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Volume Editors

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Preface

Evolutionary computation (EC) techniques are efficient, nature-inspired planning and optimization methods based on the principles of natural evolution and genetics. Owing 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 papers in this book were presented during EvoApplications 2013, 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 15 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 only last year.

EvoApplications is part of EVO*, Europe's premier co-located events in the field of evolutionary computing. EVO* was held in Vienna, Austria, during April 3–5, 2013, 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; EvoBIO, the main European conference on EC and related techniques in bioinformatics and computational biology; 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 (volumes 7831, 7832, 7833, and 7834, respectively).

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 2013 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

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 that celebrated its 15th edition this year, was 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 classic 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.

In line with its tradition of adapting the list of the tracks to the needs and demands of the researchers working in the field of evolutionary computing, new tracks have arisen this year while others have been discontinued. This edition saw the birth of four new tracks: EvoENERGY, EvoINDUSTRY, EvoROBOT, and a General track, for papers dealing with applications not covered by any of the established tracks. EvoROBOT, however, is not completely new as it goes back to 15 years ago, already being present in the first edition of the EvoWorkshops.

The number of submissions to EvoApplications 2013 increased compared to the previous edition, reaching a total of 119 entries (compared to 90 in 2012 and 162 in 2011). Table 1 shows relevant submission/acceptance statistics, with the figures for the 2012 edition also reported.

Table 1. Submission/acceptance statistics for EvoApplications 2013 and 2012

	2013			2012		
	Submissions	Accept	Ratio	Submissions	Accept	Ratio
EvoCOMNET	12	8	67%	6	4	67%
EvoCOMPLEX	9	7	78%	13	9	69%
EvoENERGY	8	5	63%	-	-	-
EvoFIN	11	6	55%	9	6	67%
EvoGAMES	9	7	78%	13	9	69%
EvoIASP	28	12	43%	13	7	54%
EvoINDUSTRY	5	2	40%	-	-	-
EvoNUM	12	3	25%	12	4	33%
EvoPAR	5	4	80%	10	8	80%
EvoRISK	2	1	50%	2	1	50%
EvoROBOT	11	7	64%	-	-	-
EvoSTOC	6	3	50%	7	3	43%
General track	1	0	0%	-	-	-%
Total	119	65	55%	90	54	60%

As for previous years, accepted papers were split into oral presentations and posters, with the paper length for these two categories being the same for all the tracks. The low acceptance rate of 55% for EvoApplications 2013, along with the significant number of submissions, is an indicator of the high quality of the articles presented at the conference, showing the liveliness of the scientific movement in the corresponding fields.

Many people helped make EvoApplications a success. We would like to express our gratitude firstly to the authors for submitting their work, to the members of the Program Committees for devoting their energy to reviewing these 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.

Finally, we are grateful to all those involved in the preparation of the event, especially Jennifer Willies for her unfaltering dedication to the coordination of the event over the years. Without her support, running a conference of this kind, with a large number of different organizers and different opinions, would be unmanageable.

Further thanks to the local organizing team: Bin Hu, Doris Dicklberger, and Günther Raidl from the Algorithms and Data Structures Group, Institute of Computer Graphics and Algorithms, Vienna University of Technology, for making the organization of such an event possible in a place as unique as Vienna.

Last but surely not least, we want to especially acknowledge Şima Etaner-Uyar for her hard work as Publicity Chair of the event, Kevin Sim as webmaster, and Marc Schoenauer for his continuous help in setting up and maintaining the MyReview management software.

April 2013

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EvoApplications 2013 was part of EVO* 2013, Europe's premier co-located events in the field of evolutionary computing, which also included the conferences EuroGP 2013, EvoCOP 2013, EvoBIO 2013, and EvoMUSART 2013

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