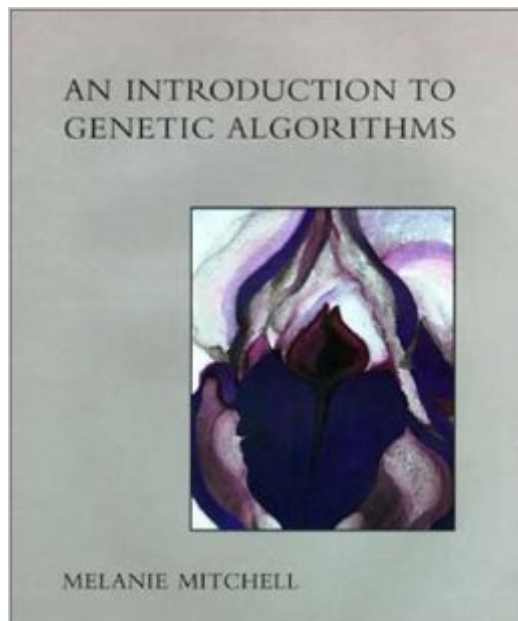


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An Introduction To Genetic Algorithms (Complex Adaptive Systems)



Synopsis

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

Book Information

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Customer Reviews

Although short, this book gives a good introduction to genetic algorithms for those who are first entering the field and are looking for insight into the underlying mechanisms behind them. It was first published in 1995, and considerable work has been done in genetic algorithms since then, but it could still serve as an adequate introduction. Emphasizing the scientific and machine learning applications of genetic algorithms instead of applications to optimization and engineering, the book could serve well in an actual course on adaptive algorithms. The author includes excellent problem sets at the end of each chapter, these being divided up into "thought exercises" and "computer exercises", and in the latter she includes some challenge problems for the ambitious reader. Chapter 1 is an overview of the main properties of genetic algorithms, along with a brief discussion of their history. The role of fitness landscapes and fitness functions is clearly outlined, and the author defines genetic algorithms as methods for searching fitness landscapes for highly fit strings. An elementary example of a genetic algorithm is given, and the author compares genetic algorithms with more traditional search methods. The author emphasizes the unique features of genetic algorithms that distinguish them from other search algorithms, namely the roles of parallel population-based search with stochastic selection of individuals, and crossover and mutation. A list of applications is given, and two explicit examples of applications are given that deal with the Prisoner's Dilemma and sorting networks. The author also gives a brief discussion as to how genetic algorithms work from a more mathematical standpoint, emphasizing the role of Holland schemas.

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