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Reactive Search and Intelligent Optimization, Roberto Battiti, Mauro Brunato, and Franco Mascia. ISBN: 978-0-387-09623-0, Operations Research/Computer Science Interfaces Series, vol. 45, Springer, November 2008.

A heuristic can have a certain number of control parameters. Since the setting of these parameters is often of crucial importance to the performance of the heuristic, much effort has been made to study how to tune these parameters. Perhaps the most popular approach is to tune them manually by trial and error. Such an approach requires algorithmic expertise and domain knowledge which an end-user might not have.

Reactive Search Optimization (RSO), proposed by R. Battiti, the leading author of this book, advocates the integration of subsymbolic machine learning techniques into heuristics for tuning control parameters in an online manner. In such a way, heuristics could become much easier for an end-user to use for solving her particular problem. Reactive Search Optimization has been successfully applied in various optimization and search problems. It has become a common practice to use machine learning techniques in designing heuristics and some new and novel heuristics paradigms have been proposed. Although many research papers on machine learn-

ing for heuristics have been published in a range of academic journals and conferences, there is a lack of suitable reference books for researchers and practitioners. This book represents a first attempt to present Reactive Search Optimization and some other related intelligent heuristics from a unified point of view in a single book.

Chapter 1 in this book gives a very brief introduction of intelligent optimization. Chapter 2 addresses several learning issues in local search. Local search is a very basic component in modern heuristics. Neighborhood settings and strategies for searching a neighbourhood have been discussed in the chapter. Chapter 3 is on simulated annealing. This method allows worsening moves with a certain probability in order to escape from local optima. Simulated annealing has several control parameters and decisions. This chapter has provided some learning techniques for setting them. Chapter 4 is on learning issues in the tabu search. Tabu search uses prohibition for guiding the search escape from local optima. Several strategies for dynamically adapting the pro-

hibition period have been presented in this chapter. Chapter 5 presents techniques for reactively modifying the objective function in order to maintain appropriate diversification of the search process. Chapter 6 introduces several mode-based search methods. These methods build a model of promising solutions and then use it to generate new candidate solutions. Chapter 7 presents supervised learning techniques for intelligent optimization. It covers regression, classification and feature selection techniques. Chapter 8 is on reinforcement learning for intelligent optimization. Chapter 9 introduces a portfolio method for combining several algorithms together for efficiently solving hard problems. This method, inspired by a standard practice in economics, provides a procedure for allocating CPU times to different individual algorithms to achieve optimal performances. Chapter 10 presents racing and its application in off-line configuration of meta-heuristics. Chapter 11 is on teams of interacting solvers, focusing on evolutionary strategies and intelligent and reactive
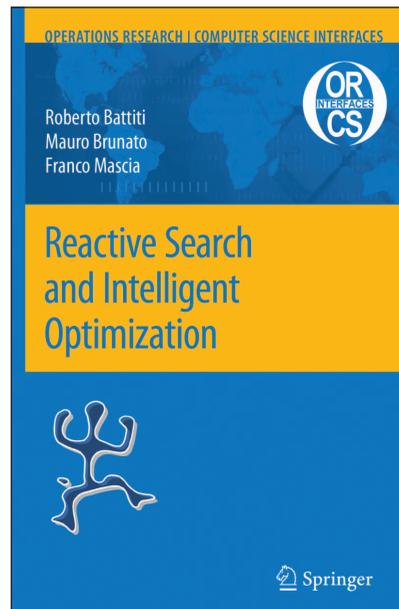
solvers. This chapter also discusses opportunities and pitfalls of this approach. Chapter 12 discusses phase transitions in combinatorial problems and empirical models for fitness surfaces. It also provides some basic methods for measuring the diversification and bias of local search algorithms.

The last chapter lists a number of research issues that need to be addressed in the area, most of them, being interdisciplinary by nature, require joint effort from researchers in operation research, software engineering, machine learning and artificial intelligence and statistics.

This book provides major motivations and examples to help a reader to understand its technical details. It is a must for both researchers and practitioner in the area of heuristics. I do believe that a researcher can find some interesting research topics in this book and a practitioner can understand how control parameters in some heuristics can be automatically tuned in an intelligent way. My only complain is very personal and biased: This book doesn't contain any multiobjective heuristics which, I hope, could be found in its second version.