Lecture Notes in Computer Science 5484

Mario Giacobini et al. (Eds.)

Applications of Evolutionary Computing

EvoWorkshops 2009: EvoCOMNET, EvoENVIRONMENT
EvoFIN, EvoGAMES, EvoHOT, EvoIASP, EvoINTERACTION
EvoMUSART, EvoNUM, EvoSTOC, EvoTRANSLOG
Tübingen, Germany, April 15-17, 2009
Proceedings

Springer

Volume Editors
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Cover illustration: "You Pretty Little Flocker" by Alice Eldridge (www.ecila.org
and www.infotech.monash.edu.au/research/groups/cema/flocker/flocker.html)

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Preface

The year 2009 celebrates the bicentenary of Darwin's birth and the 150th anniversary of the publication of his seminal work, *On the Origin of Species.* If this makes 2009 a special year for the research community working in biology and evolution, the field of evolutionary computation (EC) also shares the same excitement. 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 ever-increasing number of researchers and professionals make use of EC techniques in various application domains.

This volume presents a careful selection of relevant EC applications 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 can 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 the 2009 edition of EvoWorkshops, which was held at the Eberhard Karls Universität Tübingen, Germany, during April 15–17, 2009. EvoWorkshops are composed of a range of workshops on application-oriented aspects of EC that, since 1998, has provided 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 past ten years, several workshops have been proposed, some of them have disappeared along the way, while others have matured to become conferences of their own, such as EuroGP in 2000, EvoCOP in 2004, and EvoBIO two years ago.

EvoWorkshops are part of EVO*, Europe's premier co-located events in the field of EC. EVO* includes, in addition to EvoWorkshops, EuroGP, the main European event dedicated to genetic programming; EvoCOP, the main European conference on EC in combinatorial optimization; and EvoBIO, the main European conference on EC and related techniques in bioinformatics and computational biology. The proceedings for all of these events, EuroGP 2009, EvoCOP 2009, and EvoBIO 2009, are also available in the LNCS series (volumes 5481, 5482, and 5483).

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.

EvoWorkshops 2009 consisted of the following individual workshops:

– *EvoCOMNET*, the Sixth European Workshop on the Application of Nature-Inspired Techniques for Telecommunication Networks and Other Parallel and Distributed Systems,

– *EvoENVIRONMENT*, the First European Workshop on Nature-Inspired Methods for Environmental Issues,

– *EvoFIN*, the Third European Workshop on Evolutionary Computation in Finance and Economics,

– *EvoGAMES*, the First European Workshop on Bio-inspired Algorithms in Games,

– *EvoHOT*, the Fifth European Workshop on Bio-Inspired Heuristics for Design Automation,

– *EvoIASP*, the Eleventh European Workshop on Evolutionary Computation in Image Analysis and Signal Processing,

– *EvoINTERACTION*, the Third European Workshop on Interactive Evolution and Humanized Computational Intelligence,

– *EvoMUSART*, the Seventh European Workshop on Evolutionary and Biologically Inspired Music, Sound, Art and Design,

– *EvoNUM*, the Second European Workshop on Bio-inspired Algorithms for Continuous Parameter Optimization,

– *EvoSTOC*, the Sixth European Workshop on Evolutionary Algorithms in Stochastic and Dynamic Environments, and

– *EvoTRANSLOG*, the Third European Workshop on Evolutionary Computation in Transportation and Logistics.

EvoCOMNET addresses the application of EC techniques to the definition, analysis, and development of novel parallel and distributed algorithms, and to the solution of problems of practical and theoretical interest in all domains related to network systems. To address these challenges, this workshop promotes the study and the application of strategies inspired by the observation of biological and evolutionary processes, which usually show the highly desirable characteristics of being distributed, adaptive, scalable, and robust.

EvoENVIRONMENT is devoted to the use of nature-inspired methods for environmental issues. It deals with many diverse topics such as waste management, sewage treatment, control of greenhouse gas emissions, biodegradation of materials, efficient energy use, or use of renewable energies, to name but a few.

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 onto 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 innovative heuristics, game theory and bio-inspired techniques applied to the electronic design automation. It shows the latest developments, the reports of industrial experiences, the successful attempts to evolve rather than design new solutions, and the hybridizations of traditional methodologies."

EvoIASP, the longest-running of all EvoWorkshops, which celebrates its eleventh 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.

EvoINTERACTION deals with various aspects of interactive evolution, and more broadly of computational intelligence in interaction with human intelligence, including methodology, theoretical issues, and new applications. Interaction with humans raises several problems, mainly linked to what has been called the user bottleneck, i.e., the human fatigue.

EvoMUSART addresses all practitioners interested in the use of EC techniques for the development of creative systems. There is a growing interest in the application of these techniques in fields such as art, music, architecture, and design. The goal of this workshop is to bring together researchers that use EC in this context, providing an opportunity to promote, present, and discuss the latest work in the area, fostering its further developments and collaboration among researchers.

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 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.

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 workshop that provided a platform to present and discuss the latest research in this field.

EvoTRANSLOG deals with all aspects of the use of EC, local search, and other nature-inspired optimization and design techniques for the transportation and logistics domain. The impact of these problems on the modern economy and society has been growing steadily over the last few decades, and the workshop aims at design and optimization techniques such as evolutionary computing approaches allowing the use of computer systems for systematic design, optimization, and improvement of systems in the transportation and logistics domain.

EvoWorkshops adapt annually to the needs and preferences of researchers, and some workshops were not run this year. EvoTHEORY, the European

Workshop on Theoretical Aspects in Artificial Evolution, decided not to run in 2008 and will run again next year. While it did not take place during EVO* 2008, EvoINTERACTION was held this year, and two new workshops were also proposed this year, EvoENVIRONMENT and EvoGAMES.

The number of submissions to EvoWorkshops 2009 was once again very high, cumulating 143 entries (compared to 160 in 2007 and 133 in 2008). The following table shows relevant statistics for EvoWorkshops 2009 (both short and long papers are considered in the acceptance statistics), where also the statistics for the 2008 edition are reported, except for EvoINTERACTION whose last edition was in 2007:

Workshop	2009			Previous Edition		
	Submit	Accept	Rate	Submit	Accept	Rate
EvoCOMNET	21	15	71.4%	10	6	60%
EvoEVIRONMENT	5	4	80%	-	-	-
EvoFIN	14	8	57.1%	15	8	53.3%
EvoGAMES	15	10	66.6%	-	-	-
EvoHOT	5	4	80%	15	9	60%
EvoIASP	14	7	50%	26	16	61.5%
EvoINTERACTION	5	4	80%	7	4	57.1%
EvoMUSART	26	17	65.3%	31	17	54.8%
EvoNUM	16	9	56.2%	14	8	57.1%
EvoSTOC	11	7	63.6%	8	4	50%
EvoTHEORY	-	-	-	3	2	66.6
EvoTRANSLOG	11	6	54.5%	11	5	45.4%
Total	143	91	63.6%	133	75	56.4%

The events accepted ten-page full papers and six-page short papers. The two classes of papers were either presented orally over the three conference days, or presented and discussed during a special poster session. The significant number of submissions for EvoWorkshops 2009 shows the liveliness of the scientific activities in the corresponding fields.

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

- The Eberhard Karls Universität Tübingen, Germany
- The German Research Foundation (DFG) for financial support
- The Centre for Emergent Computing at Edinburgh Napier University, Scotland, for administrative help and event coordination
- The Institute for High Performance Computing and Networking of the Italian National Research Council

We want to especially acknowledge the invited speakers that gave two very interesting and inspirational talks during the conference days: Peter Schuster, President of the Austrian Academy of Sciences, and Stuart R. Hameroff, Professor Emeritus, Departments of Anesthesiology and Psychology and Director, Center for Consciousness Studies, University of Arizona, Tucson, Arizona.

We are also very grateful to all the people who provided local support, and in particular to Andreas Zell, Chair of Computer Architecture at the Wilhelm-Schickard Institute for Computer Science at the University of Tübingen, Peter Weit, Vice Director of the Seminar for Rhetorics at the New Philology Department at the University of Tübingen, and the Tourist Information Center of Tübingen, especially Marco Schubert.

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 this type of conference, with a large number of different organizers and different opinions, would be unmanageable. Further thanks to the Local Chair Marc Ebner for making the organization of such an event possible and successful. Last but surely not least, we want to especially acknowledge Ivanoe De Falco for his hard work as Publicity Chair of the event, and Marc Schoenauer for his continuous help in setting up and maintaining the MyReview conference management software.

April 2009

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Organization

EvoWorkshops 2009, together with the conferences EuroGP 2009, EvoCOP 2009, and EvoBIO 2009, was part of EVO* 2009, Europe's premier co-located events in the field of evolutionary computing.

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