more substantial results in synchrony with the relentless iteration of Moore's Law

The first edition of Search Methodologies: Introductory Tutorials in Optimization and Decision Support Techniques was originally put together to offer a basic introduction to the various search and optimization techniques that students might need to use during their research, and this new edition continues this tradition. Search Methodologies has been expanded and brought completely up to date, including new chapters covering scatter search, GRASP, and very large neighborhood search. The chapter authors are drawn from across Computer Science and Operations Research and include some of the world's leading authorities in their field. The book provides useful guidelines

for implementing the methods and frameworks described and offers valuable tutorials to students and researchers in the field. "As I embarked on the pleasant journey of reading through the chapters of this book, I became convinced that this is one of the best sources of introductory material on the search methodologies topic to be found. The book's subtitle, "Introductory Tutorials in Optimization and Decision Support Techniques", aptly describes its aim, and the editors and contributors to this volume have achieved this aim with remarkable success. The chapters in this book are exemplary in giving useful guidelines for implementing the methods and frameworks described." Fred Glover, Leeds School of Business, University of Colorado Boulder, USA "[The book] aims to present a series of well written tutorials by the leading experts in their fields. Moreover, it does this by covering practically the whole possible range of topics in the discipline. It enables students and practitioners to study and appreciate the beauty and the power of some of the computational search techniques that are able to effectively navigate through search spaces that are sometimes inconceivably large. I am convinced that this second edition will build on the success of the first edition and that it will prove to be just as popular." Jacek Blazewicz, Institute of Computing Science, Poznan University of Technology and Institute of Bioorganic Chemistry, Polish Academy of Sciences

Darwinian Invention and Problem Solving

Genetic Programming Theory and Practice

Evolvable Systems: From Biology to Hardware

Genetic Programming Theory and Practice II

Optimized Genetic Programming Applications: Emerging Research and Opportunities

Genetic programming is a method for getting a computer to solve a problem by telling it what needs to be done instead of how to do it. Koza, Bennett, Andre, and Keane present genetically evolved solutions to dozens of problems of design, optimal control, classification, system identification, function learning, and computational molecular biology. Among the 14 results competitive with human-produced results, including 10 rediscoveries of previously patented inventions. Researchers in artificial intelligence, machine learning, evolutionary computation, and genetic algorithms will find this an essential reference to the most recent and most important results in the rapidly growing field of genetic programming. how the success of genetic programming arises from seven fundamental differences distinguishing it from conventional approaches to artificial intelligence and machine learning * Describes how genetic programming uses architecture-altering operations to make on-the-fly decisions on whether to use subroutines, loops, recursions, and memory * Demonstrates how genetic programming possesses 16 attributes that can reasonably be expected of a system for automatically creating computer programs * Presents the general-purpose Genetic Programming Problem Solver * Focuses on the previously unsolved problem of analog circuit synthesis, presenting genetically evolved filters, amplifiers, computational circuits, a radio controller circuit, source identification circuits, a temperature-measuring circuit, a voltage reference circuit, and more * Introduces evolvable hardware in the form of field-programmable gate arrays * Includes an introduction to genetic programming for the uninitiated 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: multi-objective genetic programming, learning heuristics, Knowledge-based Genetic Programming, Evolution of Everything (EVE), lexibase selection, behavioral program synthesis, symbolic regression with noisy training data, graph databases, and multidimensional clustering. It also covers several chapters on best practices and lesson learned from hands-on experience. Additional application areas include financial operations, genetic analysis, and predicting product choice. 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 4th European Conference on Genetic Programming, EuroGP 2001, held at Lake Como, Italy in April 2001. The 17 revised full papers and 13 research posters presented were carefully reviewed and selected during a rigorous double-blind refereeing process out of 42 submissions. All current aspects of genetic programming are addressed, ranging from theoretical and foundational issues to applications in a variety of fields such as robotics, artificial retina, character recognition, financial prediction, digital filter and electronic circuit design, image processing, data fusion, and bio-sequencing.

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 Population Dynamics in GP 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.

A Genetic Programming Approach

Genetic Programming III

5th European Conference, EuroGP 2002, Kinsale, Ireland, April 3-5, 2002. Proceedings

Second European Workshop, EuroGP'99, Göteborg, Sweden, May 26-27, 1999, Proceedings

Linear Genetic Programming

This book constitutes the refereed proceedings of the Third European Conference on Genetic Programming, EuroGP 2000, held in Scotland, UK, in April 2000. The 14 revised full papers presented together with 13 short papers were carefully reviewed and selected from a total of 39 submissions. All relevant aspects of genetic programming are addressed, ranging from theoretical and foundational issues to applications in a variety of fields such as automatic design, pattern recognition, robotic control, music and image processing, and symbolic regression.

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 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 Second European Workshop on Genetic Programming, EuroPG '99, held in Göteborg, Sweden in May 1999. The 12 revised full papers and 11 posters presented have been carefully reviewed and selected for inclusion in the book. All the relevant aspects of genetic programming are addressed ranging from traditional and foundational issues to applications in a variety of fields.

Automatic Discovery of Reusable Programs

Automatic Quantum Computer Programming

Advances in Evolutionary Computing

An Introduction to Theory and Applications with Matlab

Data Mining Using Grammar Based Genetic Programming and Applications

Automatic Re-engineering of Software Using Genetic Programming describes the application of Genetic Programming to a real world application area - software re-engineering in general and automatic parallelization specifically. Unlike most uses of Genetic Programming, this book evolves sequences of provable transformations rather than actual programs. It demonstrates that the benefits of this approach are twofold: first, the time required for evaluating a population is drastically reduced, and second, the transformations can subsequently be used to prove that the new program is functionally equivalent to the original. Automatic Re-engineering of Software Using Genetic Programming shows that there are applications where it is more practical to use GP to assist with software engineering rather than to entirely replace it. It also demonstrates how the author isolated aspects of a problem that were particularly suited to GP, and used traditional software engineering techniques in those areas for which they were adequate. Automatic Re-engineering of Software Using Genetic Programming is an excellent resource for researchers in this exciting new field.

Explanation of genetic programming, which seeks to make computer do what needs to be done without being told exactly how to do it by automatically creating a working computer program from a high level statement of the problem. Includes a bibliography at the end of the video.

This book is a tutorial survey of the methodologies that are at the confluence of several fields: Computer Science, Mathematics and Operations Research. It provides a carefully structured and integrated treatment of the major technologies in optimization and search methodology. The chapter authors are drawn from across Computer Science and Operations Research and include some of the world's leading authorities in their field. It can be used as a textbook or a reference book to learn and apply these methodologies to a wide range of today's problems.

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.

8th European Conference, EuroGP 2005, Lausanne, Switzerland, March 30-April 1, 2005, Proceedings

Darwinian Invention And Problem Solving, Ntsc Video

6th European Conference, EuroGP 2003, Essex, UK, April 14-16, 2003. Proceedings

Introductory Tutorials in Optimization and Decision Support Techniques

Evolutionary Intelligence

Linear Genetic Programming presents a variant of Genetic Programming that evolves imperative computer programs as linear sequences of instructions, in contrast to the more traditional functional expressions or syntax trees. Typical GP phenomena, such as non-effective code, neutral variations, and code growth are investigated from the perspective of linear GP. This book serves as a reference for researchers; it includes sufficient introductory material for students and newcomers to the field.

Data is more valuable than ever in the twenty-first century, and tremendous amounts of data are being generated every second. With a fast-growing information industry, engineers are required to develop new tools and techniques that increase human capabilities of mining useful knowledge from the vast amounts of data. Optimized Genetic Programming Applications: Emerging Research and Opportunities is an essential reference source that explores the concept of genetic programming and its role in managing engineering problems. It also examines genetic programming as a supervised machine learning technique, focusing on implementation and application. As a resource that details both the theoretical aspects and implementation of genetic programming, this book is a useful source for academicians, biological engineers, computer programmers, scientists, researchers, and upper-level students seeking the latest research on genetic programming.

This book provides both the research and practitioner communities with a comprehensive coverage of the metaheuristic methodologies that have proven to be successful in a wide variety of real-world problem settings. Moreover, it is these metaheuristic strategies that hold particular promise for success in the future. The various chapters serve as stand alone presentations giving both the necessary background underpinnings as well as practical guides for implementation.

The idea of evolving machines, whose origins can be traced to the cybernetics movementofthe1940sand1950s,hasrecentlyresurgedintheformofthenascent ?eld of bio-inspired systems and evolvable hardware. The inaugural workshop, Towards Evolvable Hardware, took place in Lausanne in October 1995, followed by the First International Conference on Evolvable Systems: From Biology to Hardware (ICES), held in Tsukuba, Japan in October 1996. The second ICES conference was held in Lausanne in September 1998, with the third and fourth being held in Edinburgh, April 2000 and Tokyo, October 2001 respectively. This has become the leading conference in the ?eld of evolvable systems and the 2003 conference promised to be at least as good as, if not better than, the four that preceded it. The ?fth international conference was built on the success of its predec- sors, aiming at presenting the latest developments in the ?eld. In addition, it brought together researchers who use biologically inspired concepts to imp- ment real systems in arti?cial intelligence, arti?cial life, robotics, VLSI design and related domains. We would say that this ?fth conference followed on from the previous four in that it consisted of a number of high-quality interesting thought-provoking papers.

Genetic Programming Theory and Practice XIII

Understanding, Approaches and Tools

European Conference, EuroGP 2000 Edinburgh, Scotland, UK, April 15-16, 2000 Proceedings

4th European Conference, EuroGP 2001 Lake Como, Italy, April 18-20, 2001 Proceedings

Genetic Programming

In this volume we present the accepted contributions to the Sixth European Conference on Genetic Programming (EuroGP 2003) which took place at the University of Essex, UK on 14-16 April 2003. EuroGP is now a well-established conference and, without any doubt, the most important international event - voted to Genetic Programming occurring in Europe. The proceedings have all been published by Springer-Verlag in the LNCS series. EuroGP began as an - ternational workshop in Paris, France in 1998 (14-15 April, LNCS 1391). Sub- quently the workshop was held in G" oteborg, Sweden in 1999 (26-27 May, LNCS 1598) and then EuroGP became an annual conference: in 2000 in Edinburgh, UK (15-16 April, LNCS 1802), in 2001 in Lake Como, Italy (18-19 April, LNCS 2038) and in 2002 in Kinsale, Ireland (3-5 April, LNCS 2278). From the outset, there have always been specialized workshops, co-located with EuroGP, focusing on applications of evolutionary algorithms (LNCS 1468, 1596, 1803, 2037, and 2279). This year was no exception and EvoWorkshops 2003, incorporating Evo- BIO, EvoCOP, EvoIASP, EvoMUSART, EvoSTIM and EvoROB, took place at the University of Essex (LNCS 2611). Genetic Programming (GP) is that part of Evolutionary Computation which solves particular complex problems or tasks by evolving and adapting popu- tions of computer programs, using Darwinian evolution and Mendelian genetics as a source of inspiration.

Background on genetic algorithms, LISP, and genetic programming. Hierarchical problem-solving. Introduction to automatically defined functions: the two-boxes problem. Problems that straddle the breakeven point for computational effort. Boolean parity functions. Determining the architecture of the program. The lawnmower problem. The bumblebee problem. The increasing benefits of ADFs as problems are scaled up. Finding an impulse response function. Artificial ant on the San Mateo trail. Obstacle-avoiding robot. The minesweeper problem. Automatic discovery of detectors for letter recognition. Flashes and four-of-a-kinds in a pinochle deck. Introduction to biochemistry and molecular biology. Prediction of transmembrane domains in proteins. Prediction of omega loops in proteins. Lookahead version of the transmembrane problem. Evolutionary selection of the architecture of the program. Evolution of primitives and sufficiency. Evolutionary selection of terminals. Evolution of closure. Simultaneous evolution of architecture, primitive functions, terminals, sufficiency, and closure. The role representation and the Lens effect. Default parameters. Computer implementation. Electronic mailing list and public repository.

Theory and Applications

Handbook of Metaheuristics

Genetic Programming Theory and Practice III

EvoWorkshops 2000: EvoIASP, EvoSCONDI, EvoTel, EvoSTIM, EvoRob, and EvoFlight, Edinburgh, Scotland, UK, April 17, 2000 Proceedings

Genetic and Evolutionary Computation for Image Processing and Analysis