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Artificial Evolution

13th International Conference, Évolution Artificielle, EA 2017
Paris, France, October 25–27, 2017
Revised Selected Papers

Springer

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Preface

This LNCS volume comprises the best papers presented at the 13th Biennial International Conference on Artificial Evolution, EA[1] 2017, held in Paris (France). This conference proceeds a long series of previous issues, that took place in Lyon (2015), Bordeaux (2013), Angers (2011), Strasbourg (2009), Tours (2007), Lille (2005), Marseille (2003), Le Creusot (2001), Dunkerque (1999), Nimes (1997), Brest (1995), and Toulouse (1994).

We sought original contributions relevant to artificial evolution, including, but not limited to: evolutionary computation, evolutionary optimization, co-evolution, artificial life, population dynamics, theory, algorithmics and modelling, implementations, application of evolutionary paradigms to the real world (industry, biosciences, etc.), other biologically inspired paradigms (swarm, artificial ants, artificial immune systems, cultural algorithms), memetic algorithms, multi-objective optimization, constraint handling, parallel algorithms, dynamic optimization, machine learning and hybridization with other soft computing techniques.

Each submitted paper was reviewed by four members of the international Program Committee. Among the 33 submissions received, 17 papers were selected for oral presentation and seven other papers for poster presentation. As for the previous editions, a selection of the best papers which were presented at the conference and further revised are published (see LNCS volumes 1063, 1363, 1829, 2310, 2936, 3871, 4926, 5975, 7401, 8752, and 9554). For this edition, the high quality of the papers selected for the oral presentation led us to include a revised version of 16 papers in this volume of Springer's LNCS series.

As usual, the success of EA 2017 is due to dedicated team work, for which I would like to express my gratitude:

- Gabriela Ochoa and Jean-Daniel Fekete, who accepted to be our keynote speakers.
- The Program Committee for their careful work: the high quality of the selected papers is a proof of their strong commitment.
- The Organizing Committee for their efficient work and kind availability, in particular the local team, Nadia Boukhelifa, Alberto Tonda, and our student volunteers, Marc Barnabé, Thomas Chabin, and Benoît Génot.
- ISC-PIF who hosted the EA2017 event: David Chavalarias, the director, and the local ISC organization team, Margaux Calon and Franck Leclerc, for their kind, efficient, and daily help.
- The members of the Steering Committee for their valuable assistance.
- Aurélien Dumez and Pierrick Legrand for the administration of the conference website.

[1] As for previous editions of the conference, the EA acronym is based on the original French name "Évolution Artificielle."

- Marc Schoenauer and Anne Jeannin-Girardon for their support and management of the MyReview system.
- Laetitia Jourdan for publicity.
- Pierrick Legrand and Pierre Parrend for editing the proceedings.
- Lhassane Idoumghar for registrations.
- Emmanuel Cayla and Nicolas Monmarché for the organization of the Twin Event "Art and Artificial Evolution" at Galerie Louchard.

I take this opportunity to thank the different partners whose financial and material support were precious: the MIA department of INRA, the Inria Saclay research unit, AgroParisTech, ISC-PIF, Polytech-Tours, the Local Solver company, the RO and MACS research groups (GDR) of CNRS.

We are as always deeply grateful to all authors who submitted their research work to the conference, to all artists who contributed to the art exhibition, and to all attendees who made the conference so lively. The scientific quality as well as the warm and friendly atmosphere of this series of conferences is the result of a rare alchemy that is still maintained. Thank you for all these years of fidelity, thank you for EA 2017.

February 2018 Evelyne Lutton

Évolution Artificielle 2017 — EA 2017

October 25–27, 2017
Paris, France
13th International Conference on Artificial Evolution

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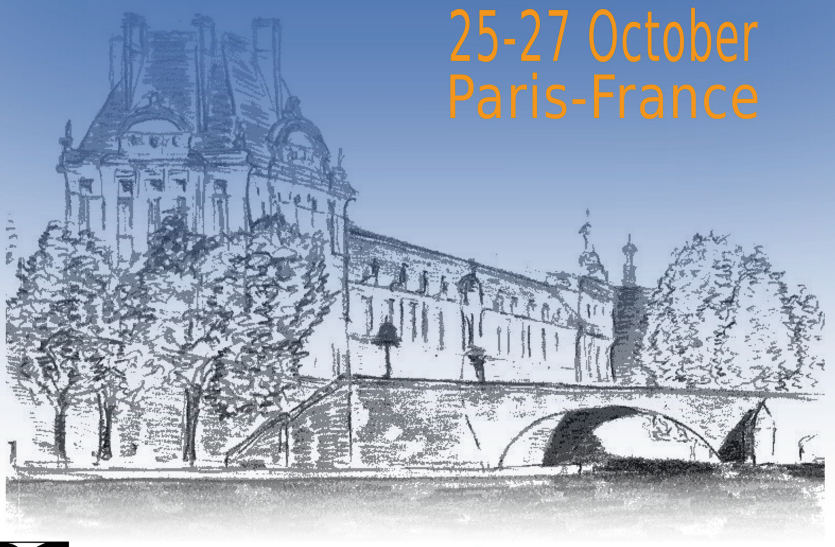

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Abstracts of Invited Talks

The Cartography of Computational Search Spaces

Gabriela Ochoa

Abstract. Recent findings and visual (static and animated) maps characterizing combinatorial and program search spaces were presented in this talk. The foundations for a new perspective to understand problem structure and improve heuristic search algorithms are established: search space cartography.

A multitude of heuristic and bio-inspired search algorithms have been proposed, each trying to be more powerful and innovative. However, little attention has been devoted to understanding the structure of the problems and what makes them hard to solve for a given algorithm. Formal theoretical results are difficult to obtain, and they may only apply to problem classes and algorithms chosen more for their amenability to analysis than for their relevance and difficulty.

Heuristic methods operate by searching a large space of candidate solutions. The search space can be regarded as a spatial structure where each point (candidate solution) has a height (objective or fitness function value) forming a fitness landscape surface. The performance of optimization algorithms crucially depends on the fitness landscape structure, and the study of landscapes offers an alternative to problem understanding where realistic formulations and algorithms can be analyzed.

Most fitness landscapes analysis techniques study the local structure of search spaces. There is currently a lack of tools to study instead their global structure, which is known to impact the performance of algorithms. Our recently proposed model, local optima networks, fills this gap by bringing tools from complex networks to study optimization. This model provides fundamental new insight into the structural organization and the connectivity pattern of a search space with given move operators. Most importantly, it allows us to visualize realistic search spaces in ways not previously possible and offers a whole new set of quantitative network metrics for characterizing them.

Progressive Data Analysis: A New Computation Paradigm for Scalability in Exploratory Data Analysis

Jean-Daniel Fekete

Abstract. Exploring data requires a short feedback loop, with a latency of at most 10 s because of human cognitive capabilities and limitations. When data become large or analyses become complex, sequential computations can no longer be completed in a few seconds and interactive exploration is severely hampered. This talk described a novel computation paradigm called "progressive data analysis" that brings low-latency guarantee at the programming language level the by performing computations in a progressive fashion. Moving this progressive computation at the language level relieves the programmer of exploratory data analysis systems from implementing the whole analytics pipeline in a progressive way from scratch, streamlining the implementation of scalable exploratory analytics systems. The new paradigm was described, novel experiments showing that humans can cope effectively with progressive systems were reported, and demos using a prototype implementation called ProgressiVis were shown. The requirements it implies through exemplar applications were explained, and opportunities and challenges ahead were presented, in the domains of visualization and machine-learning.

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