Foreword

by Gerhard-Wilhelm Weber & A. Sevtap Kestel

The purpose of this book, *Handbook of Research on Artificial Intelligence Techniques and Algorithms,* is to invite and gather chapters contributing to methodological developments and successful implementations of Heuristics and Metaheuristics and their hybrid versions. Special emphasis has been put on real-world applications problems but other implementations have been welcome, too. In fact, *meta-heuristics optimization* methods have become very successful in tackling a large variety of optimization problems in areas such as industry, business, operational research, computer science, engineering, government, and many others. This book surveys, deeply inquiries, studies, and comprehensively displays various ongoing and emerging cutting-edge techniques in important areas of investigation and of high-level tools for original, intelligent, and innovative real-life applications in the world of today and tomorrow.

In the course of the last decades, the toolbox of computer science, statistics and applied mathematics, informatics, bio and life sciences has gained the attention of numerous researchers and practitioners from all over the world in emerging analytics, algorithms, and information technologies, providing a strong impact on all areas of engineering and information technologies and in economy, finance, and social sciences.

The authors of this book's chapters are experienced and enthusiastic scientists from all over the world, who refine and combine and use the less model-based and the deep model-based methods of mathematics; the first ones, smart or intelligent algorithms, have their roots in the engineering domains, in computer science, informatics, and bio- or nature-inspired traditions of approach and reasoning. They are often named as heuristics and model-free, herewith reflecting the real-world need of managing and overcoming a fast complexity and large-scale nature of the problems; mathematically regarded, they are less rigorous, and "freed" from the firm requirements of calculus, in order to integrate nature- and bio-inspired ideas to efficiently handle truly hard challenges. The emergence of those algorithms from Artificial Intelligence, which are rather natural and intuitive, often preserve a "black-box" part, occurring in parallel to the powerful advances in mathematics, actuarial sciences, and statistics, which are widely model-based. These directions of advances are labelled Statistical Learning, Machine Learning, and Inverse Problems (those three yet more mathematical), Metaheuristics and Matheuristics, and under the name and hospitality of modern Operational Research. Model-based and model-free streams meet, exchange, merge, and hybridize in various Centres of Excellence at important conferences and in key research and agendas on the regional and world stages to leave behind misunderstanding and wrong perceptions of different kinds between those two streamlines of academic culture and to jointly gain from new effects of synergy in order together to advance scientific insight and corresponding tools, and herewith to offer a powerful hand to the solution of present and forthcoming real-world needs. In fact, tremendous chal-

lenges do exist in every field of the modern life, in engineering and economy, in development and the improvement of living conditions, and the gaining of future opportunities.

A special emphasis is paid in this book to the presence of *uncertainties* of multiple kinds which we find nearly everywhere. In mathematical terms, there are probability theory, actuarial mathematics and statistics, set-valued calculus, stochastic calculus, and stochastic hybrid systems with jumps, etc., which are employed more and more, whereas engineers, computer scientists, and practitioners have developed and strongly use their heuristic and meta-heuristic approximations and varieties of the mathematical toolbox. However, these two cultures and traditions are not regarded as separated from each other in the present work, because of their potential of *common* chances and promise to humankind.

To all the authors of these valuable contributions, we extend our hearty appreciation and thanks for having shared their energy, knowledge, and insight with the entire academic community and mankind. We are grateful to the publishing house of IGI Global, and to the editorial team, consisting of editor Prof. Dr. Pandian Vasant and the Editorial Advisory Board, for having provided the opportunity and the floor for expert authors to publish their newest achievements and proposals. We extend our cordial gratitude to all of them for having made possible a premium book of a high academic standard, of intellectual, practical, and human importance!

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