

# Preface

The development of powerful search and optimization techniques is of great importance in science and engineering, particularly in today's world that requires researchers and practitioners to tackle a variety of challenging real-world problems as technology becomes an ever more important aspect of everyday life. There are two well-established and widely known fields that are addressing these issues: (i) traditional numerical optimization techniques and (ii) comparatively recent bio-inspired heuristics, such as evolutionary algorithms and genetic programming. Both of these fields have developed approaches with their unique strengths and weaknesses, allowing them to solve some challenging problems while sometimes failing in others.

The goal of the Numerical and Evolutionary Optimization (NEO) workshop series is to bring together people from these fields and other related research areas to discuss, compare and merge their complimentary perspectives. NEO encourages the development of fast and reliable hybrid methods that maximize the strengths and minimize the weaknesses of each underlying paradigm, while also being applicable to a broader class of problems. Moreover, NEO fosters the understanding and adequate treatment of real-world problems, particularly in emerging fields that affect us all, such as health care, smart cities and big data, among many others.

The NEO has been founded as an international workshop series with possible venues mainly in Mexico but also other locations all over the world. The first two editions of this series, NEO 2013 and NEO 2014, were held in Tlalnepantla, State of Mexico, Mexico, hosted by the Cinvestav-IPN. NEO 2015 was held in Tijuana, Baja California, Mexico, hosted by the Instituto Tecnológico de Tijuana (ITT). We refer to <http://neo.cinvestav.mx> for more details and up to date information.

This volume represents the first post proceedings of the NEO series. It comprises a selection of extended works that have mainly been presented at NEO 2015, but speakers from previous NEO editions have also been invited to contribute. The book contains 17 chapters which are for convenience of the reader divided into four

parts: Genetic Programming (Part I), Combinatorial Optimization (Part II), Multi-objective Optimization (Part II), and Machine Learning and Real World Applications (Part IV). The book contains a nice balance between theory and practice, with some chapters providing necessary introductions to recent techniques, while some others present real-world examples of how these fields can address important problems. More precisely, the chapters deal with the development and discussion of several deterministic (Chaps. [Approximation Algorithms for a Mixed Postman Problem with Restrictions on the Arcs](#), [On Steering Dominated Points in Hypervolume Indicator Gradient Ascent for Bi-Objective Optimization](#), [Multi-objective Optimal Design of Nonlinear Controls](#), and [The Directed Search Method for Unconstrained Parameter Dependent Multi-objective Optimization Problems](#)) and stochastic (Chaps. [An Introduction to Geometric Semantic Genetic Programming](#), [Semantic Genetic Programming for Sentiment Analysis](#), [Automatic Random Tree Generator on FPGA](#), [The Importance of Proper Diversity Management in Evolutionary Algorithms for Combinatorial Optimization](#), [Flexibility in Biopharmaceutical Manufacturing using Particle Swarm Algorithms and Genetic Algorithms](#), and [Generalized Differential Evolution for Numerical and Evolutionary Optimization](#)) methods, with numerical local search strategies for the support of global heuristics (Chaps. [On Steering Dominated Points in Hypervolume Indicator Gradient Ascent for Bi-Objective Optimization](#) and [The Directed Search Method for Unconstrained Parameter Dependent Multi-objective Optimization Problems](#)), and with some hybrids of numerical and evolutionary optimization strategies (Chaps. [Local Search Approach to Genetic Programming for RF-PAS Modeling Implemented in FPGA](#) and [Multi Agent Collaborative Search](#)). The methods are applied to a variety of different applications, such as sentiment analysis (Chap. [Semantic Genetic Programming for Sentiment Analysis](#)), the mixed postman problem with restriction on the arcs (Chap. [Approximation Algorithms for a Mixed Postman Problem with Restrictions on the Arcs](#)), the Sudoku puzzle (Chap. [The Importance of Proper Diversity Management in Evolutionary Algorithms for Combinatorial Optimization](#)), biopharmaceutical manufacturing (Chap. [Flexibility in Biopharmaceutical Manufacturing Using Particle Swarm Algorithms and Genetic Algorithms](#)), the design of nonlinear controls (Chap. [Multi-Objective Optimal Design of Nonlinear Controls](#)), EEG signal interpretation (Chap. [EEG Signal Implementation of Movement Intention for the Teleoperation of the Mobile Differential Robot](#)), recommendation systems (Chap. [Profiting From Several Recommendation Algorithms Using A Scalable Approach](#)), circuit design (Chap. [On the Selection of Solutions in Multiobjective Analog Circuit Design](#)), injection molding (Chap. [Multi-objective Optimization of an Injection Molding Process](#)), and the ambulance location problem (Chap. [The Ambulance Location Problem in Tijuana, Mexico](#)).

Finally, we would like to express our gratitude to all invited speakers and attendees of the NEO to make this series happen and to all authors for their valuable contributed chapters. Finally, we would like to thank all the reviewers whose evaluations have helped to maintain the quality of the book. We hope that this volume will contribute to the further development of numerical and evolutionary optimization.

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