about this book

Optimization Algorithms delves into the diverse world of optimization algorithms, offering an extensive exploration of deterministic graph search algorithms, trajectory-based algorithms, evolutionary computing algorithms, swarm intelligence algorithms, and machine learning-based methods. It is designed to cater to both novices and experts, featuring a wealth of examples and in-depth case studies that span a broad spectrum of design, planning, and control problems. These examples encompass a wide array of practical scenarios, including, but not limited to, routing problems, assembly line balancing, optimal pricing, composite laminate design, controller parameter tuning, political districting, product manufacturing planning, neural network training, facility allocation, doctor scheduling, supply/demand optimization, airline flight operations, electric motor control, and online advertising optimization. This book stands as a valuable resource for anyone looking to deepen their understanding and proficiency in the dynamic and ever-evolving field of optimization.

Who should read this book?

This book is tailored to meet the needs of a diverse range of readers, particularly working professionals who deal with optimization problems across various domains. It serves as an invaluable resource for practitioners seeking to deepen their understanding and skills in solving optimization problems. The content is also highly beneficial for continuing education and training centers, catering to general-interest readers and learners with a keen interest in optimization algorithms. Computer engineering/science and systems engineering

students, along with researchers, will find this book a treasure trove of knowledge, enhancing their academic and practical understanding. Additionally, university professors can use this comprehensive guide in designing and enriching undergraduate and postgraduate courses on topics such as graph search, metaheuristic optimization, bio-inspired algorithms, cooperative and adaptive algorithms, and the application of machine learning in optimization. This book is a versatile and rich source of information, well-suited for anyone involved or interested in the dynamic field of optimization.

How this book is organized: A roadmap

The book is divided into five parts and 12 chapters with three appendices, 114 code listings, several projects, and more than 140 exercises and their solutions:

- This book will guide you through the realms of optimization algorithms, beginning with deterministic graph search algorithms in part 1, where foundational concepts and techniques are covered.
- Part 2 progresses into trajectory-based algorithms like simulated annealing and tabu search, applying them to diverse problems.
- In part 3, the focus shifts to evolutionary computing algorithms, delving into genetic algorithms and their applications.
- Part 4 explores swarm intelligence algorithms, including particle swarm optimization, ant colony optimization, and artificial bee colony algorithms, demonstrating their nature-inspired problem-solving capabilities.
- Part 5 converges on machine learning-based methods, bridging machine learning and optimization to address complex problems using techniques like self-organizing maps, graph machine learning, and reinforcement learning.

This book includes three appendices, serving as invaluable companions that offer practical insights and resources to enhance your understanding and proficiency in implementing optimization algorithms.

Appendix A guides you in setting up the Python environment and introduces various state-of-the-art Python libraries such as mathematical programming solvers, graph and mapping libraries, and machine learning libraries.

Appendix B provides a variety of relevant resources, including optimization test functions, combinatorial optimization benchmark datasets, geospatial datasets, and machine learning datasets.

Finally, Appendix C presents a comprehensive set of exercises and solutions organized chapter-wise. These exercises encompass various styles, including multiple-choice questions (MCQs), matching exercises, word search, crossword puzzles, coding exercises, and problem-solving exercises. The purpose of these exercises is to actively reinforce and solidify your understanding of optimization concepts and algorithms explored throughout the book.

These bonus appendices are available in the ePub and Kindle versions of this book, and you can read them online in liveBook available here: https://www.manning.com/books/optimization-algorithms..

For readers looking to grasp the core concepts of search and optimization algorithms, I recommend starting with part 1, which lays the foundation. Afterward, you are free to explore the subsequent chapters in any order that aligns with your interests. Each chapter is crafted to stand on its own, providing flexibility in your learning journey.

A crucial aspect of this learning process is actively engaging with the included code listings. By experimenting with and tuning the algorithm parameters, you'll gain practical insights into, and a deeper understanding of, the subject matter. Additionally, I encourage you to attempt the exercises provided online in appendix C, as they are designed to reinforce your knowledge. If you encounter difficulties, the solutions are included, offering guidance to help you overcome any obstacles. This hands-on approach is essential for a thorough and rewarding learning experience.

About the code

This book is enriched with an extensive array of source code presented in numbered listings, numerous practical projects, and exercises (along with their solutions). It utilizes state-of-the-art Python libraries in the code listings to ensure a contemporary and effective learning experience. All of this code, which is implemented in the form of Python Jupyter notebooks—a web-based interactive computing platform—is readily available for download from the book's GitHub repository: https://github.com/Optimization-Algorithms-Book/Code-Listings. This setup not only facilitates an interactive and engaging learning process but also allows you to directly experiment with and modify the code. Note that the book is structured with the assumption that you have Python 3.6 or a newer version installed on your system.

You can also get executable snippets of code from the liveBook (online) version of this book at https://livebook.manning.com/book/optimization-algorithms. The complete code for the examples in the book is available for download from the Manning website at www.manning.com.

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