Lecture Notes in Computer Science 7492

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Carlos A. Coello Coello Vincenzo Cutello
Kalyanmoy Deb Stephanie Forrest
Giuseppe Nicosia Mario Pavone (Eds.)

Parallel Problem Solving from Nature - PPSN XII

12th International Conference
Taormina, Italy, September 1-5, 2012
Proceedings, Part II

Springer

Volume Editors

Carlos A. Coello Coello
CINVESTAV-IPN, Mexico City, Mexico
E-mail: ccoello@cs.cinvestav.mx

Vincenzo Cutello
Giuseppe Nicosia
Mario Pavone
University of Catania, Italy
E-mail:{cutello, nicosia, mpavone}@dmi.unict.it

Kalyanmoy Deb
Indian Institute of Technology, Kanpur, India
E-mail: deb@iitk.ac.in

Stephanie Forrest
University of New Mexico, Albuquerque, NM, USA
E-mail: forrest@cs.unm.edu

ISSN 0302-9743 e-ISSN 1611-3349
ISBN 978-3-642-32963-0 e-ISBN 978-3-642-32964-7
DOI 10.1007/978-3-642-32964-7
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2012944753

CR Subject Classification (1998): J.3, I.2, F.1, F.2, I.4-5, G.2

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

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

This LNCS volume contains the proceedings of the 12th International Conference on Parallel Problem Solving from Nature (PPSN 2012). This biennial event constitutes one of the most important and highly regarded international conferences in evolutionary computation and bio-inspired metaheuristics. Continuing with a tradition that started in Dortmund, in 1990, PPSN 2012 was held during September 1–5, 2012 in Taormina, Sicily, Italy.

PPSN 2012 received 226 submissions from 44 countries. After an extensive peer-review process involving more than 230 reviewers, the Program Committee Chairs went through all the reports and ranked the papers according to the reviewers' comments. Each paper was evaluated by at least four reviewers. The top 105 manuscripts were finally selected for inclusion in this LNCS volume and for presentation at the conference. This represents an acceptance rate of 46%, which guarantees that PPSN will continue to be one of the most respected conferences for researchers working in natural computing around the world.

PPSN 2012 featured four distinguished keynote speakers: Angelo Cangelosi (University of Plymouth, UK), Natalio Krasnogor (University of Nottingham, UK), Panos M. Pardalos (University of Florida, USA), and Leslie G. Valiant (Harvard University, USA).

The meeting began with six workshops: "Evolving Predictive Systems" (Bogdan Gabrys and Athanasios Tsakonas), "Joint Workshop on Automated Selection and Tuning of Algorithms" Part A: Continuous Search Spaces—Focus on Algorithm Selection (Heike Trautmann, Mike Preuss, Olaf Mersmann, and Bernd Bischl), Part B: Discrete Search Spaces – Focus on Parameter Selection (Andrew Parkes and Ender Özcan), "Theoretical Aspects of Evolutionary Multiobjective Optimization: Interactive Problem Solving Sessions and New Results" (Dimo Brockhoff and Günter Rudolph), "Modeling Biological Systems" (Julia Handl, Joshua Knowles, and Yaochu Jin), and "Parallel Techniques in Search, Optimization, and Learning" (Enrique Alba and Francisco Luna). The workshops offered and ideal opportunity for the conference members to explore specific topics in evolutionary computation, bio-inspired computing, and metaheuristics in an informal and friendly setting.

PPSN 2012 also included eight tutorials: "Introduction to Bioinformatics" (Jaume Bacardit, University of Nottingham, UK), "Evolutionary Multi-Objective Optimization" (Jürgen Branke, University of Warwick, UK), "Implementing Artificial Evolution on GPGPU-Based Computing Eco-Systems with the EASEA-CLOUD Massively Parallel Platform" (Pierre Collet, Strasbourg University, France), "Programming by Optimization—A New Paradigm for Developing High-Performance Software" (Holger H. Hoos, University of British Columbia, Canada), "Computational Intelligence and Games" (Pier Luca Lanzi, Polytechnic of Milan, Italy), "Ant Colony Optimization" (Vittorio Maniezzo, University of Bologna,

Italy), "Complex Systems Science in Its Thirties" (Roberto Serra, University of Modena and Reggio Emilia, Italy), and "Expressive Genetic Programming" (Lee Spector, Hampshire College, USA).

We wish to express our gratitude to the authors who submitted their papers to PPSN 2012 and to the Program Committee members and external reviewers who provided thorough evaluations of all these submissions. We also express our profound thanks to Marisa Lappano Anile, Claudio Angione, Jole Costanza, Giovanni Carapezza, Giovanni Murabito, and all the members of the Organizing Committee for their substantial efforts in preparing for and running the meeting. Thanks to all the keynote and tutorial speakers for their participation, which greatly enhanced the quality of this conference. Finally, we also express our gratitude to all the organizations that provided financial support for this event.

September 2012

Carlos Coello Coello
Vincenzo Cutello
Kalyanmoy Deb
Stephanie Forrest
Giuseppe Nicosia
Mario Pavone

Organization

PPSN 2012 was organized and hosted by the Optimization and BioComputing Group of the Department of Mathematics and Computer Science, University of Catania, Italy. The University of Catania is the 29th oldest university in the world. Its establishment dates back to 1434.

Conference Committee

General Chairs

Vincenzo Cutello	University of Catania, Italy
Mario Pavone	University of Catania, Italy

Honorary Chair

Hans-Paul Schwefel	Technische Universität Dortmund, Germany

Program Chairs

Carlos A. Coello Coello	CINVESTAV-IPN, Mexico
Kalyanmoy Deb	Indian Institute of Technology, India
Stephanie Forrest	University of New Mexico, USA
Giuseppe Nicosia	University of Catania, Italy

Tutorial Chairs

Giuseppe Narzisi	Cold Spring Harbor Laboratory, USA
Germán Terrazas Angulo	University of Nottingham, UK

Workshop Chair

Alberto Moraglio	University of Birmingham, UK

E-Publicity Chairs

Heder Bernardino Soares	LNCC, Brazil
Fernando Esponda	Instituto Tecnologico Autonomo de Mexico, Mexico

Financial Manager

Marisa Lappano Anile	University of Catania, Italy

Local Organization

Giovanni Carapezza	University of Catania, Italy
Piero Consoli	University of Catania, Italy
Jole Costanza	University of Catania, Italy

Matteo De Felice	ENEA, Italy
Luigi Malagó	Politecnico di Milano, Italy
Giovanni Murabito	University of Catania, Italy
Annalisa Occhipinti	University of Catania, Italy
Elisa Pappalardo	University of Catania, Italy
Giovanni Stracquadanio	Johns Hopkins University, USA
Renato Umeton	University of Rome "La Sapienza", Italy

Steering Committee

Carlos Cotta	Universidad de Málaga, Spain
David W. Corne	Heriot-Watt University Edinburgh, UK
Kenneth A. De Jong	George Mason University, USA
Agoston E. Eiben	Vrije Universiteit Amsterdam, The Netherlands
Juan Julián Merelo Guervós	Universidad de Granada, Spain
Günter Rudolph	Technische Universität Dortmund, Germany
Thomas P. Runarsson	University of Iceland, Iceland
Robert Schaefer	University of Krakow, Poland
Marc Schoenauer	Université Paris Sud, France
Xin Yao	University of Birmingham, UK

Workshops

Evolving Predictive Systems
Bogdan Gabrys and Athanasios Tsakonas

Workshop on Automated Selection and Tuning of Algorithms
Part A: Continuous Search Spaces – Focus on Algorithm Selection
Heike Trautmann, Mike Preuss, Olaf Mersmann, and Bernd Bischl

Workshop on Automated Selection and Tuning of Algorithms
Part B: Discrete Search Spaces – Focus on Parameter Selection
Andrew Parkes and Ender Özcan

Theoretical Aspects of Evolutionary Multiobjective Optimization:
Interactive Problem Solving Sessions and New Results
Dimo Brockhoff and Günter Rudolph

Modeling Biological Systems Workshop
Julia Handl, Joshua Knowles, and Yaochu Jin

Parallel Techniques in Search, Optimization, and Learning
Enrique Alba and Francisco Luna

Tutorials

Introduction to Bioinformatics
Jaume Bacardit

Evolutionary Multi-Objective Optimization
Jürgen Branke

Implementing Artificial Evolution on GPGPU-Based Computing Eco-Systems with the EASEA-CLOUD Massively Parallel Platform
Pierre Collet

Programming by Optimization—A New Paradigm for Developing High-Performance Software
Holger H. Hoos

Computational Intelligence and Games
Pier Luca Lanzi

Ant Colony Optimization
Vittorio Maniezzo

Complex Systems Science in Its Thirties
Roberto Serra

Expressive Genetic Programming
Lee Spector

Keynote Speakers

Angelo Cangelosi	University of Plymouth, UK
Natalio Krasnogor	University of Nottingham, UK
Panos M. Pardalos	University of Florida, USA
Leslie G. Valiant	Harvard University, USA

Program Committee

Enrique Alba	Wolfgang Banzhaf	Hans-Georg Beyer
Youhei Akimoto	Helio Jose Barbosa	Mauro Birattari
Jaroslaw Arabas	Thomas Bartz-Beielstein	Christian Blum
Paolo Arena	Simone Bassis	Yossi Borenstein
Dirk Arnold	Roberto Battiti	Peter Bosman
Anne Auger	Gerardo Beni	Pascal Bouvry
Dogan Aydin	Heder S. Bernandino	Anthony Brabazon
Jaume Bacardit	Adam Berry	Jürgen Branke

Dimo Brockhoff
Will Browne
Larry Bull
Tadeusz Burczynski
Edmund Burke
Stefano Cagnoni
Erick Cantú-Paz
Luigi Cardamone
Uday Chakraborty
Kay Chen Tan
Tianshi Chen
Ying-ping Chen
Miroslav Chlebik
Sung-Bae Cho
Siang-Yew Chong
Carlos Coello Coello
David Corne
Ernesto Costa
Carlos Cotta
Peter Cowling
Matteo De Felice
Kalyanmoy Deb
Kenneth A. De Jong
Antonio Della Cioppa
Gianni Di Caro
Luca Di Gaspero
Federico Divina
Marco Dorigo
Benjamin Doerr
RafałDrężewski
Jérémie Dubois-Lacoste
Gusz Eiben
Aniko Ekart
Talbi El-Ghazali
Michael Emmerich
Aniko Ekart
Anton Ereemev
Anna I Esparcia-Alcázar
José Figueira
Steffen Finck
Carlos M. Fonseca
Giuditta Franco
Tobias Friedrich
Marcus Gallagher
Jonathan M. Garibaldi
Mario Giacobini
Adam Ghandar
Tobias Glasmachers
Faustino Gomez
Maoguo Gong
Salvatore Greco
Roderich Groß
Steven Gustafson
Walter Gutjahr
Pauline Haddow
Hisashi Handa
Nikolaus Hansen
Julia Handl
Jin-Kao Hao
Emma Hart
Verena Heidrich-Meisner
Philip Hingston
Andrew Hone
Matthew Hyde
Christian Igel
Pedro Isasi Viñuela
Hisao Ishibuchi
Christian Jacob
Thomas Jansen
Licheng Jiao
Yaochu Jin
Bryant A. Julstrom
Devis Karaboga
George Karakostas
Andy Keane
Graham Kendall
Joshua Knowles
Timo Koetzing
Krzysztof Krawiec
Halina Kwasnicka
Dario Landa-Silva
Pier Luca Lanzi
Jörg Lassig
Sanja Lazarova-Molnar
Per Kristian Lehre
Peter Lewis
Xiaodong Li
Tianjun Liao
Giosué Lo Bosco
Fernando Lobo
Daniele Loiacono
Manuel López-Ibáñez
Jose A. Lozano
Simon Lucas
Evelyne Lutton
Luigi Malagó
Jacek Mandziuk
Vittorio Maniezzo
Angelo Marcelli
Elena Marchiori
Benedetto Matarazzo
Matteo Matteucci
Giancarlo Mauri
Barry McCollum
Alexander Melkozerov
Juan Julián Merelo Guervós
Olaf Mersmann
Silja Meyer-Nieberg
Zbigniew Michalewicz
Martin Middendorf
Kaisa Miettinen
Orazio Miglino
Julian Miller
Sara Montagna
Orazio Miglino
Marco A. Montes de Oca
Alberto Moraglio
Alison A. Motsinger-Reif
Christian Müller
Giuseppe Narzisi
Boris Naujoks
Ferrante Neri
Frank Neumann
Una-May O'Reilly
Gabriella Ochoa
Gisele Pappa
Elisa Pappalardo
Luis Paquete
Andrew Parkes
Marco Pavone
Martin Pelikan
David Pelta
Clara Pizzuti
Silvia Poles

Petr Posík
Mike Preuss
Christian Prins
Adam Pruegel-Bennett
Günther Raidl
Vitorino Ramos
William Rand
Khaled Rasheed
Mauricio Resende
Katya Rodriguez
Eduardo A. Rodríguez Tello
Philipp Rohlfshagen
Andrea Roli
Günter Rudolph
Thomas Runarsson
Thomas A. Runkler
Conor Ryan
Erol Sahin
Michael Sampels
Ivo Sbalzarini
Robert Schaefer
Andrea Schaerf
Marc Schoenauer
Oliver Schütze
Michele Sebag
Bernhard Sendhoff
Roberto Serra
Marc Sevaux
Jonathan Shapiro
Moshe Sipper
Roman Slowinski
Christine Solnon
Terence Soule
Dipti Srinivasan
Catalin Stoean
Giovanni Stracquadanio
Thomas Stützle
Dirk Sudholt
Ponnuthurai Suganthan
Jerry Swan
Daniel Tauritz
Jorge Tavares
Andrea G.B. Tettamanzi
Madeleine Theile
Lothar Thiele
Dirk Thierens
Jon Timmis
Jerzy Tiuryn
Julian Togelius
Marco Tomassini
Heike Trautmann
Vito Trianni
Bianca Truthe
Elio Tuci
Andrew M. Tyrrell
Renato Umeton
Leonardo Vanneschi
Sebastien Verel
Carlos Martín Vide
Verel Carlos
Markus Wagner
Lipo Wang
Darrel Whitley
R. Paul Wiegand
Carola Winzen
Carsten Witt
Man-Leung Wong
John Woodward
Ning Xiong
Xin Yao
Gary Yen
Tina Yu
Yang Yu
Christine Zarges
Ivan Zelinka
Qingfu Zhang
Eckart Zitzler

Sponsor

ESTECO
IBM Italy
SolveIT Software Pty Ltd

Patronage

Angelo Marcello Anile Association
IET - The Institute of Engineering and Technology
Tao Science Research Center, Italy
UNINFO
University of Catania, Italy

Table of Contents – Part II

Multiobjective Optimization

Swarm Intelligence, Collective Behaviour, Coevolution and Robotics

Memetic Algorithms, Hybridized Techniques, Meta and Hyperheuristics

Applications (II)

Table of Contents – Part I

Theory of Evolutionary Computation

Machine Learning, Classifier Systems, Image Processing

Experimental Analysis, Encoding, EDA, GP

Applications (I)