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Modern Optimization with R

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http://www3.dsi.uminho.pt/pcortez/mor/

Nowadays and with the increasing number of real world applications, many tasks can be viewed as an optimization problem. Sometimes, we are required to maximize or to minimize an objective function. The field of optimization can be used in different application domains. Optimization is part of the field of operations research which was developed with many classical techniques such as linear programming. In the last years, there have been new optimization algorithms, all of which are part of the term *modern optimization*. The book *Modern Optimization with* R describes these algorithms. Each chapter starts with an introduction, followed by the main content and ends with an R command summary and exercises. This book includes modern optimization methods combined with real applications. Examples in the area can be found of time series forecasting, data mining classification, and regression models. The book is divided into seven different chapters. A detailed description can be found below:

Chapter 1 introduces the motivation for modern optimization methods and why R should be used to explore such methods. In this chapter, several key modern optimization topics can be found, namely the representation of a solution, the evaluation function, constraints, and an overall view of modern optimization methods. This chapter ends with the description of the optimization tasks that are used for tutorial purposes in the next chapter.

Chapter 2 presents the basic concepts of R. For those people who are familiar with R, this chapter can be skipped.

Chapter 3 details particularly three blind search approaches: pure blind, grid, and Monte Carlo search.

Chapter 4 introduces local search methods, namely hill climbing, simulated annealing, and tabu search. An example comparison between several local search methods is shown, the implementation in R is also considered.

Chapter 5 presents population-based search methods, namely genetic and evolutionary algorithms, differential evolution, particle swarm optimization, and estimation of distribution

algorithms. Two additional examples are discussed, followed by an example comparison between population-based methods and how to handle constraints.

Chapter 6 is dedicated to multi-objective optimization. This chapter first presents three demonstrative multi-objective tasks and then discusses three multi-objective optimization approaches.

Finally, Chapter 7 presents three real world applications of previously discussed methods: the salesman problem, time series forecasting, and wine quality classification.

The author has made all the code files, exercises, solutions to the exercises, and data examples available at: http://www3.dsi.uminho.pt/pcortez/mor/. This book is suitable for undergraduate and graduate students in statistics, computer science, information technology, and related areas, as well as data analysts interested in exploring modern optimization methods using the statistical language R. The book use different R packages. Some of them are: **pso**, **TSP**, **Rcurl**, **multicore**, **rminer**, **genalg**, **copulaedas**, **rgeos**, **kernlab**, **DEoptim** and **tabuSearch**, the last is the most dominant in Chapter 4. The author provides valuable comments about the pros and cons of various optimization methods. Codes can be customized to solve problems of interest/desired problems. This book makes a good contribution in to the literature of modern optimization. It is well written and structured.

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