

Preface

Metaheuristics are a relatively new but already established approach to combinatorial optimization. A metaheuristic is a generic algorithmic template that can be used for finding high quality solutions of hard combinatorial optimization problems. To arrive at a functioning algorithm, a metaheuristic needs to be configured: typically some modules need to be instantiated and some parameters need to be tuned. I call these two problems "structural" and "parametric" tuning, respectively. More generally, I refer to the combination of the two problems as "tuning".

Tuning is crucial to metaheuristic optimization both in academic research and for practical applications. Nevertheless, relatively little research has been devoted to the issue. This book shows that the problem of tuning a metaheuristic can be described and solved as a machine learning problem.

Using the machine learning perspective, it is possible to give a formal definition of the tuning problem and to develop a generic algorithm for tuning metaheuristics. Moreover, from the machine learning perspective it is possible to highlight some flaws in the current research methodology and to state some guidelines for future empirical analysis in metaheuristics research.

This book is based on my doctoral dissertation and contains results I have obtained starting from 2001 while working within the *Metaheuristics Network*.¹ During these years I have been affiliated with two research groups: INTELLEKTIK, Technische Universität Darmstadt, Darmstadt, Germany and IRIDIA, Université Libre de Bruxelles, Brussels, Belgium. I am therefore grateful to the research directors of these two groups: Prof. Wolfgang Bibel, Dr. Thomas Stützle, Prof. Philippe Smets, Prof. Hugues Bersini, and Prof. Marco Dorigo.

I am particularly indebted to my supervisor Prof. Dorigo for the guidance, the help, and the invaluable support. Marco is a great scientist and a great

¹ The *Metaheuristics Network* is a Training and Research Network funded by the Improving Human Potential Programme of the Commission of the European Communities, under contract number HPRN-CT-1999-00106.

person: It is for me an immense honor to be his student, his colleague, and his friend.

I am also grateful to the senior scientists in charge of the other nodes of the *Metaheuristics Network*, Prof. Luca M. Gambardella and Prof. Ben Paechter; to all the young researchers involved in the activities of the network; and to all my colleagues of IRIDIA. In particular, I wish to thank: Mr. Prasanna Balaprakash, Dr. Christian Blum, Prof. Gianluca Bontempi, Dr. Marco Chiarandini, Dr. Gianni Di Caro, Dr. Joshua Knowles, Mr. Max Manfrin, Dr. Luís Paquete, Dr. Paola Pellegrini, Dr. Andrea Roli, Dr. Olivia Rossi-Doria, Dr. Michael Sampels, Dr. Krzysztof Socha, and Dr. Mark Zlochin.

On a more personal basis, I wish to thank: Master Jean-Pierre Van Roy and all the friends at the lambic brewery *Cantillon*, Master Aldo Piatti of the judo club *Bu-Sen Bresso*, Prof. Bouzian El Amri of the judo club of the Université Libre de Bruxelles, Master Zena and Prof. Mameluco of the capoeira group *Raça Brasil*, Prof. Patrick Chaput of the Brazilian jiu-jitsu academy *Jiu-Jimania*, and Master Daniel Liseune of the french boxing club *le Gaulois*.

I am grateful to my family for their love and support: my brother Luca, Stefania, my mother Anna, my father Claudio . . . and Carlotta, the person I am so happy and proud to share my life with.

This work of mine is dedicated to my father for all what he gave me and for all what he taught me. Especially for explaining me, many years ago, what happens to the steps of an escalator when they get to the top . . . and most of all, for teaching me to ask this kind of questions! My father taught me to pay attention to things, to take pleasure in wondering first, and to look for rational explanations immediately afterwards. My approach to the issues discussed in this book, proudly reflects his teachings.

Brussels, Belgium
January 2009

Mauro Birattari



<http://www.springer.com/978-3-642-00482-7>

Tuning Metaheuristics
A Machine Learning Perspective
Birattari, M.
2009, X, 221 p., Hardcover
ISBN: 978-3-642-00482-7