ORSA Journal on Computing

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

Book Review

Jennifer Ryan,

To cite this article:
Jennifer Ryan, (1991) Book Review. ORSA Journal on Computing 3(2):176-176. https://doi.org/10.1287/ijoc.3.2.176

ORSA Journal of Computing
Vol. 3, No. 2, Spring 1991

0899-1499/91/0302-0176 $01.25

Book Review

Review of: D. E. Goldberg, 1989. *Genetic Algorithms in Search, Optimization and Machine Learning*, Addison-Wesley, Reading, MA.

Reviewed by: Jennifer Ryan
Department of Mathematics
Campus Box 170
University of Colorado at Denver
P.O. Box 173364
Denver CO 80217-3364
BITNET:jryan@cudenver

Genetic algorithms (GAs) are search procedures that simulate biological evolution. Although John Holland laid the foundation for their application in the early 1960's, GAs have become widely used only in the last decade. *Genetic Algorithms in Search, Optimization and Learning*, by David E. Goldberg, provides an easy-to-read, informal presentation of the topic. The book introduces genetic algorithms and the GA terminology and shows how GAs can be used in their two main application areas, machine learning and optimization.

The first chapter, entitled "A Gentle Introduction to Genetic Algorithms" is just that. Goldberg introduces GAs in the context of optimization as a robust alternative to traditional heuristic search methods. He quickly convinces the reader that the method does indeed work with a small example that can be done by hand. He also defines the GA terminology, most of which is derived from the biology.

In the second chapter, the author presents the mathematical foundations of genetic algorithms, in particular the schema theorem. Although his mathematical presentation is not entirely rigorous, he does impart a good deal of intuition. He uses the k-armed bandit problem to illustrate the importance of carefully balancing the roles of exploitation and exploration in a GA (or in any search procedure). Goldberg introduces the minimal deceptive problem along with the notion (not yet well defined) of a *GA-hard* problem.

Chapter 3 is concerned with the computer implementation of a GA. Goldberg shows the reader how to implement the major GA steps of reproduction, crossover and mutation. Although this material may be unnecessary for an experienced programmer, it should be helpful to a novice programmer trying to code a GA. This chapter also discusses more subtle but extremely important points, such as fitness scaling and the choice of fitness function.

Goldberg covers advanced GA techniques and operators in the fourth and fifth chapters. Chapter 4 introduces improvements to the basic technique, in particular multiple point crossovers, in the context of real applications. In spite its title, "Advanced Operators and Techniques in Genetic Search," Chapter 5 is important reading even for a first-time GA developer. An effective GA for many (perhaps most) applications, for example those in which the chromosomes are order based, will require the use of techniques explained in this chapter.

The sixth and seventh chapters are devoted to a discussion of genetics-based machine learning. Goldberg begins by introducing the notion of a classifier system and describing apportionment of credit and then explains how a genetic algorithm can be used to introduce new rules into a learning classifier system. Once again, Goldberg begins by working through a small example, and he follows the model of presentation he used for the material on optimization. He discusses issues regarding the coding of a classifier system, and introduces more advanced topics in the context of applications.

Goldberg concludes each chapter with a summary and a collection of problems and computer assignments. An appendix contains a concise review of the elementary combinatorics and probability required to understand the probabilistic analyses included in the text. Other appendices describe random number generation and provide Pascal code for a genetic algorithm and a classifier system. These should be a big help to inexperienced programmers attempting to implement a genetic algorithm.

This book is designed as a text, and it would be well suited for a project oriented special topics course. It would also be useful to those interested in quickly familiarizing themselves with genetic algorithms.