

Franz Rothlauf et al. (Eds.)

LNCS 3907

# Applications of Evolutionary Computing

**EvoWorkshops 2006: EvoBIO, EvoCOMNET, EvoHOT  
EvoIASP, EvoINTERACTION, EvoMUSART, and EvoSTOC  
Budapest, Hungary, April 2006, Proceedings**



Springer

TP311.1-53

E93 Franz Rothlauf et al. (Eds.)

2006

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Proceedings



Springer



E200603518

Volume Editors

see next page

The cover illustration is the work of Pierre Grenier

Library of Congress Control Number: 2006922618

CR Subject Classification (1998): F.1, D.1, B, C.2, J.3, I.4, J.5

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

ISSN 0302-9743

ISBN-10 3-540-33237-5 Springer Berlin Heidelberg New York

ISBN-13 978-3-540-33237-4 Springer Berlin Heidelberg New York

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Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India  
Printed on acid-free paper SPIN: 11732242 06/3142 5 4 3 2 1 0

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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. Due to their efficiency and the simple underlying principles, these methods can be used for a large number of problems in the context of problem solving, optimization, and machine learning. A large and continuously increasing number of researchers and practitioners make use of EC techniques in many application domains. This book presents a careful selection of relevant EC applications combined with thorough examinations of techniques for a successful application of EC. The presented papers illustrate the current state of the art in the application of EC and should help and inspire researchers and practitioners to develop efficient EC methods for design and problem solving.

All the papers in this book were presented during EvoWorkshops 2006, which consisted of a varying collection of workshops on application-oriented aspects of EC. Since 1998, the format of the EvoWorkshops has proved to be very successful and to represent significant advances in the application areas of EC. As a result, over the last few years, EvoWorkshops has become one of the major events to focus solely on applicational aspects of EC, constituting an important link between EC research and the application of EC in a variety of domains.

EvoWorkshops is co-located with EuroGP, the main European event dedicated to genetic programming, and EvoCOP, which has become the main European conference on evolutionary computation in combinatorial optimization. The proceedings for both of these events, EuroGP 2006 and EvoCOP 2006, are also available in the LNCS series (number 3905 and 3906).

EvoWorkshops 2006, of which this volume contains the proceedings, was held in Budapest, Hungary, on April 10–12, 2006, jointly with EuroGP 2006 and EvoCOP 2006. EvoWorkshops 2006 consisted of the following individual workshops:

- *EvoBIO*, the Fourth European Workshop on Evolutionary Bioinformatics,
- *EvoCOMNET*, the Third European Workshop on Evolutionary Computation in Communications, Networks, and Connected Systems,
- *EvoHOT*, the Third European Workshop on Evolutionary Computation in Hardware Optimization,
- *EvoIASP*, the Eighth European Workshop on Evolutionary Computation in Image Analysis and Signal Processing,
- *EvoINTERACTION*, the First European Workshop on Interactive Evolution and Humanized Computational Intelligence,
- *EvoMUSART*, the Fourth European Workshop on Evolutionary Music and Art, and

- *EvoSTOC*, the Third European Workshop on Evolutionary Algorithms in Stochastic and Dynamic Environments.

EvoBIO is concerned with the exploitation of EC and related techniques in bioinformatics and computational biology. For analyzing and understanding biological data, EC plays an increasingly important role in the pharmaceutical industry, in biotechnology, and in associated industries, as well as in scientific discovery.

EvoCOMNET addresses the application of EC techniques to problems in communications, networks, and connected systems. New communication technologies, the creation of interconnected communication and information networks such as the Internet, new types of interpersonal and interorganizational communication, and the integration and interconnection of production centers and industries are the driving forces on the road towards a connected, networked society. EC techniques are important tools for facing these challenges.

EvoHOT highlights the latest developments in the field of EC applications to hardware and design optimization. This includes various aspects like the design of electrical and digital circuits or the solving of classical hardware optimization problems.

EvoIASP, which was the first international event solely dedicated to the applications of EC to image analysis and signal processing, addressed this year topics ranging from fingerprinting to classification problems and artificial ants.

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. human fatigue.

EvoMUSART focuses on 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 EvoMUSART 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.

EvoSTOC addresses the application of EC in stochastic environments. This includes optimization problems with noisy and approximated fitness functions that are changing over time, the treatment of noise, and the search for 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.

EvoWorkshops 2006 continued the tradition of providing researchers in these fields, 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, besides fostering closer future interaction between members of all scientific communities that may benefit from EC techniques.

This year, the EvoWorkshops had the highest number of submissions ever. The number of submissions increased from 123 in 2004 to 143 in 2005 to 149 in 2006. EvoWorkshops 2006 accepted full papers with twelve pages and short papers with a reduced number of five pages. The acceptance rate of 43.6% for EvoWorkshops 2006 is an indicator for the high quality of the papers presented at the workshops and included in these proceedings. The following table gives some details on the number of submissions, the number of accepted papers, and the acceptance ratios for EvoWorkshops 2005 and EvoWorkshops 2006 (accepted short papers are in brackets). Of further importance for the statistics is the acceptance rate of EvoWorkshops 2004 which was 44.7%.

year	2006			2005		
	submissions	accept	ratio	submissions	accept	ratio
EvoBIO	40	21	52.5%	32	13	40.6%
EvoCOMNET	16	5	31.2%	22	5	22.7%
EvoHOT	9	5	55.6%	11	7	63.6%
EvoIASP	35	12(7)	34.3%	37	17	45.9%
EvoInteraction	8	6	75%	-	-	-
EvoMUSART	29	10(4)	34.5%	29	10(6)	34.5%
EvoSTOC	12	6(2)	50.0%	12	4(4)	33.3%
Total	149	65(13)	43.6%	143	56(10)	39.1%

We would like to thank all the members of the program committees for their quick and thorough work. We thank the Artpool Art Research Center of Budapest, and especially György Galántai, for offering space and expertise without which the wonderful evolutionary art and music exhibition associated with the conference would not have been possible. Furthermore, we would like to acknowledge the support from Napier University, Edinburgh.

Finally, we would like to say a special thanks to everybody who was involved in the preparation of the event. Special thanks are due to Jennifer Willies, whose work is a great and invaluable help. Without her support, running such a type of conference with a large number of different organizers and different opinions would be impossible. Further thanks go to the local organizer, Aniko Ekart, and her group, who made it possible to run such a conference in such a nice place.

April 2006

Franz Rothlauf	Jürgen Branke	Stefano Cagnoni
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EvoWorkshops 2006 was jointly organized with EuroGP 2006 and EvoCOP 2006.

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