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Cecilia Di Chio et al. (Eds.)

Applications of Evolutionary Computation

EvoApplications 2012: EvoCOMNET, EvoCOMPLEX,
EvoFIN, EvoGAMES, EvoHOT, EvoIASP, EvoNUM,
EvoPAR, EvoRISK, EvoSTIM, and EvoSTOC
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Volume Editors

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Preface

The field of evolutionary computation (EC) brings together researchers who aim to solve a wide range of problems using nature-inspired techniques and methods. The essential operators of natural evolution and genetics (namely, reproduction, variation and selection) are used to tackle problems in many areas, ranging from optimization to planning, from design to classification, from simulation to control.

All the papers in this volume represent carefully chosen, state-of-the-art examples of applications of EC. They are intended to provide inspiration and guideline to researchers and professionals willing to use an EC approach to answer their own questions.

This was the 15th year that the EvoApplications conference, as one of the main events of the Evo* family (it originally started in 1998 as EvoWorkshops), provided a professional (and social) platform to researchers willing to discuss the varied aspects of applications of EC.

EvoApplications, year after year, evolves and adapts itself in order to accommodate newly emergent topics. Moreover, in this 2012 edition of Evo*, we saw the EvoMusArt event become a conference in its own right, joining EuroGP (a conference since 2000), EvoCOP (2004), EvoBIO (2007) and EvoApplications (2010) in what is described as “Europe’s premier co-located events in the field of EC.”

EVO* was held during April 11–13, 2012 in the beautiful city of Málaga, Spain. Evo* 2012 included in addition to EvoApplications: EuroGP, the main European event dedicated to genetic programming; EvoCOP, the main European conference on EC in combinatorial optimization; EvoBIO, the main European conference on EC and related techniques in bioinformatics and computational biology; EvoMusArt, the main European conference on evolutionary and biologically inspired music, sound, art and design. The proceedings for all of these events are also available in the LNCS series (volumes 7244, 7245, 7246 and 7247).

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 2012 consisted of the following 11 tracks:

- *EvoCOMNET*, track on nature-inspired techniques for telecommunication networks and other parallel and distributed systems
- *EvoCOMPLEX*, track on algorithms and complex systems
- *EvoFIN*, track on evolutionary and natural computation in finance and economics

- *EvoGAMES*, track on bio-inspired algorithms in games
- *EvoHOT*, track on bio-inspired heuristics for design automation
- *EvoIASP*, track on EC in image analysis and signal processing
- *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
- *EvoSTIM*, track on nature-inspired techniques in scheduling, planning and timetabling
- *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.

EvoHOT focuses on all bio-inspired heuristics applied to electronic design automation. The track's goal is to show the latest developments, industrial experiences, and successful attempts to *evolve rather than* design new solutions. EvoHOT 2012 allows one both to peek into the problems that will be faced in the next generation of electronics, and to demonstrate innovative solutions to classical CAD problems, such as fault tolerance and test.

EvoIASP, the longest-running of all EvoApplications which celebrated its 14th 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 in engineering. It deals with theoretical aspects and engineering 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.

Recent events involving both natural disasters and man-made attacks have emphasized the importance of solving challenging problems in risk management, security and defence. EvoRISK seeks 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, and real-world applications of these subjects.

EvoSTIM presents an opportunity for EC researchers in the inter-related areas of planning, scheduling and timetabling to come together, present their latest research and discuss current developments and applications.

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. These topics recently gained increasing attention in the EC community and EvoSTOC was the first event that provided a platform to present and discuss the latest research in this field.

Continuing in the tradition of adapting the list of events to the needs and demands of the researchers working in the field of EC, two new tracks were introduced: EvoPAR (track on parallel implementation of evolutionary algorithms) and EvoRISK (track on computational intelligence for risk management, security and defence applications).

The number of submissions to EvoApplications 2012 was again fairly high, accumulating 90 entries (compared to 162 in 2011 and 191 in 2010 – bearing in mind that these numbers included submissions for EvoMusArt). The following table shows relevant statistics for EvoApplications 2012, where the statistics for the 2011 edition are also reported.

	2012			Previous edition		
	Submissions	Accept	Ratio	Submissions	Accept	Ratio
EvoCOMNET	6	4	67%	15	8	53%
EvoCOMPLEX	13	9	69%	11	5	45%
EvoFIN	9	6	67%	8	6	75%
EvoGAMES	13	9	69%	17	11	65%
EvoHOT	2	1	50%	7	5	71%
EvoIASP	13	7	54%	19	7	37%
EvoMUSART	-	-	-	43	24	56%
EvoNUM	12	4	33%	9	5	56%
EvoPAR	10	8	80%	-	-	-
EvoRISK	2	1	50%	-	-	-
EvoSTIM	3	2	67%	9	4	44%
EvoSTOC	7	3	43%	8	5	63%
Total	90	54	60%	162	87	54%

As for previous years, accepted papers were split into oral presentations and posters. And similarly to last year, the paper length for these two categories was the same for all the tracks. The low acceptance rate of 60% for EvoApplications 2012 is an indicator of the high quality of the articles presented at the events, showing the liveliness of the scientific movement in the corresponding fields.

Many people helped make EvoApplications a success. We would like to thank the following institutions:

- The University of Málaga, and particularly the School of Computer Science with its director Prof. José M. Troya, and the School of Telecommunications with its director Prof. Antonio Puerta
- The Málaga Convention Bureau
- The Institute for Informatics and Digital Innovation at Edinburgh Napier University, UK, for administrative help and event coordination

Even with an excellent support and location, an event like EVO* would not have been feasible without authors submitting their work, members of the Program Committees dedicating energy in reviewing those papers, and an audience. All these people deserve our gratitude.

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 such a type of conference with a large number of different organizers and different opinions would be unmanageable. Further thanks to the local organizer Carlos Cotta (University of Málaga, Spain) for making the organization of such an event possible and

successful. Last but surely not least, we want to specially acknowledge Penousal Machado (University of Coimbra, Portugal) for his hard work as Publicity Chair and Webmaster, and Marc Schoenauer (INRIA, France) for his continuous help in setting up and maintaining the MyReview management software.

April 2012

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EvoApplications 2012 was part of EVO* 2012, Europe's premier co-located events in the field of evolutionary computing, that included the conferences EuroGP 2012, EvoCOP 2012, EvoBIO 2012 and EvoMusArt 2012.

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