

Chapter 8

Genetic Algorithm Implementation Using Matlab

8.1 Introduction

MATLAB (Matrix Laboratory), a product of Mathworks, is a scientific software package designed to provide integrated numeric computation and graphics visualization in high-level programming language. Dr Cleve Moler, Chief scientist at MathWorks, Inc., originally wrote MATLAB, to provide easy access to matrix software developed in the LINPACK and EISPACK projects. The very first version was written in the late 1970s for use in courses in matrix theory, linear algebra, and numerical analysis. MATLAB is therefore built upon a foundation of sophisticated matrix software, in which the basic data element is a matrix that does not require predimensioning.

MATLAB has a wide variety of functions useful to the genetic algorithm practitioner and those wishing to experiment with the genetic algorithm for the first time. Given the versatility of MATLAB's high-level language, problems can be coded in m-files in a fraction of the time that it would take to create C or Fortran programs for the same purpose. Couple this with MATLAB's advanced data analysis, visualisation tools and special purpose application domain toolboxes and the user is presented with a uniform environment with which to explore the potential of genetic algorithms.

The Genetic Algorithm Toolbox uses MATLAB matrix functions to build a set of versatile tools for implementing a wide range of genetic algorithm methods. The Genetic Algorithm Toolbox is a collection of routines, written mostly in m-files, which implement the most important functions in genetic algorithms.

8.2 Data Structures

MATLAB essentially supports only one data type, a rectangular matrix of real or complex numeric elements. The main data structures in the Genetic Algorithm toolbox are:

- chromosomes
- objective function values
- fitness values

Chaptergenetic Algorithm Implementation Using Matlab

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Chapter genetic Algorithm Implementation Using Matlab:

Introduction to Genetic Algorithms S.N. Sivanandam, S. N. Deepa, 2007-10-24

The origin of evolutionary algorithms was an attempt to mimic some of the processes taking place in natural evolution. Although the details of biological evolution are not completely understood even nowadays, there exist some points supported by strong experimental evidence. Evolution is a process operating over chromosomes rather than over organisms. The former are organic tools encoding the structure of a living being, i.e., a creature is built decoding a set of chromosomes. Natural selection is the mechanism that relates chromosomes with the efficiency of the entity they represent, thus allowing that efficient organism which is well adapted to the environment to reproduce more often than those which are not. The evolutionary process takes place during the reproduction stage. There exists a large number of reproductive mechanisms in Nature. Most common ones are mutation that causes the chromosomes of offspring to be different to those of the parents and recombination that combines the chromosomes of the parents to produce the offspring. Based upon the features above, the three mentioned models of evolutionary computing were independently and almost simultaneously developed.

Introduction to Evolutionary Algorithms Xinjie Yu, Mitsuo Gen, 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.

Classical and Recent Aspects of Power System Optimization

Ahmed F. Zobaa, Shady Abdel Aleem, Almoataz Youssef Abdelaziz, 2018-06-29 Classical and Recent Aspects of Power System Optimization presents conventional and meta-heuristic optimization methods and algorithms for power system studies. The classic aspects of optimization in power systems such as optimal power flow, economic dispatch, unit commitment, and power quality optimization are covered, as are issues relating to distributed generation, sizing, allocation, problems, scheduling of renewable resources, energy storage, power reserve-based problems, efficient use of smart grid capabilities, and protection studies in modern power systems. The book brings together innovative research outcomes, programs, algorithms, and

approaches that consolidate the present state and future challenges for power Analyzes and compares several aspects of optimization for power systems which has never been addressed in one reference Details real life industry application examples for each chapter e g energy storage and power reserve problems Provides practical training on theoretical developments and application of advanced methods for optimum electrical energy for realistic engineering problems

Applied Intelligent Control of Induction Motor Drives Tze Fun Chan,Keli Shi,2011-01-19 Induction motors are the most important workhorses in industry They are mostly used as constant speed drives when fed from a voltage source of fixed frequency Advent of advanced power electronic converters and powerful digital signal processors however has made possible the development of high performance adjustable speed AC motor drives This book aims to explore new areas of induction motor control based on artificial intelligence AI techniques in order to make the controller less sensitive to parameter changes Selected AI techniques are applied for different induction motor control strategies The book presents a practical computer simulation model of the induction motor that could be used for studying various induction motor drive operations The control strategies explored include expert system based acceleration control hybrid fuzzy PI two stage control neural network based direct self control and genetic algorithm based extended Kalman filter for rotor speed estimation There are also chapters on neural network based parameter estimation genetic algorithm based optimized random PWM strategy and experimental investigations A chapter is provided as a primer for readers to get started with simulation studies on various AI techniques Presents major artificial intelligence techniques to induction motor drives Uses a practical simulation approach to get interested readers started on drive development Authored by experienced scientists with over 20 years of experience in the field Provides numerous examples and the latest research results Simulation programs available from the book s Companion Website This book will be invaluable to graduate students and research engineers who specialize in electric motor drives electric vehicles and electric ship propulsion Graduate students in intelligent control applied electric motion and energy as well as engineers in industrial electronics automation and electrical transportation will also find this book helpful Simulation materials available for download at www.wiley.com/go/chanmotor

Intelligent Systems in Science and Information 2014 Kohei Arai,Supriya Kapoor,Rahul Bhatia,2015-02-13 The book *Intelligent Systems in Science and Information 2014* is the carefully edited collection of 25 extended chapters from selected papers in the field of Computational Intelligence that which received highly recommended feedback during the Science and Information Conference SAI 2014 review process All chapters have gone through substantial extension and consolidation and were subject to another round of rigorous review and additional modification and represent the state of the art of the cutting edge research and technologies in the related areas

Design and Implementation of Iris Pattern Recognition Based on Wireless Network Systems Thura Ali Khalaf,2019-06-04 Master s Thesis from the year 2016 in the subject Computer Science Technical Computer Science grade 81 language English abstract The goal of this thesis is to propose a fast and accurate iris pattern recognition system based on

wireless network system This thesis presents three parts in the first part Libor Masek algorithm is enhanced to achieve higher recognition rate Another method of iris pattern recognition is proposed which named genetic algorithm The two used iris pattern recognition methods are compared according to their accuracy and execution time When testing persons of the Chinese Academy of Sciences Institute of Automation CASIA database both methods achieved 100% recognition rates because there is at least one image sample for each person which is correct matched and there is no person that is false matched But when testing image samples per persons of CASIA database the genetic algorithm achieved higher recognition rates and lower error rates than Libor Masek algorithm It has been found that the recognition time of genetic algorithm is less than Masek algorithm The second part presents an iris image compression decompression by using Principal Component Analysis PCA for compression process and Inverse Principal Component Analysis IPCA for decompression process It has been proven that PCA is the most suitable method for compressing iris images because of its ability to reduce their size while maintaining the good quality of the reconstructed images Reconstructed images using IPCA have low compression ratios CRs and high Peak to Signal Ratios PSNRs which leads to good quality For more security a multi stage image compression is performed in order to protect network s transmitted data from hackers because hackers cannot guess how much the image has been compressed The third part includes wireless network system consisting of one central Personal Computer PC and four Personal Computers PCs that communicate with each other through router device The central PC takes the responsibility of monitoring and controlling the PCs of the whole network All network PCs communicate with each other by using Transmission Control Protocol Internet Protocol TCP IP protocol suite that use client server sockets to transfer images between PCs on the network

Genetic Algorithms in Engineering and Computer Science G. Winter, 1995 Genetic Algorithms in Engineering and Computer Science Edited by G Winter University of Las Palmas Canary Islands Spain J P riaux Dassault Aviation Saint Cloud France M Gal n P Cuesta University of Las Palmas Canary Islands Spain This attractive book alerts us to the existence of evolution based software Genetic Algorithms and Evolution Strategies used for the study of complex systems and difficult optimization problems unresolved until now Evolution algorithms are artificial intelligence techniques which mimic nature according to the survival of the fittest Darwin s principle They randomly encode physical quantitative or qualitative variables via digital DNA inside computers and are known for their robustness to better explore large search spaces and find near global optima than traditional optimization methods The objectives of this volume are two fold to present a compendium of state of the art lectures delivered by recognized experts in the field on theoretical numerical and applied aspects of Genetic Algorithms for the computational treatment of continuous discrete and combinatorial optimization problems to provide a bridge between Artificial Intelligence and Scientific Computing in order to increase the performance of evolution programs for solving real life problems Fluid dynamics structure mechanics electromagnetics automation control resource optimization image processing and economics are the featured multi disciplinary areas among

others in Engineering and Applied Sciences where evolution works impressively well This volume is aimed at graduate students applied mathematicians computer scientists researchers and engineers who face challenging design optimization problems in Industry They will enjoy implementing new programs using these evolution techniques which have been experimented with by Nature for 3 5 billion years

A Beginner's Guide to Image Shape Feature Extraction

Techniques Jyotismita Chaki, Nilanjan Dey, 2019-07-25 This book emphasizes various image shape feature extraction methods which are necessary for image shape recognition and classification Focussing on a shape feature extraction technique used in content based image retrieval CBIR it explains different applications of image shape features in the field of content based image retrieval Showcasing useful applications and illustrating examples in many interdisciplinary fields the present book is aimed at researchers and graduate students in electrical engineering data science computer science medicine and machine learning including medical physics and information technology

Smart Antennas with MATLAB, Second Edition Frank Gross, 2015-02-09 The most complete current guide to smart antenna design and performance Featuring new coverage of reconfigurable antennas vector antennas and direction finding antennas this up to date resource offers a rigorous review of the basic electromagnetic principles that drive smart antenna design and deployment Case studies and worked examples using MATLAB are provided End of chapter assignments reinforce the concepts presented Thoroughly revised to reflect recent developments and the latest technologies this is a comprehensive reference for all professionals students and researchers in the field of smart antennas Smart Antennas with MATLAB Second Edition covers Fundamentals of electromagnetic fields Antenna fundamentals Array fundamentals Principles of random variables and processes Propagation channel characteristics Angle of arrival estimation Smart antennas Direction finding Electromagnetic vector sensors Smart antenna design and optimization

Fuzzy Controllers

Teodor Lucian Grigorie, 2011-02-28 Trying to meet the requirements in the field present book treats different fuzzy control architectures both in terms of the theoretical design and in terms of comparative validation studies in various applications numerically simulated or experimentally developed Through the subject matter and through the inter and multidisciplinary content this book is addressed mainly to the researchers doctoral students and students interested in developing new applications of intelligent control but also to the people who want to become familiar with the control concepts based on fuzzy techniques Bibliographic resources used to perform the work includes books and articles of present interest in the field published in prestigious journals and publishing houses and websites dedicated to various applications of fuzzy control Its structure and the presented studies include the book in the category of those who make a direct connection between theoretical developments and practical applications thereby constituting a real support for the specialists in artificial intelligence modelling and control fields

Practical

Genetic Algorithms Randy L. Haupt, Sue Ellen Haupt, 2004-05-31 Randy Haupt and Sue Ellen Haupt both affiliated with The Pennsylvania State University Applied Research Laboratory emphasize practical applications rather than theory in this

second edition of a book CD ROM guide for practicing scientists engineers economists artists and others interested in the basics of genetic algorithms GAs This edition contains code in both MATLAB and High Performance Fortran on the CD ROM plus expanded information on methods for improving GA performance and a new chapter on other artificial intelligence methods of optimization such as simulated annealing and ant colony optimization Chapter exercises allow the book to be used as a text Annotation 2004 Book News Inc Portland OR booknews com *Practical Genetic Algorithms* Randy L. Haupt,Sue Ellen Haupt,2004-07-16 This book deals with the fundamentals of genetic algorithms and their applications in a variety of different areas of engineering and science Most significant update to the second edition is the MATLAB codes that accompany the text Provides a thorough discussion of hybrid genetic algorithms Features more examples than first edition

An Introduction to Optimization Edwin K. P. Chong,Stanislaw H. Zak,1996 This timely and authoritative book fills a growing need for an introductory text to optimization methods and theory at the senior undergraduate and beginning graduate levels With consistently accessible and elementary treatment of all topics An Introduction to Optimization helps students build a solid working knowledge of the field including unconstrained optimization linear programming and constrained optimization Supplemented with more than one hundred tables and illustrations an extensive bibliography and numerous worked out examples to illustrate both theory and algorithms this book also provides a review of the required mathematical background material a mathematical discussion at a level accessible to MBA and business students a treatment of both linear and nonlinear programming an introduction to the most recent developments including neural networks genetic algorithms and the nonsimplex method of Karmarkar a chapter on the use of descent algorithms for the training of feedforward neural networks exercise problems after every chapter MATLAB exercises and examples and an optional solutions manual with MATLAB source listings This book helps students prepare for the advanced topics and technological developments that lie ahead It is also a useful book for researchers and professionals in mathematics electrical engineering economics statistics and business **Mechatronic Systems 2004** S. O. Reza Moheimani,2005 **Technometrics** ,2005

Modeling and Parameter Estimation of Contact Processes Ariel Cintron-Arias,2006 *Synthesis of Shape Morphing Compliant Mechanisms* Kerr-Jia Lu,2004 **Parallel Evolutionary Computations** Nadia Nedjah,Enrique Alba,Luiza de Macedo Mourelle,2006-05-08 Parallel Evolutionary Computation focuses on the aspects related to the parallelization of evolutionary computations such as parallel genetic operators parallel fitness evaluation distributed genetic algorithms and parallel hardware implementations as well as on their impact on several applications The book is divided into four parts The first part deals with a clear software like and algorithmic vision on parallel evolutionary optimizations The second part is about hardware implementations of genetic algorithms a valuable topic which is hard to find in the present literature The third part treats the problem of distributed evolutionary computation and presents three interesting applications wherein parallel EC new ideas are featured Finally the last part deals with the up to date field of parallel particle

swarm optimization to illustrate the intrinsic similarities and potential extensions to techniques in this domain The book offers a wide spectrum of sample works developed in leading research throughout the world about parallel implementations of efficient techniques at the heart of computational intelligence It will be useful both for beginners and experienced researchers in the field of computational intelligence

First International Conference on 'Genetic Algorithms in Engineering Systems, Innovations and Applications', GALEZIA, 12-14 September 1995, Venue, Halifax Hall, University of Sheffield, UK. Institution of Electrical Engineers. Computing & Control Division,1995 **Proceedings of the ... Midwest Symposium on Circuits and Systems** ,2003

Chaptergenetic Algorithm Implementation Using Matlab: Bestsellers in 2023 The year 2023 has witnessed a noteworthy surge in literary brilliance, with numerous engrossing novels captivating the hearts of readers worldwide. Lets delve into the realm of bestselling books, exploring the fascinating narratives that have captivated audiences this year. Chaptergenetic Algorithm Implementation Using Matlab : Colleen Hoovers "It Ends with Us" This touching tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover masterfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can succeed. Chaptergenetic Algorithm Implementation Using Matlab : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This captivating historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids captivating storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens "Where the Crawdads Sing" This mesmerizing coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens weaves a tale of resilience, survival, and the transformative power of nature, captivating readers with its evocative prose and mesmerizing setting. These bestselling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of engaging stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a brilliant and suspenseful novel that will keep you guessing until the very end. The novel is a warning tale about the dangers of obsession and the power of evil.

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