

Preface

Evolutionary computation (EC) techniques are efficient, nature-inspired planning and optimization methods based on the principles of natural evolution and genetics. Due to their efficiency and simple underlying principles, these methods can be used in the context of problem solving, optimization, and machine learning. A large and continuously increasing number of researchers and professionals make use of EC techniques in various application domains. This volume presents a careful selection of relevant EC examples combined with a thorough examination of the techniques used in EC. The papers in the volume illustrate the current state of the art in the application of EC and should help and inspire researchers and professionals to develop efficient EC methods for design and problem solving.

All the papers in this book were presented during EvoApplications 2014, which incorporates a range of tracks on application-oriented aspects of EC. Originally established as EvoWorkshops in 1998, it provides a unique opportunity for EC researchers to meet and discuss application aspects of EC and has been an important link between EC research and its application in a variety of domains. During these 16 years new workshops and tracks have arisen, some have disappeared, while others have matured to become conferences of their own, such as EuroGP in 2000, EvoCOP in 2004, EvoBIO in 2007, and EvoMUSART in 2012.

EvoApplications is part of EVO*, Europe's premier colocated event in the field of evolutionary computing. EVO* was held from April 23 to 25, 2014. Granada, Spain, home to 'The Alhambra' UNESCO World Heritage Site provided the setting, with the Universidad de Granada, Departamento de Arquitectura y Tecnología de los Computadores representing the venue, and included, in addition to EvoApplications, EuroGP, the main European event dedicated to genetic programming; EvoCOP, the main European conference on evolutionary computation in combinatorial optimization and EvoMUSART the main International Conference on Evolutionary and Biologically Inspired Music, Sound, Art and Design. The proceedings for all of these events in their 2013 edition are also available in the LNCS series.

The central aim of the EVO* events is to provide researchers, as well as people from industry, students, and interested newcomers, with an opportunity to present new results, discuss current developments and applications, or just become acquainted with the world of EC. Moreover, it encourages and reinforces possible synergies and interactions between members of all scientific communities that may benefit from EC techniques.

EvoApplications 2014 consisted of the following individual tracks:

- *EvoCOMNET*, track on nature-inspired techniques for telecommunication networks and other parallel and distributed systems,
- *EvoCOMPLEX*, track on evolutionary algorithms and complex systems,
- *EvoENERGY*, track on EC in energy applications,

- *EvoFIN*, track on evolutionary and natural computation in finance and economics,
- *EvoGAMES*, track on bio-inspired algorithms in games,
- *EvoIASP*, track on EC in image analysis signal processing and pattern recognition,
- *EvoINDUSTRY*, track on nature-inspired techniques in industrial settings,
- *EvoNUM*, track on bio-inspired algorithms for continuous parameter optimization,
- *EvoPAR*, track on parallel implementation of evolutionary algorithms,
- *EvoRISK*, track on computational intelligence for risk management, security, and defence applications,
- *EvoROBOT*, track on EC in robotics
- *EvoSTOC*, track on evolutionary algorithms in stochastic and dynamic environments, and
- *EvoBIO*, track on EC and related techniques in bioinformatics and computational biology.

EvoCOMNET addresses the application of EC techniques to problems in distributed and connected systems such as telecommunication and computer networks, distribution and logistic networks, interpersonal and interorganizational networks, etc. To address the challenges of these systems, this track promotes the study and the application of strategies inspired by the observation of biological and evolutionary processes that usually show the highly desirable characteristics of being distributed, adaptive, scalable, and robust.

EvoCOMPLEX covers all aspects of the interaction of evolutionary algorithms (and metaheuristics in general) with complex systems. Complex systems are ubiquitous in physics, economics, sociology, biology, computer science, and many other scientific areas. Typically, a complex system is composed of smaller aggregated components, whose interaction and interconnectedness are non trivial. This leads to emergent properties of the system, not anticipated by its isolated components. Furthermore, when the system behavior is studied from a temporal perspective, self-organization patterns typically arise.

EvoFIN is the only European event specifically dedicated to the applications of EC, and related natural computing methodologies, to finance and economics. Financial environments are typically hard, being dynamic, high-dimensional, noisy, and co-evolutionary. These environments serve as an interesting test bed for novel evolutionary methodologies.

EvoGAMES aims to focus the scientific developments in computational intelligence techniques that may be of practical value for utilization in existing or future games. Recently, games, and especially video games, have become an important commercial factor within the software industry, providing an excellent test bed for application of a wide range of computational intelligence methods.

EvoIASP, the longest-running of all EvoApplications tracks which celebrates its 15th edition this year, has been the first international event solely dedicated to the applications of EC to image analysis and signal processing in complex domains of high industrial and social relevance.

EvoNUM aims at applications of bio-inspired algorithms, and cross-fertilization between these and more classical numerical optimization algorithms, to continuous optimization problems. It deals with applications where continuous parameters or functions have to be optimized, in fields such as control, chemistry, agriculture, electricity, building and construction, energy, aerospace engineering, and design optimization.

EvoPAR covers all aspects of the application of parallel and distributed systems to EC as well as the application of evolutionary algorithms for improving parallel architectures and distributed computing infrastructures. EvoPAR focuses on the application and improvement of distributed infrastructures, such as grid and cloud computing, peer-to-peer (P2P) system, as well as parallel architectures, GPUs, manycores, etc., in cooperation with evolutionary algorithms.

EvoRISK focuses on challenging problems in risk management, security, and defence, and covers both theoretical developments and applications of computational intelligence to subjects such as cyber crime, IT security, resilient and self-healing systems, risk management, critical infrastructure protection (CIP), military, counter terrorism and other defence-related aspects, disaster relief, and humanitarian logistics.

EvoSTOC addresses the application of EC in stochastic and dynamic environments. This includes optimization problems with changing, noisy, and/or approximated fitness functions and optimization problems that require robust solutions, providing the first platform to present and discuss the latest research in this field.

EvoBIO brings together experts across multiple fields, who draw inspiration from biological systems in order to produce solutions to complex biological problems.

And finally, a General track including those papers dealing with applications not covered by any of the established tracks.

This year's edition of EvoApplications had 128 submissions, with 55 papers accepted for oral presentation and 24 for poster presentation.

Many people have helped make EvoApplications a success. We would like to express our gratitude first to the authors for submitting their work, to the members of the Program Committees for devoting their energy to reviewing those papers, and to the audience for their lively participation.

We would also like to thank the Institute for Informatics and Digital Innovation at Edinburgh Napier University, UK, for their coordination efforts.

The papers were submitted, reviewed, and selected using the MyReview conference management software. We are sincerely grateful to Marc Schoenauer of Inria, France, for his great assistance in providing, hosting, and managing the software.

We would like to thank the local organizing team: Juan Julián Merelo Guervós, Victor M. Rivas Santos, Pedro A. Castillo Valdivieso, María Isabel García Arenas, Pablo García Sánchez, Antonio Fernández Ares, and Javier Asensio. We thank Kevin Sim from the Institute for Informatics and Digital Information, Edinburgh Napier University for creating and maintaining the official Evo* 2014 website, and Pablo García Sánchez (Universidad de Granada, Spain) and Mauro Castelli (Universidade Nova de Lisboa, Portugal) for being responsible for Evo* 2014 publicity.

We would also like to express our sincerest gratitude to our invited speakers, who gave the inspiring keynote talks: Prof. Thomas Schmickl of the University of Karl-Franzens University, Graz, Austria, Prof. Federico Morán of Universidad Complutense de Madrid, Spain, and Prof. Susan Stepney of the University of York, UK.

We especially want to express our genuine gratitude to Jennifer Willies of the Institute for Informatics and Digital Innovation at Edinburgh Napier University, UK. Her dedicated and continued involvement in Evo* since 1998 has been and remains essential for building the image, status, and unique atmosphere of this series of events.

April 2014

Anna I. Esparcia-Alcázar
 Antonio M. Mora
 Alexandros Agapitos
 Paolo Burelli
 William S. Bush
 Stefano Cagnoni
 Carlos Cotta
 Ivanoe De Falco
 Antonio Della Cioppa
 Federico Divina
 Rolf Drechsler
 A.E. Eiben
 Francisco Fernández de Vega
 Kyrre Glette
 Evert Haasdijk
 J. Ignacio Hidalgo
 Paul Kaufmann
 Trung Thanh Nguyen
 Petr Pošík
 Robert Schaefer
 Kevin Sim
 Anabela Simões
 Andrea G.B. Tettamanzi
 Neil Urquhart
 Mengjie Zhang
 Nur Zincir-Heywood

Applications of Evolutionary Computation
17th European Conference, EvoApplications 2014,
Granada, Spain, April 23-25, 2014, Revised Selected
Papers
Esparcia-Alcázar, A.I.; Mora, A.M. (Eds.)
2014, XXVIII, 969 p. 336 illus., Softcover
ISBN: 978-3-662-45522-7