Welcome

Dear GECCO attendees,

Welcome to the 2022 Genetic and Evolutionary Computation Conference (GECCO). After two years of meeting online – very successfully, we need to say – we are delighted to bring you the first ever hybrid-format GECCO: nearly every event and presentation will be accessible by every attendee, no matter their physical location and time zone.

GECCO is the leading, peer-reviewed conference in the field of evolutionary computation, and the main conference of the Special Interest Group on Genetic and Evolutionary Computation (SIGEVO) of the Association for Computing Machinery (ACM). To identify the most important and technically sound papers, the conference implements a rigorous and selective review process, conducted by two chairs per track in coordination with the Editor-in-Chief. The technical program is divided into 13 tracks reflecting all aspects of our field, including the recently established Neuroevolution track.

This year, we received 427 regular paper submissions and accepted 158 of them as oral presentations (37% acceptance rate) and 152 are appearing in the Companion Proceedings as poster papers (alongside 32 submitted directly as posters). Besides the technical tracks, GECCO’22 offers 38 tutorials, 23 workshops that cover important topics in our field, and a range of events: the Humies Awards ceremony, 10 competitions, Women@GECCO, Evolutionary Computation in Practice, a five-day SIGEVO Summer School preceding the conference, the “Conversation with John Koza”, the job market, and much more. The highlights of the event are the keynotes given by three esteemed North American researchers: Cynthia Breazeal of MIT, USA and Erik Goodman of MSU, USA and Meinolf Sellmann of InsideOpt, USA.

We are thankful to all authors, tutorial speakers, as well as workshop and competition organizers who contributed to GECCO despite the ongoing pandemic conditions. We would also like to express our thanks to all organizers, in particular to all chairs: tracks, tutorials, workshops, publicity, competitions, late breaking abstracts, and hot-off-the-press. We also thank the organizers of the Humies, Women@GECCO, and summer school, as well as to the members of our program committee. We sincerely appreciate all these efforts and contributions.

Some members of the organization team deserve particular recognition: Aldeida Aleti, Publicity Chair; Ales Zamuda, Virtualisation Chair; Alma Rahat, Proceedings Chair; Erik Hemberg, Local Chair; Irene Moser, Electronic Media Chair; and Nelishia Pillay and Sara Tari, Student Affairs Chairs. Every single one of them has been indispensable. We also thank Ahmed Kheiri for optimizing the schedule of this hybrid conference; Brenda Ramirez, Melanie Field, and Roxane Rose of Executive Events who helped us with registrations and the logistics of the event, as well as Franz Rothlauf, Emma Hart, Anne Auger and Peter Bosman from SIGEVO and the Business Committee for their valuable advice and guidance. Moreover, our gratitude goes to our generous business sponsors and institutional supporters: Autogenetics, the BEACON Centre, Google, and the Technology Innovation Institute.

Last but not least, we thank our fellow organisers and the venues for working with us to provide you with a safe and sustainable event. Among others: to increase safety, the staff wear masks, and we provide spare masks and hand sanitiser; and to increase sustainability, we no longer print the program, and we provide locally sourced products and locally sourced keynote speakers.

Enjoy the conference… and stay safe and healthy!

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School of Computer Science, The University of Adelaide

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EML – Evolutionary Machine Learning
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GA – Genetic Algorithms
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GECH – General Evolutionary Computation and Hybrids
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GP – Genetic Programming
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RWA – Real World Applications
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Xie, Huayang, Oracle New Zealand
Xin-She, Yang, Middlesex University
Xiong, Ning, Malardalen University
Xue, Yu, Nanjing University of Information Science and Technology
Yamada, Takeshi, NTT Communication Science Labs.
Yaman, Anil, Vrije Universiteit Amsterdam
Yang, Cuie, Hong kong Baptist University
Yannakakis, Georgios N., Institute of Digital Games, University of Malta, Malta; University of Malta
Ye, Furong, Leiden University
Yevseyeva, Iryna, De Montfort University
Yousuf, Aisha, Raytheon BBN Technologies
Yu, Haibo,
Yuan, Gonglin, Victoria University of Wellington
Zaefferer, Martin, DHBW Ravensburg
Zafra, Amelia, University of Cordoba
Zamuda, Aleš, University of Maribor
Zapotecas-Martínez, Saúl, Universidad Autónoma Metropolitana
Zarges, Christine, Aberystwyth University
Zavoianu, Ciprian, Robert Gordon University
Zenisek, Jan, University of Applied Sciences Upper Austria
Zhan, Zhi-Hui, South China University of Technology, Pazhou Laboratory
Zhang, Fangfang, Victoria University of Wellington
Zheng, Weijie, Southern University of Science and Technology, University of Science and Technology of China
Zhong, Jinghui, South China University of Technology
Zhou, Aimin, Department of Computer Science and Technology, East China Normal University
Zincir, Ibrahim, Izmir University of Economics
Zincir-Heywood, Nur, Dalhousie University
Zipkin, Joseph, Massachusetts Institute of Technology
al-Rifaie, Mohammad Majid, University of Greenwich
da Cruz, Andre Rodrigues, Centro Federal de EducaçãLo Tecnológica de Minas Gerais
de França, Fabricio, UFABC
de Nobel, Jacob, Leiden University
de Oliveira Neto, Francisco Gomes, Chalmers and the University of Gothenburg
de la Fraga, Luis Gerardo, CINVESTAV
van Stein, Bas, LLACS, Leiden University
van der Blom, Koen, Leiden University
Özcan, Ender, University of Nottingham
Tinós, Renato, University of São Paulo
Schedule
## Schedule at a Glance.

<table>
<thead>
<tr>
<th>Saturday, July 09</th>
<th>Sunday, July 10</th>
<th>Monday, July 11</th>
<th>Tuesday, July 12</th>
<th>Wednesday, July 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutorials and Workshops (08:30–10:20)</td>
<td>Tutorials and Workshops (08:30–10:20)</td>
<td>Opening Session (08:30–08:50)</td>
<td>Invited Keynote <strong>Meinolf Sellmann</strong> (08:50–10:00)</td>
<td>Paper Sessions, Hop, IMPACT and Funding-Related Session (09:00–10:20)</td>
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<tr>
<td>Break</td>
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<tr>
<td>Tutorials and Workshops (10:50–12:40)</td>
<td>Tutorials and Workshops (10:50–12:40)</td>
<td>Paper Sessions, and ECiP (10:30–11:50)</td>
<td>Invited Keynote <strong>Cynthia Breazeal</strong> (10:30–11:40)</td>
<td>SIGEVO Keynote <strong>Erik Goodman</strong> (10:50–12:00)</td>
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<td>Break</td>
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<tr>
<td>Tutorials and Workshops (16:00–17:50)</td>
<td>Tutorials, Workshops, and Competitions (16:00–17:50)</td>
<td>Poster Session I (Hybrid) (16:00–18:00)</td>
<td>Paper Sessions, and HOP (14:30–15:50)</td>
<td>Paper Sessions, and HOP (16:20–17:40)</td>
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<tr>
<td>Break</td>
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<tr>
<td>Women@GECCO (18:00–20:00)</td>
<td>Koza Reception (18:00–20:00)</td>
<td>Social Event <strong>Tuesday Night Banquet</strong> (18:30–21:30)</td>
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Workshop and Tutorial Sessions (July 09, 2022)

<table>
<thead>
<tr>
<th>Time</th>
<th>Atlantic 1</th>
<th>Atlantic 2</th>
<th>Atlantic 3</th>
<th>Pacific A</th>
<th>Pacific B-C</th>
<th>Pacific C-H</th>
<th>Pacific F</th>
<th>Caspian</th>
<th>Online 1</th>
<th>Online 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Graph-based Genetic Programming (Kalkreut, Sotto, Vasicek)</td>
<td>Evolution of Neural Networks (Miikkulainen)</td>
<td>Model-Based Evolutionary Algorithms (Thierens, Bosman)</td>
<td>Runtime Analysis of Population-based Evolutionary Algorithms (Lehre, Oliveto)</td>
<td>ECXAI: Evolutionary Computation and Explainable AI</td>
<td>GI: Genetic Improvement</td>
<td>GI: Genetic Improvement</td>
<td>GI: Genetic Improvement</td>
<td>A Gentle Introduction to Theory (For Non-Theoreticians) (Doerr)</td>
<td>Selection Hyper-heuristics (Kheiri, Keedwell)</td>
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<td>Embedding Knowledge into Optimization Process (Gandomi)</td>
<td>Evolutionary Computation for Feature Selection and Feature Construction (XUE, Zhang)</td>
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<td>10:50–12:40</td>
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<tr>
<td>13:40–15:30</td>
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<td>Benchmarking and analyzing iterative optimization heuristics with IOHprofiler (Doerr, Wang, Vermetten, Bäck, Nobel, Ye)</td>
<td>Lexicase Selection (Helmuth, Cava, Medical)</td>
<td>Bayesian Optimization (Cuckuyt, Gonzalez, Branke)</td>
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<tr>
<td>16:00–17:50</td>
<td>A (Biased) Introduction to Benchmarking (Auger)</td>
<td>Automated Algorithm Configuration and Design (López-Ibáñez, of, Stützle, Cáceres)</td>
<td>Quality-Diversity Optimization (Cally, Mouret, Doncieux)</td>
<td>Introductory Mathematical Programming for EC (Shir)</td>
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No Sessions  Advanced Tutorials  Introductory Tutorials  Workshops
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<tr>
<th>Time</th>
<th>Atlantic 1</th>
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<th>Atlantic 3</th>
<th>Pacific A</th>
<th>Pacific B-C</th>
<th>Pacific C-H</th>
<th>Pacific F</th>
<th>Caspian</th>
<th>Online 1</th>
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<td>16:00–17:50</td>
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</tbody>
</table>

**Schedule**

**Workshop and Tutorial Sessions (July 10, 2022)**

- **Specialized Tutorials**
- **Competition**
- **Introductory Tutorials**
- **Advanced Tutorials**
- **Workshops**

No Sessions
## Parallel Sessions (Monday, July 11 – Wednesday, July 13)

<table>
<thead>
<tr>
<th>Time</th>
<th>Atlantic 1</th>
<th>Atlantic 2</th>
<th>Atlantic 3</th>
<th>Pacific A</th>
<th>Pacific B-C</th>
<th>Pacific G-H</th>
<th>Pacific F</th>
<th>Caspian</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:30-11:50</td>
<td>GECH 1</td>
<td>GP 2</td>
<td>CS 1</td>
<td>SBSE 1 - NE 3</td>
<td>EMO 4</td>
<td>SBSE 2</td>
<td>NE 4</td>
<td>NE 1</td>
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<tr>
<td>12:50-14:10</td>
<td>ENUM 1 - Theory 1</td>
<td>EML 1</td>
<td>GA 1</td>
<td>RWA 4</td>
<td>RWA 5</td>
<td>ECOM 5</td>
<td>RWA 6</td>
<td>NE 2</td>
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<tr>
<td>14:40-16:00</td>
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<td>EML 2</td>
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<td>12:40-14:00</td>
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<td>EML 3</td>
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<td>14:30-15:50</td>
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<td>EML 4</td>
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<tr>
<td>16:20-17:40</td>
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<td>ACO-SI 2</td>
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<td>09:00-10:20</td>
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<td>EML 5</td>
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</table>

*Sessions with Best Paper Nominees*

No Sessions
## Track List and Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACO-SI</td>
<td>Ant Colony Optimization and Swarm Intelligence</td>
</tr>
<tr>
<td>CS</td>
<td>Complex Systems (Artificial Life/Artificial Immune Systems/Generative and Developmental Systems/Evolutionary Robotics/Evolvable Hardware)</td>
</tr>
<tr>
<td>ECOM</td>
<td>Evolutionary Combinatorial Optimization and Metaheuristics</td>
</tr>
<tr>
<td>EML</td>
<td>Evolutionary Machine Learning</td>
</tr>
<tr>
<td>EMO</td>
<td>Evolutionary Multiobjective Optimization</td>
</tr>
<tr>
<td>ENUM</td>
<td>Evolutionary Numerical Optimization</td>
</tr>
<tr>
<td>GA</td>
<td>Genetic Algorithms</td>
</tr>
<tr>
<td>GECH</td>
<td>General Evolutionary Computation and Hybrids</td>
</tr>
<tr>
<td>GP</td>
<td>Genetic Programming</td>
</tr>
<tr>
<td>NE</td>
<td>Neuroevolution</td>
</tr>
<tr>
<td>RWA</td>
<td>Real World Applications</td>
</tr>
<tr>
<td>SBSE</td>
<td>Search-Based Software Engineering</td>
</tr>
<tr>
<td>Theory</td>
<td>Theory</td>
</tr>
</tbody>
</table>
**Time Zone**

All times in this program appears in Boston's time zone (UTC/GMT-4, Eastern Daylight Time).

For your convenience, we provide here the equivalent time in a few selected major cities around the world:

- For New York (USA), same as Boston.
- For Toronto (Canada), same as Boston.
- For Chicago/Houston (USA), please subtract 1 hour.
- For Los Angeles/San Francisco (USA), please subtract 3 hours.
- For Vancouver (Canada), please subtract 3 hours.
- For Paris (France)/Madrid (Spain)/Frankfurt (Germany), please add 6 hours.
- For London (UK)/Lisbon (Portugal), please add 5 hour.
- For Sao Paulo (Brazil), please add 1 hour.
- For New Delhi (India), please add 9 and a half hours.
- For Sydney/Melbourne (Australia), please add 14 hours.
- For Shanghai/Beijing (China), please add 12 hours.
- For Taipei (Taiwan), please add 12 hours.
- For Tokyo (Japan), please add 13 hours.
- For Johannesburg/Cape Town (South Africa), please add 6 hours.
- For Wellington (New Zealand), please add 16 hours.
Keynotes
This talk summarizes our 15+ years of work on the use of Machine Learning for Search & Optimization. I review the four main approaches that we invented during this time. Since learning during search takes effort, it should not surprise that we designed three of these approaches for a particular target range of total function evaluations: from few tens of dozens, to thousands, to many hundreds of thousands of function evaluations. The last hybrid I review regards a surrogate-based approach for optimization under stochastic uncertainty. The wonder of this research area is that each of these four methods defines the state of the art in its respective area, giving significant empirical evidence that learning to optimize can be highly effective.

**Biosketch:** Meinolf currently serves as CTO of InsideOpt, a US-based startup that produces general-purpose software for automating decision-making under uncertainty. Before, he held positions as Director for Network Optimization at Shopify, Lab Director for the Machine Learning and the Knowledge Representation Labs at General Electric’s Global Research Center, Senior Manager for Cognitive Computing at IBM Research, and Assistant Professor for Computer Science at Brown University. Meinolf received his doctorate degree in 2002 from Paderborn University (Germany) and then went on to Cornell University as Postdoctoral Associate. Meinolf has published over 80 articles in international conferences and journals, holds six patents, served as PC Chair of IAAI 2021 and 2022, LION 2016, and CPAIOR 2013, Conference Chair of CP 2007, and Associate Editor of the Informs Journal on Computing. He won over 22 first prizes at international programming competitions, most recently two first prizes at the AI4TSP competition held at IJCAI 2021.
People have welcomed conversational AI technologies into our homes, workplaces, and institutions where we interact with them on a daily basis. The proliferation of digital assistants in a multitude of embodiments (e.g., speakers, displays, avatars, robots) in human environments over extended periods of time provides us with new ways to investigate, develop and assess the design of personified AIs that emotionally engage and support people to promote human flourishing across a wide range of applications and usage contexts. In this talk, I highlight a number of research projects where we are developing, fielding, and assessing social robots in homes, schools, and living communities of older adults. We explore different embodiments and develop adaptive algorithmic capabilities for our robots to sustain interpersonal engagement and personalize to people's needs to support novel interventions in education, social engagement, and emotional wellness. In addition to evaluating the impact of these capabilities and features on improving learning, sustaining engagement, nudging behavior, and shifting attitudes — we are also examining the nature of the relationship that people form with these personified AI technologies and how it contributes to these impacts. We conclude by reflecting on the ethical and responsible design of intelligent technologies that emotionally engage and build relationships with people.

**Biosketch:** Cynthia Breazeal is a Professor at the MIT Media Lab where she founded and directs the Personal Robots Group. She is also MIT dean for digital learning leading professional education, and director of MIT’s initiative on Responsible AI for Social Empowerment and Education (RAISE) to help bring AI education to K12 and the workforce. She is a pioneer in the field of social robotics and human-robot interaction. Her research focuses on the design and real-world impact of personalized and emotionally engaging personified AI technologies that promote personal growth, learning, creativity and flourishing by people of all ages. She is author of the seminal book ‘Designing Sociable Robots,’ named a AAAI Fellow, and is a recipient of the George R. Stibitz Computer & Communications Pioneer Award. She has spoken at prestigious venues such as TED, CES, SXSW, the World Economic Forum, and the United Nations on topics related to AI, innovation, and society. She is globally recognized as an award-winning innovator, designer, and entrepreneur. Her work has been recognized by the National Academy of Engineering, the National Design Awards, and Technology Review's TR100/35 Award. She was founder, Chief Scientist and Chief Experience Officer of the mass consumer home robotics startup, Jibo, Inc. whose eponymous robot received numerous design and innovation awards by CES, Fast Company, Core 77, and was featured on the cover of TIME magazine as part of the 2017 Best Inventions Awards. She received her doctorate from MIT in Electrical Engineering and Computer Science in 2000.
An Evolutionary Optimizer’s Path to Commercial Success and Some Rocket Science Beyond It
Erik Goodman, Michigan State University and BEACON Center for the Study of Evolution in Action, USA

Few EC technologies have gone from universities to commercial success. Goodman will describe the SHERPA algorithm, part of the HEEDS design exploration framework, and how Red Cedar Technology, which he co-founded, eventually succeeded. Beginning 20 years ago, SHERPA used a self-adapting ensemble of EC methods (GA, ES, DE, SA, etc.) in each run, requiring no choice of optimization methods or parameters by the engineering user. It is a best-selling engineering design optimizer, still built around the original code developed in 1999-2010, although current owner Siemens now has 20+ developers on HEEDS and SHERPA. Goodman will then turn to a problem outside SHERPA’s scope, addressed with unpublished parallel EC methods. NASA provided a futuristic challenge problem to teams of DARPA awardees, to develop ways to optimize the distribution of a set of solid propellant types (eventually to be 3D-printed) in a rocket. Goodman will describe the modeling of the rocket and several problem-specific EC methods used to find feasible solutions to this problem with a design space of $10^{300} - 10^{500}$ and over 700 constraints.

Biosketch: Erik D. Goodman is PI and Executive Director of the BEACON Center for the Study of Evolution in Action, an NSF Science and Technology Center headquartered at Michigan State University, funded by NSF for 2010-20, and now continuing with funding from MSU. BEACON has a dynamic research program and extensive education and outreach programs, and includes evolutionary biologists as well as computer scientists/engineers studying evolutionary computation (for search and optimization) and evolution of digital organisms. Goodman is a professor in Electrical and Computer Engineering, Mechanical Engineering, and Computer Science and Engineering. He was co-founder and VP Technology, Red Cedar Technology, Inc., (now a division of Siemens), which developed design optimization software that has become a best-selling system in industry. He was named Michigan Distinguished Professor of the Year, 2009, and received the MSU Distinguished Faculty Award in 2011. He was elected Chair of the Executive Board (2003-2005) and Senior Fellow, International Society for Genetic and Evolutionary Computation; then was Founding Chair of the ACM SIG on Genetic and Evolutionary Computation (SIGEVO), 2005. His current personal research is on evolutionary algorithms for optimization of heterogeneous propellant grains for solid-fuel rockets and on evolutionary approaches to neural architecture search.
Koza Reception
A Conversation with John Koza
30 years after the publication of Genetic Programming: On the programming of computers by means of natural selection
Sunday, July 10, 18:00-20:00, in the Conference Hotel

2022 marks 30 years after the publication of John Koza’s first book on Genetic Programming by MIT Press in 1992. While more volumes would follow, in 1994, 1999 and 2003, this first full exposure of GP to the research community deserves a special place in our memory. After a generation has passed, this moment is an opportunity to take stock and look back at the developments following this initial publication and its reception in the community.

On the eve of GECCO-2022 we shall hold a conversation with John Koza, delivered in both in-person and online formats. For those in attendance in Boston, there will be a reception with food and drinks (including a cash bar).

John was also the organizer of the Genetic Programming Conference series and played a key role in bringing together leaders of three conferences: ICGA, GP and PPSN, and in establishing the governance structure of the International Society for Genetic and Evolutionary Computation (ISGEC) and its GECCO Conferences. He also helped lead the transition from ISGEC into ACM SIGEVO. He created the Human-Competitive Results Awards Competition (Humies) and has sponsored it annually for nearly 20 years. John also invented the scratch-off lottery ticket, created a board game (Consensus) about the Electoral College, and founded the National Popular Vote movement, which is striving today to effectively eliminate the effects of the Electoral College without requiring a constitutional amendment.

Every GECCO-2022 attendee is invited to the event, on Sunday evening, July 10, 18:00-20:00 Eastern Time, live or via Zoom. Come and join a special celebration!
Introductory Tutorials

**Graybox Optimization and Next Generation Genetic Algorithms**
Darrell Whitley, *Colorado State University*
Saturday, July 09, 08:30–10:20
Atlantic 2

**Evolutionary Diversity Optimization for Combinatorial Optimization**
Jakob Bossek, *RWTH Aachen University*
Aneta Neumann, *The University of Adelaide*
Frank Neumann, *The University of Adelaide*
Saturday, July 09, 08:30–10:20
Atlantic 3

**Representations for Evolutionary Algorithms**
Franz Rothlauf, *Universität Mainz*
Saturday, July 09, 08:30–10:20
Pacific A

**Difficulties in Fair Performance Comparison of Multiobjective Evolutionary Algorithms**
Hisao Ishibuchi, *Southern University of Science and Technology*
Lie Meng Pang, *Southern University of Science and Technology*
Ke Shang, *Southern University of Science and Technology*
Saturday, July 09, 08:30–10:20
Online 1

**Evolutionary Continuous Dynamic Optimization**
Danial Yazdani, *Southern University of Science and Technology*
Xin Yao, *Southern University of Science and Technology*
Saturday, July 09, 08:30–10:20
Online 2

**Graph-based Genetic Programming**
Roman Kalkreuth, *TU Dortmund*
Leo Sotto, *Fraunhofer Institute for Algorithms and Scientific Computing*
Zdenek Vasicek, *Brno University of Technology*
Saturday, July 09, 10:50–12:40
Atlantic 1

**Evolution of Neural Networks**
Risto Miikkulainen, *The University of Texas at Austin and Cognizant AI Labs*
Saturday, July 09, 10:50–12:40
Atlantic 2

**Model-Based Evolutionary Algorithms**
Dirk Thierens, *Utrecht University*
Peter Bosman, *Centrum Wiskunde & Informatica (CWI)*
Saturday, July 09, 10:50–12:40
Atlantic 3

**A Gentle Introduction to Theory (For Non-Theoreticians)**
Benjamin Doerr, *Ecole Polytechnique and Laboratoire d’Informatique (LIX)*
Saturday, July 09, 10:50–12:40
Online 1

**Selection Hyper-heuristics**
Ahmed Kheiri, *Lancaster University*
Edward Keedwell, *University of Exeter*
Saturday, July 09, 10:50–12:40
Online 2

**Generative Hyper-heuristics**
Daniel Tauritz, *Auburn University*
John Woodward, *Queen Mary University of London*
Saturday, July 09, 13:40–15:30
Atlantic 1

**Bayesian Optimization**
Ivo Couckuyt, *Ghent University*
Sebastian Rojas Gonzalez, *Ghent University*
Juergen Branke, *University of Warwick*
Saturday, July 09, 13:40–15:30
Pacific A
Transfer Learning in Evolutionary Spaces  
Nelishia Pillay, University of Pretoria  
Saturday, July 09, 13:40–15:30  
Online 1

Learning Classifier Systems: Cognitive Inspired Machine Learning for eXplainable AI  
Abubakar Siddique, Victoria University of Wellington  
Will Browne, Queensland University of Technology  
Saturday, July 09, 13:40–15:30  
Online 2

A (Biased) Introduction to Benchmarking  
Anne Auger, Inria  
Saturday, July 09, 16:00–17:50  
Atlantic 1

Automated Algorithm Configuration and Design  
Manuel López-Ibáñez, University of Málaga and University of Manchester  
Thomas Stützle, Université Libre de Bruxelles  
Leslie Pérez Cáceres, Pontificia Universidad Católica de Valparaíso  
Saturday, July 09, 16:00–17:50  
Atlantic 2

Quality-Diversity Optimization  
Antoine Cully, Imperial College  
Jean-Baptiste Mouret, Inria Nancy - Grand Est and CNRS, Université de Lorraine  
Stéphane Doncieux, ISIR, Sorbonne University and CNRS  
Saturday, July 09, 16:00–17:50  
Atlantic 3

Introductory Mathematical Programming for EC  
Ofer Shir, Tel-Hai College and The Galilee Research Institute - Migal  
Saturday, July 09, 16:00–17:50  
Pacific A

Embedding Knowledge into Optimization Process  
Amir H. Gandomi, University of Technology Sydney  
Saturday, July 09, 16:00–17:50  
Online 1

Evolutionary Computation for Feature Selection and Feature Construction  
Bing XUE, Victoria University of Wellington  
Mengjie Zhang, Victoria University of Wellington  
Saturday, July 09, 16:00–17:50  
Online 2

Advanced Tutorials

Genetic improvement: Taking real-world source code and improving it using computational search methods  
Saemundur Haraldsson, University of Stirling and University of Stirling  
John Woodward, Queen Mary University of London  
Alexander Brownlee, Stirling University  
Emily Winter, Lancaster University  
Brad Alexander, The University of Adelaide  
Saturday, July 09, 08:30–10:20  
Atlantic 1

Runtime Analysis of Population-based Evolutionary Algorithms  
Per Lehre, University of Birmingham and The Alan Turing Institute  
Pietro Oliveto, University of Sheffield  
Saturday, July 09, 10:50–12:40  
Pacific A
Benchmarking and analyzing iterative optimization heuristics with IOHprofiler
Carola Doerr, Sorbonne University and CNRS, LIP6
Hao Wang, Leiden University
Diederick Vermetten, Leiden University
Thomas Bäck, Leiden University
Jacob de Nobel, Leiden University
Furong Ye, Leiden University

Saturday, July 09, 13:40–15:30
Atlantic 2

Lexicase Selection
Thomas Helmuth, Hamilton College
William La Cava, Boston Children's Hospital and Harvard Medical School

Saturday, July 09, 13:40–14:35
Atlantic 3

Sequential Experimentation by Evolutionary Algorithms
Ofer Shir, Tel-Hai College and The Galilee Research Institute - Migal
Thomas Bäck, Leiden University

Sunday, July 10, 08:30–10:20
Atlantic 2

Statistical Analyses for Multi-objective Stochastic Optimization Algorithms
Tome Eftimov, Jožef Stefan Institute
Peter Korošec, Jožef Stefan Institute

Sunday, July 10, 08:30–10:20
Atlantic 3

Theory and Practice of Population Diversity in Evolutionary Computation
Dirk Sudholt, University of Passau
Giovanni Squillero, Politecnico di Torino

Sunday, July 10, 08:30–10:20
Online 1

CMA-ES and Advanced Adaptation Mechanisms
Youhei Akimoto, University of Tsukuba and RIKEN AIP
Nikolaus Hansen, Inria and Ecole Polytechnique

Sunday, July 10, 08:30–10:20
Online 2

Evolutionary Submodular Optimisation
Aneta Neumann, The University of Adelaide
Frank Neumann, The University of Adelaide
Chao Qian, Nanjing University

Sunday, July 10, 10:50–12:40
Atlantic 2

Benchmarking Multiobjective Optimizers 2.0
Dimo Brockhoff, Inria and IP Paris
Tea Tušar, Jožef Stefan Institute

Sunday, July 10, 10:50–12:40
Atlantic 3

Coevolutionary Computation for Adversarial Deep Learning
Jamal Toutouh, Massachusetts Institute of Technology and University of Málaga
Una-May O’Reilly, Massachusetts Institute of Technology

Sunday, July 10, 13:40–15:30
Atlantic 2

Constraint-Handling Techniques used with Evolutionary Algorithms
Carlos Coello Coello, CINVESTAV-IPN

Sunday, July 10, 13:40–15:30
Atlantic 3
Specialized Tutorials

Optimization Challenges at the European Space Agency
Dario Izzo, European Space Agency
Manuel López-Ibáñez, University of Málaga and University of Manchester
Sunday, July 10, 08:30–10:20
Pacific A

Introduction to Automated Design of Scheduling Heuristics with Genetic Programming
Marko Durasevic, University of Zagreb Faculty of electrical engineering and computing
Domagoj Jakobovic, University of Zagreb, Faculty of Electrical Engineering and Computing
Yi Mei, School of Engineering and Computer Science, Victoria University of Wellington
Su Nguyen, Research Centre for Data Analytics and Cognition, La Trobe University
Mengjie Zhang, School of Engineering and Computer Science, Victoria University of Wellington
Sunday, July 10, 10:50–12:40
Atlantic 1

Ant Colony Optimisation for Software Engineers
Carlos Gavidia-Calderon, The Open University
Hector Menendez, Kings College London
Sunday, July 10, 13:40–15:30
Online 2

Evolutionary Computation and Machine Learning in Security
Stjepan Picek, Radboud University and Delft University of Technology
Domagoj Jakobovic, University of Zagreb
Sunday, July 10, 16:00–17:50
Atlantic 2

Evolutionary Computation and Evolutionary Deep Learning for Image Analysis, Signal Processing and Pattern Recognition
Mengjie Zhang, Victoria University of Wellington
Stefano Cagnoni, University of Parma
Sunday, July 10, 16:00–17:50
Atlantic 3

Decomposition Multi-Objective Optimisation Current Developments and Future Opportunities
Ke Li, University of Exeter
Qingfu Zhang, City University of Hong Kong
Sunday, July 10, 16:00–17:50
Online 2
Workshops,
Late-breaking Abstracts, and Women@GECCO
AABOH – Analysing algorithmic behaviour of optimisation heuristics

Organizers: Anna V Kononova, LIACS, Leiden University, The Netherlands; Hao Wang, LIACS, Leiden University, The Netherlands; Michael Emmerich, LIACS, Leiden University, The Netherlands; Peter A. N. Bosman, Centre for Mathematics and Computer Science, The Netherlands; Daniela Zaharie, West University of Timisoara, Romania; Fabio Caraffini, Institute of Artificial Intelligence, De Montfort University, Leicester, UK; Johann Dreo, Pasteur Institute and CNRS, France

Room: Pacific F

Session 1: Contributed Paper

Time: Sunday, July 10, 08:30–10:20

Welcome Talk

08:30

Survivor Selection in a Crossoverless Evolutionary Algorithm
Nielis Brouwer, Danny Dijkzeul, Levi Koppenhol, Iris Pijning, Daan van den Berg

08:35

Exactly characterizable parameter settings in a crossoverless evolutionary algorithm
Levi Koppenhol, Nielis Brouwer, Danny Dijkzeul, Iris Pijning, Joeri Sleegers, Daan van den Berg

08:50

Examining Algorithm Behavior using Recurrence Quantification and Landscape Analyses
Mario Munoz Acosta

09:05

The Effect of Decoding Fairness on Particle Swarm Optimization for the p-Median Problem
Pavel Kromer, Vojtech Uher

09:20

Dynamic Computational Resource Allocation for CFD Simulations Based on Pareto Front Optimization
Gašper Petelin, Margarita Antoniou, Gregor Papa

09:35

Using Structural Bias to Analyse the Behaviour of Modular CMA-ES
Diederick Vermetten, Fabio Caraffini, Bas van Stein, Anna Kononova

09:50

Closing

10:05

Session 2: Theoretical and Empirical Analysis of Optimisation Heuristics

Time: Sunday, July 10, 10:50–12:40

Opening Talk

10:50

Invited Talk
Benjamin Doerr, École Polytechnique, Palaiseau, France

10:55

Invited Talk
Thomas Bartz-Beielstein, TH Koeln, Institute for Data Science, Engineering, and Analytics, Germany

11:40

Panel Discussion

12:25

Closing Remarks

12:35
BBOB – Black Box Optimization Benchmarking

Organizers: Anne Auger, Inria and CMAP, Ecole Polytechnique, IP Paris, France; Dimo Brockhoff, Inria and CMAP, Ecole Polytechnique, IP Paris, France; Konstantin Dietrich, TH Köln, Germany; Paul Dufossé, Inria and Thales Defense Mission Systems, France; Tobias Glasmachers, Ruhr-Universität Bochum, Germany; Nikolaus Hansen, Inria and CMAP, Ecole Polytechnique, IP Paris, France; Olaf Mersmann, TU Köln, Germany; Petr Pošík, Czech Technical University, Czech Republic; Tea Tušar, Jožef Stefan Institute, Slovenia

Room: Pacific F

Session 1: A Benchmarking Jam Session
Time: Saturday, July 09, 08:30–10:20

The BBOBies: "Mini-Introduction to COCO"

Benchmarking the Hooke-Jeeves Method, MTS-LS1, and BSrr on the Large-scale BBOB Function Set
Ryoji Tanabe

08:30

Benchmarking an algorithm for expensive high-dimensional objectives on the bbob and bbob-largescale testbeds
Zachary Hoffman, Steve Huntsman

08:35

Benchmarking some variants of the CMAES-APOP using Keeping Search Points and Mirrored Sampling combined with Active CMA on the BBOB Noiseless Testbed
Duc Manh Nguyen

08:55

Benchmarking of Two Implementations of CMA-ES with Diagonal Decoding on the bbob Test Suite
Mohamed Gharafi

09:15

Benchmarking CMA-ES with Margin on the bbob-mixint Testbed
Ryoki Hamano, Shota Saito, Masahiro Nomura, Shinichi Shirakawa

09:35

The BBOBies: "Session remarks"

10:15

Session 2: Constrained Optimization
Time: Saturday, July 09, 10:50–12:40

The BBOBies: "The bbob-constrained Test Suite and Constrained Performance Assessment in COCO"

10:50

Benchmarking ϵMAg-ES and BP-ϵMAg-ES on the bbob-constrained Testbed
Michael Hellwig, Hans-Georg Beyer

11:05

Benchmarking several strategies to update the penalty parameters in AL-CMA-ES on the bbob-constrained testbed
Paul Dufossé, Asma Atamna

11:25

Constrained blackbox optimization with the NOMAD solver on the COCO constrained test suite
Charles Audet, Sébastien Le Digabel, Ludovic Salomon, Christophe Tribes

11:45

Open Discussion

12:05
BENCH – Good Benchmarking Practices for Evolutionary Computation

**Organizers:** Carola Doerr, CNRS and Sorbonne University, France; Tomi Eftimov, Stefan Institute, Slovenia; Pascal Kerschke, TU Dresden, Germany; Boris Naujoks, TH Cologne, Germany; Mike Preuss, Leiden University, The Netherlands; Vanessa Volz, modl.ai, Denmark

**Time:** Saturday, July 9, 16:00–17:50, Pacific B-C

- **Welcome & Opening**
  - 16:00

- **Invited Talk: Performance Evaluation in the Real World: Challenges and Potential Solutions**
  - Risto Miikkulainen
  - 16:10

- **Invited Talk: A Real-World Perspective on Benchmarking Optimization Algorithm**
  - Tea Tušar
  - 16:55

- **Discussion: relevance, approaches, and practicability of benchmarking for industry**
  - 17:40

ECADA – Evolutionary Computation for the Automated Design of Algorithms

**Organizers:** Daniel R. Tauritz, Auburn University, USA; John Woodward, Queen Mary University of London, UK; Manuel López-Ibáñez, University of Malaga, Spain

**Time:** Sunday, July 10, 13:40–15:30, Caspian

- **Opening Talk**
  - Daniel Tauritz, John Woodward, Manuel López-Ibáñez
  - 13:40

- **Why Functional Program Synthesis Matters (In the Realm of Genetic Programming)**
  - Fraser Garrow, Michael Lones, Robert Stewart
  - 13:50

- **Reinforcement learning based adaptive metaheuristics**
  - Michele Tessari, Giovanni Iacca
  - 14:15

- **Invited Talk: Transfer Learning in Automated Design Using Generation Hyper-Heuristics**
  - Nelishia Pillay
  - 14:40

- **Closing Remarks**
  - Daniel Tauritz, John Woodward, Manuel López-Ibáñez
  - 15:25

ECDM – Evolutionary Computation and Decision Making

**Organizers:** Tinkle Chugh, University of Exeter, UK; Richard Allmendinger, University of Manchester, UK; Jussi Hakanen, Silo AI, Finland

**Room:** Caspian

**Session 1**

**Time:** Sunday, July 10, 08:30–10:20

- **Opening Talk**
  - 08:30
Desirable Properties of Performance Indicators for Assessing Interactive Evolutionary Multiobjective Optimization Methods 08:40
Pouya Aghaei Pour, Sunith Bandaru, Bekir Afsar, Kaisa Miettinen

R-MBO: A Multi-surrogate Approach for Preference Incorporation in Multi-objective Bayesian Optimisation 09:05
Tinkle Chugh

Invited Talk: Evolutionary Computation and Decision Making in Unsupervised Learning 09:30
Julia Handl

Closing Remarks 10:15

Session 2
Time: Sunday, July 10, 10:50–12:40

Opening Talk 10:50

Interactive MOEA/D with Multiple Types of Preference Information 10:55
Giomara Larraga Maldonado, Kaisa Miettinen

Preliminary Results of Advanced Heuristic Optimization in the Risk-based Energy Scheduling Competition 11:20
Jose Almeida, Fernando Lezama, Joao Soares, Zita Vale, Bruno Canizes

Interactive Evolutionary Multiobjective Optimization with Modular Physical User Interface 11:45
Atanu Mazumdar, Stefan Otayagich, Kaisa Miettinen

Closing Remarks 12:10

ECXAI – Evolutionary Computation and Explainable AI

Organizers: Jaume Bacardit, Newcastle University, UK; Alexander E.I. Brownlee, University of Stirling, UK; Giovanni Iacca, University of Trento, Italy; John McCall, Robert Gordon University, UK; Stefano Cagnoni, University of Parma, Italy; David Walker, University of Plymouth, UK

Room: Pacific B-C

Session 1: Introduction, invited talk & ECXAI papers
Time: Saturday, July 09, 10:50–12:40

The intersection of Evolutionary Computation and Explainable AI 10:50
Jaume Bacardit, Alexander Brownlee, Stefano Cagnoni, Giovanni Iacca, John McCall, David Walker

Invited Talk: Performance Evaluation in the Real World: Challenges and Potential Solutions 11:10
Will N. Browne

Towards Explainable Metaheuristic: Mining Surrogate Fitness Models for Importance of Variables 11:50
Manjinder Singh, Alexander Brownlee, David Cairns

An Explainable Visualisation of the Evolutionary Search Process 12:10
Mathew Walter, David Walker, Matthew Craven
Towards the Evolutionary Assessment of Neural Transformers Trained on Source Code
Martina Saletta, Claudio Ferretti
13:40

Interpretable AI for policy-making in pandemics
Leonardo Custode, Giovanni Iacca
14:00

Evolving Explainable Rule Sets
Hormoz Shahrazad, Babak Hodjat, Risto Miikkulainen
14:20

Improving the Search of Learning Classifier Systems Through Interpretable Feature Clustering
Hayden Andersen, Andrew Lensen, Will Browne
14:40

Open Discussion
15:00

EGML-EC – Enhancing Generative Machine Learning with Evolutionary Computation
Organizers: Jamal Totouh, University of Malaga, Spain - MIT, USA; Una-May O’Reilly, MIT, USA; João Correia, University of Coimbra, Portugal; Penousal Machado, University of Coimbra, Portugal; Sergio Nesmachnow, Universidad de la República, Uruguay
Time: Saturday, July 09, 13:40–15:30, Pacific F

Opening Talk
Jamal Toutouh, João Correia
13:40

COIL: Constrained Optimization in Learned Latent Space: Learning Representations for Valid Solutions
Peter Bentley, Soo Ling Lim, Adam Gaier, Linh Tran
13:45

Evolving SimGANs to Improve Abnormal Electrocardiogram Classification
Gabriel Wang, Anish Thite, Rodd Talebi, Anthony D’Achille, Alex Musa, Jason Zutty
14:07

Exploring Expression-based Generative Adversarial Networks
Francisco Baeta, João Correia, Tiago Martins, Penousal Machado
14:29

Multi-target evolutionary latent space search of a generative adversarial network for human face generation
Benjamín Machín, Sergio Nesmachnow, Jamal Toutouh
14:51

Open Discussion
15:13

Closing Remarks
Jamal Toutouh, João Correia
15:25
**EQUUM – Evolutionary Optimization in Uncertainty Quantification Models**

**Organizers:** Josu Ceberio, University of the Basque Country (UPV/EHU), Spain; Rafael Villanueva, Universitat Politècnica de València (UPV), Spain; Ignacio Hidalgo, Universidad Complutense de Madrid, Spain; Francisco Fernandez, de Vega Universidad de Extremadura, Spain

**Time:** Sunday, July 10, 10:50–12:40, Pacific A

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<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>10:50</td>
<td>Opening Talk</td>
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<tr>
<td></td>
<td>Josu Ceberio, Rafael Villanueva, Ignacio Hidalgo, Francisco Fernandez de Vega</td>
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<tr>
<td>11:00</td>
<td>Approaching Epistemic and Aleatoric uncertainty with Evolutionary Optimization: Examples and Challenges</td>
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<tr>
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<td>Josu Ceberio, Juan Cortés, Francisco Fernández de Vega, Óscar Garnica, José Hidalgo, José Velasco, Rafael Villanueva</td>
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<tr>
<td>11:20</td>
<td>Evolutionary Approach to Model Calibration with Uncertainty: An Application to Breast Cancer Growth Model</td>
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<td>Carlos Andreu-Vilarroig, Josu Cebeiro, Juan-Carlos Cortés, Francisco Fernández de Vega, José-Ignacio Hidalgo, Rafael-Jacinto Villanueva</td>
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<td>11:40</td>
<td>Probability Density Function Computation in Evolutionary Model Calibration with Uncertainty</td>
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<td>Vicente Bevia</td>
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<td>12:00</td>
<td>Closing Remarks</td>
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<td>Josu Ceberio, Rafael Villanueva, Ignacio Hidalgo, Francisco Fernandez de Vega</td>
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</tbody>
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**EvoRL – Evolutionary Reinforcement Learning**

**Organizers:** Giuseppe Paolo, Huawei Technologies France; Adam Gaier, Autodesk AI Lab; Antoine Cully, Imperial College London, UK; Alexandre Coninx, Sorbonne University, France

**Time:** Sunday, July 10, 16:00–17:50, Caspian

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>16:00</td>
<td>Welcome and introduction</td>
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<tr>
<td>16:03</td>
<td>On the Effect of the Sampling Ratio of Past Trajectories in the Combination of Evolutionary Algorithm and Deep Reinforcement Learning</td>
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<td>Yasen Wang, Youhei Akimoto</td>
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<td>16:21</td>
<td>Safety-Informed Mutations for Evolutionary Deep Reinforcement Learning</td>
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<td>Enrico Marchesini, Christopher Amato</td>
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<td>16:39</td>
<td>Learning to acquire novel cognitive tasks with evolution, plasticity and meta-meta-learning</td>
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<td></td>
<td>Thomas Miconi</td>
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<tr>
<td>16:57</td>
<td>Invited Talk</td>
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<td></td>
<td>Julian Togelius, Associate Professor Department of Computer Science and Engineering Tandon School of Engineering New York University</td>
</tr>
</tbody>
</table>
**EvoSoft – Evolutionary Computation Software Systems**

**Organizers:** Stefan Wagner, University of Applied Sciences Upper Austria; Michael Affenzeller, University of Applied Sciences Upper Austria

**Time:** Saturday, July 09, 08:30–10:20, Pacific G-H

**Welcome & Opening Talk**

08:30

**JGEA: a Modular Java Framework for Experimenting with Evolutionary Computation**

Eric Medvet, Giorgia Nadizar, Luca Manzoni

08:35

**Recent developments in HNCO**

Arnaud Berny

08:55

**Facilitating the Hybridization of Parallel Evolutionary Algorithms in Cluster Computing Environments**

Hatem Khalloof, Sergen Ciftci, Shadi Shahoud, Clemens Düpmeier, Kevin Förderer, Veit Hagenmeyer

09:15

**DynStack - A Benchmarking Framework for Dynamic Optimization Problems in Warehouse Operations**

Andreas Beham, Sebastian Leitner, Johannes Karder, Bernhard Werth, Stefan Wagner

09:35

**Discussion on Recent Advances and Future Trends in EC Software Systems**

09:55

**Workshop Closing**

10:15

**GI – Genetic Improvement**

**Organizers:** Bobby R. Bruce, UC Davis, USA; Vesna Nowack, Fixie Project, Lancaster University, UK; Aymeric Blot, CREST, UCL, UK; Emily Winter, Fixie Project, Lancaster University, UK; Bill Langdon, CREST, UCL, UK; Justyna Petke, CREST, UCL, UK

**Room:** Pacific G-H

**Session 1**

**Time:** Saturday, July 09, 10:50–12:40

**Welcome Talk**

Bobby R. Bruce

10:50

**Invited Keynote**

Westley Weimer, University of Michigan

10:55

**Amaru - A Framework for combining Genetic Improvement with Pattern Mining**

Oliver Krauss

12:00

**Genetic Improvement in the Shackleton Framework for Optimizing LLVM Pass Sequences**

Shuyue Stella Li, Hannah Peeler, Andrew Sloss, Kenneth Reid, Wolfgang Banzhaf

12:25

**Session 2**
**Time:** Saturday, July 09, 13:40–15:30

**Evaluation of Genetic Improvement Tools for Improvement of Non-functional Properties of Software**
Shengjie Zuo, Aymeric Blot, Justyna Petke

**Opportunities for Genetic Improvement of Cryptographic Code**
Chitchanok Chuengsatiansup, Markus Wagner, Yuval Yarom

**Towards evolution-based autonomy in large-scale systems**
Damien Anderson, Paul Harvey, Yusaku Kaneta, Petros Papadopoulos, Philip Rodgers, Marc Roper

**Genetic Improvement of Shoreline Evolution Forecasting Models**
Mahmoud Al Najar, Rafael Almar, Erwin Bergsma, Jean-Marc Delvit, Dennis Wilson

**The case for Grammatical Evolution in test generation**
Aidan Murphy, Thomas Laurent, Anthony Ventresque

**Leveraging Fuzzy System to Reduce Uncertainty of Decision Making in Software Engineering Automation**
Yueke Zhang, Yu Huang

**Session 3**
**Time:** Saturday, July 09, 16:00–17:50

**Dissecting Copy/Delete/Replace/Swap mutations: Insights from a GIN Case Study**
Sherlock Licorish, Markus Wagner

**Py2Cy: A Genetic Improvement Tool To Speed Up Python**
James Zhong, Max Hort, Federica Sarro

**Automatically Exploring Computer System Design Spaces**
Bobby Bruce

**Industry+Student+Faculty Event**

**Prizes and Closing Remarks**

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**IAM – Industrial Applications of Metaheuristics**

**Organizers:** Silvino Fernandez Alzueta, ArcelorMittal Global R D; Pablo Valledor Pellicer, ArcelorMittal Global R D; Thomas Stützle, Université Libre de Bruxelles

**Time:** Saturday, July 09, 08:30–10:20, Pacific B-C

**Welcome and Introduction**

**Invited Talk: Industrial applications of AI in ArcelorMittal: a true global approach**
Carlos Alba, Chief Digital Officer of ArcelorMittal Global Research & Development

**Algorithmically-Guided Postharvest Protocols by Experimental Combinatorial Optimization**
Ofer Shir, Boris Yazmir, Assaf Israeli, Dan Gamrasni
Multi-depot periodic vehicle routing with variable visit patterns
Vinicius Gandra, Carlo S. Sartori, Hatice Çalik, Pieter Smet

One-Shot Optimization for Vehicle Dynamics Control Systems: Towards Benchmarking and Exploratory Landscape Analysis
André Thomaser, Anna Kononova, Marc-Eric Vogt, Thomas Bäck

IWLCS – Learning Classifier Systems

Organizers: David Pätzel, University of Augsburg, Germany; Alexander Wagner, University of Hohenheim, Germany; Michael Heider, University of Augsburg, Germany

Time: Saturday, July 09, 16:00–17:50, Caspian

Welcome Note
David Pätzel, Alexander Wagner, Michael Heider

An Overview of LCS Research from 2021 to 2022
Michael Heider, David Pätzel, Alexander Wagner

Preliminary Tests of an Anticipatory Classifier System with Experience Replay
Olgierd Unold, Norbert Kozlowski, Łukasz Smierzchała

XCSF under Limited Supervision
Markus Görlich-Bucher, Jörg Hähner

XCS on Embedded Systems: An Analysis of Execution Profiles and Accelerated Classifier Deletion
Mathis Brede, Tim Hansmeier, Marco Platzner

Invited Talk: An LCS for Critical Software Test Selection in Continuous Integration
Lukas Rosenbauer

Open Discussion, and Closing Remarks
David Pätzel, Alexander Wagner, Michael Heider

LEOL – Large-Scale Evolutionary Optimization and Learning

Organizers: Nabi Omidvar, University of Leeds, UK; Yuan Sun, University of Melbourne, Australia; Xiaodong Li, RMIT University, Australia

Time: Sunday, July 10, 16:00–17:50, Online 1

Welcome and Introduction

Invited Talk: Evolutionary Learning for Combinatorial Optimisation
Su Nguyen, La Trobe University, Australia

Accelerating Genetic Algorithm Evolution Via Ant-Based Mutation and Crossover for Application to Large-scale TSPs
Darren Chitty

Lexicase Selection at Scale
Li Ding, Ryan Boldi, Thomas Helmuth, Lee Spector
High-performance Cartesian Genetic Programming on GPU for the Inference of Gene Regulatory Networks using scRNA-Seq Time-Series Data
Luciana Prachedes, José Eduardo da Silva, Heder Bernardino, Itamar de Oliveira

NEWK – Neuroevolution at work
Organizers: Ivanoe De Falco, ICAR-CNR, Italy; Antonio Della Cioppa, University of Salerno, Italy; Umberto Scafuri, ICAR-CNR, Italy; Ernesto Tarantino, ICAR-CNR, Italy
Time: Sunday, July 10, 13:40–15:30, Online 1

Opening Talk
Ivanoe De Falco, Antonio Della Cioppa, Ernesto Tarantino

Evolution of Activation Functions for Deep Learning-Based Image Classification
Raz Lapid, Moshe Sipper

On the Impact of Body Material Properties on Neuroevolution for Embodied Agents: the Case of Voxel-based Soft Robots
Eric Medvet, Giorgia Nadizar, Federico Pigozzi

Heed the Noise in Performance Evaluations in Neural Architecture Search
Arkadiy Dushatskiy, Tanja Alderliesten, Peter Bosman

Open Discussion

Closing Remarks
Ivanoe De Falco, Antonio Della Cioppa, Ernesto Tarantino

QD-Benchmarks – Quality Diversity Algorithm Benchmarks
Organizers: John Rieffel, Union College, USA; Antoine Cully, Imperial College London, UK; Jean-Baptiste Mouret, Inria Nancy - Grand Est, CNRS, Université de Lorraine, France; Stéphane Doncieux, Université Pierre et Marie Curie-Paris, France; Stefanos Nikolaidis, University of Southern California, USA; Julian Togelius, New York University, USA; Matthew C. Fontaine, University of Southern California, USA; Amy K Hoover, New Jersey Institute of Technology, USA
Room: Pacific B-C

Session 1
Time: Sunday, July 10, 10:50–12:40

Welcoming/Opening Remarks

Towards QD-suite: developing a set of benchmarks for Quality-Diversity algorithms.
Salehi, Doncieux

Hypervolume-based Benchmark Functions for Quality Diversity Algorithms.
Mouret

Fontaine, Soros, Togelius, Hoover, Nikolaidis
QD Benchmark: planar arm.  
Cully, Gaier, Mouret  
11:45

Benchmarking Quality-Diversity Algorithms on Neuroevolution for Reinforcement Learning.  
Flageat, Lim, Grillotti, Allard, Smith, Cully  
12:00

Chalumeau, Pierrot, Macé, Flajolet, Beguir, Cully, Perrin-Gilbert  
12:15

Open/Panel Discussion  
12:30

Session 2  
Time: Sunday, July 10, 13:40–15:30

Welcome Talk  
13:40

A Collection of Quality Diversity Optimization Problems Derived from Hyperparameter Optimization of Machine Learning Models  
Lennart Schneider, Florian Pfisterer, Janek Thomas, Bernd Bischl  
13:45

Multimodal optimisation tasks to assess Quality-Diversity optimisation performance.  
Hoover, Preuss  
14:00

Quantifying Efficiency in Quality Diversity Optimization.  
Tjanaka, Fontaine, Nikolaidis  
14:15

A discretization-free metric for assessing Quality Diversity algorithms  
Paul Kent, Juergen Branke, Jean-Baptiste Mouret, Adam Gaier  
14:30

Open/Panel Discussion  
14:45

Wrap-up  
15:25

QuantOpt – Quantum Optimization

Organizers: Alberto Moraglio, University of Exeter, UK; Serban Georgescu, Fujitsu Research of Europe, UK; Francisco Chicano, University of Malaga, Spain; Darrell Whitley, Colorado State University, USA; Oleksandr Kyriienko, University of Exeter, UK; Denny Dahl, ColdQuanta, USA; Ofer Shir, Tel-Hai College and Migal Institute, Israel; Lee Spector, Amherst College, Hampshire College, and the University of Massachusetts, Amherst, USA

Room: Pacific G-H

Session 1  
Time: Sunday, July 10, 08:30–10:20

Welcome and Introduction  
08:30

Invited talk: Stochastic Search Acceleration for Global Optimization: Digital Annealer and Future Technologies  
Ali Sheikholeslami  
08:33
Quantum Parametric Circuit Optimization with Estimation of Distribution Algorithms
Vicente P. Soloviev, Pedro Larrañaga, Concha Bielza

Evolutionary Quantum Architecture Search for Parametrized Quantum Circuits
Li Ding, Lee Spector

The Applicability of Reinforcement Learning for the Automatic Generation of State Preparation Circuits
Thomas Gabor, Maximilian Zorn, Claudia Linnhoff-Popien

A Novel Quantum-inspired Evolutionary Computation-based Quantum Circuit Synthesis for Various Universal Gate Libraries
Yao-Hsin Chou, Shu-Yu Kuo, Yu-Chi Jiang, Ching-Hsuan Wu, Jyun-Yi Shen, Cheng-Yen Hua, Pei-Shin Huang, Yun-Ting Lai, Yong Feng Tong, Ming-He Chang

Session 2
Time: Sunday, July 10, 10:50–12:40

AutoQubo: Data-driven automatic QUBO generation
Alberto Moraglio, Serban Georgescu, Przemyslaw Sadowski

Algorithmic QUBO Formulations for k-SAT and Hamiltonian Cycles
Jonas Nüsslein, Thomas Gabor, Claudia Linnhoff-Popien, Sebastian Feld

Techniques to Enhance a QUBO Solver For Permutation-Based Combinatorial Optimization
Siong Thye Goh, Jianyuan Bo, Sabrish Gopalakrishnan, Hoong Chuin Lau

Enhancing a QUBO solver via Data Driven Multi-start and its Application to Vehicle Routing Problem
Wei Yeap Suen, Matthieu Parizy, Hoong Chuin Lau

Probabilistic reasoning as Quadratic Unconstrained Binary Optimization
Marco Baioletti

Hybrid Quantum-Classical Heuristic for the Bin Packing Problem
Mikel Garcia de Andoin, Eneko Osaba, Izaskun Oregi, Esther Villar Rodriguez, Mikel Sanz

Session 3
Time: Sunday, July 10, 13:40–15:30

Invited talk 2: Instant Insanity via Quantum Computing
Denny Dahl

Modifying the Quantum-Assisted Genetic Algorithm
Thomas Gabor, Michael Lachner, Nico Kraus, Christoph Roch, Jonas Stein, Daniel Ratke, Claudia Linnhoff-Popien

Quantum Neuron Selection: Finding High Performing Subnetworks With Quantum Algorithms
Tim Whitaker

Panel Discussion

Closing Remarks
SAEOpt – Surrogate-Assisted Evolutionary Optimisation

Organizers: Alma Rahat, Swansea University, UK; Richard Everson, University of Exeter, UK; Jonathan Fieldsend, University of Exeter, UK; Handing Wang, Xidian University, China; Yaochu Jin, Bielefeld University, Germany; Tinkle Chugh, University of Exeter, UK

Time: Sunday, July 10, 16:00–17:50, Pacific B-C

Invited Talk: Perspectives to Dealing with Computationally Expensive Multiobjective Optimization Problems with Interactive Methods
Kaisa Miettinen
16:00

Mono-surrogate vs Multi-surrogate in Multi-objective Bayesian Optimisation
Tinkle Chugh
16:55

Flash Talks from GECCO Attendees, and Discussions
17:20

SecDef – Genetic and Evolutionary Computation in Defense, Security, and Risk Management

Organizers: Erik Hemberg, ALFA Group, MIT CSAIL, USA; Marwa Elsayed, Dalhousie University, Canada

Time: Sunday, July 10, 16:00–17:50, Pacific G-H

Welcome and Introduction
16:00

Invited talk: Quantum Computing Security
Eslam G. Abdallah
16:03

Samuel Migirditch, John Asplund, William Curran
16:47

CyberEvo: Evolutionary Search of Knowledge-based Behaviors in a Cyber Attack Campaign
Stephen Moskal, Erik Hemberg, Una-May O’Reilly
17:02

Feature Encoding with Autoencoder and Differential Evolution for Network Intrusion Detection using Machine Learning
Miguel Leon, Tijana Markovic, Sasikumar Punnekkat
17:17

Wrap-up
17:32
SymReg – Symbolic Regression

Organizers: Michael Kommenda, University of Applied Sciences Upper Austria, Austria; William La Cava, Boston Children's Hospital and Harvard Medical School, USA; Gabriel Kronberger, University of Applied Sciences Upper Austria, Austria; Steven Gustafson, Noonum Inc, USA

Time: Saturday, July 09, 16:00–17:50, Pacific F

Welcome & Opening Talk 16:00

Uncertainty in Equation Learning 16:10
Matthias Werner, Andrej Junginger, Philipp Hennig, Georg Martius

Bingo: A Customizable Framework for Symbolic Regression with Genetic Programming 16:25
David Randall, Tyler Townsend, Jacob Hochhalter, Geoffrey Bomarito

Interaction-Transformation Evolutionary Algorithm with coefficients optimization 16:40
Guilherme Imai Aldeia, Fabrício de França

Coefficient Mutation in the Gene-pool Optimal Mixing Evolutionary Algorithm for Symbolic Regression 16:55
Marco Virgolin, Peter Bosman

Genetic Programming with Stochastic Gradient Descent Revisited: Initial Findings on SRBench 17:10
Grant Dick

Invited Talk From the Winner of the Symbolic Regression Competition 17:25

Closing Remarks 17:40
Funding-Related Session

Enrique Alba, University of Málaga, Spain

Wednesday, July 13, 09:00-10:20, Caspian

The present international options for getting funded in research are many and varied in goals and means. An important body for funding research is the European Research Council (ERC), that offers to any scientist around the world the opportunity to develop their ground-breaking ideas in a host institution of the EU and associated countries. There are three main types of research grants, managed by the ERC executive agency: starting, consolidator, and advanced grants (synergy and proof of concept are also possible), targeted to researchers in different academic ages after their PhD. ERC offers a way of supporting very competitive principal investigators with original proposals that are high-risk/high-gain, with amounts that range up to 1.5 to 2.5 Million Euros for 5 years (other values above and below are possible for funding amounts and years). This seminar will introduce ERC and the available funding system in order to foster future proposal submissions, hopefully contributing to our modern societies and their future needs.

Biosketch: Prof. Enrique Alba works as a Full Professor at the University of Málaga (Spain), having a long teaching experience in distributed/parallel programming, software quality, evolutionary computing, bases for R+D+i and smart cities, both at graduate and master/doctoral levels. Prof. Alba leads an international team of researchers in the field of complex optimization/learning with applications in industry, smart cities, bioinformatics, software engineering, telecoms, and others. In addition to the organization of numerous ACM/IEEE international events, Prof. Alba has offered dozens of postgraduate courses, delivered more than 80 seminars in international institutions, and directed many research projects (9 with national funds, 7 in Europe, and numerous bilateral actions). Also, Prof. Alba has directed 12 projects for innovation in companies and has worked as invited professor at France, Luxembourg, Ostrava, Scotland, Japan, Argentina, Cuba, Uruguay, and Mexico. He has served as editor in several international journals and book series of Springer-Verlag and Wiley, as well has reviewed articles for more than 30 impact journals. He is included in the list of most prolific DBLP authors, and has published 130 articles in journals indexed by ISI, 11 books, and hundreds of communications in proceedings of peer-reviewed scientific conferences. He is included in the top five most relevant researchers in Informatics in Spain (according to ISI), and is the most influencing researcher of UMA in engineering (webometrics), with 14 awards to his professional activities. Pr. Alba's H index is 65, with more than 19,000 cites to his work. He is now working at ERCEA in Brussels, as a Seconded National Expert in computer science.
### Student Workshop

**Organizers:** William La Cava, Nelishia Pillay  
**Room:** Caspian

#### Session 1  
**Time:** Saturday, July 9, 08:30–10:20

- **Towards Landscape-aware Parameter Tuning for the \((1+\lambda, \lambda)\) Genetic Algorithm for Permutations.**  
  Alexandr Smirnov, Vladimir Mironovich  
  **08:30**

- **Analysis of Neutral Rewrite Operator Effects on Arithmetic Domain.**  
  Dmytro Vitel, Alessio Gaspar  
  **08:55**

- **GUI-Based, Efficient Genetic Programming For Unity3D.**  
  Robert Gold, Andrew Haydn Grant, Erik Hemberg, Chathika Gunaratne, Una-May O’Reilly  
  **09:20**

- **Genetic Algorithm Cleaning in Sequential Data Mining: Analyzing Solutions to Parsons’ Puzzles.**  
  Kok Cheng Tan, Daniel Zantedeschi, Amruth Kumar, Alessio Gaspar  
  **09:45**

#### Session 2  
**Time:** Saturday, July 9, 10:50–12:40

- **Untangling phylogenetic diversity's role in evolutionary computation using a suite of diagnostic fitness landscapes.**  
  Shakiba Shahbandegan, Jose Guadalupe Hernandez, Alexander Lalejini, Emily Dolson  
  **10:50**

- **Evolutionary Training of Deep Neural Networks on Heterogeneous Computing Environments.**  
  Subodh Kalia, Chilukuri K. Mohan, Ramakrishna Nemani  
  **11:15**

- **Multi-Objective Recommender System for Corporate MOOC.**  
  Mounir Hafsa, Pamela Wattebled, Julie Jacques, Laetitia Jourdan  
  **11:40**

- **Coevolution of Neural Networks for Agents and Environments.**  
  Estelle Chigot, Dennis G. Wilson  
  **12:05**

#### Session 3: Student Luncheon  
**Time:** Saturday, July 9, 12:40–13:40

Immediately following the workshop, boxed lunches will be provided for all students who wish to attend.
Late-breaking Abstracts

Organizers: Yew-Soon Ong, Abhishek Gupta

Time: Monday, July 11, 16:00-18:00, and Tuesday, July 12, 08:30-10:00

LBAs will be presented during the poster sessions.

Textonmap Optimization for Spine Segmentation using Adaptive Differential Evolution
Sohei Yamakawa, Keiko Ono, Erina Makihara, Daisuke Tawara, Shoma Yakushijin, Naoya Ikushima

A Population Based-Approach to Address Real-Life Transport On-Demand Problems
Sonia Nasri, Hend Bouziri, Wassila Aggoune-Matala

CNN Structure Optimization using Differential Evolution with Individual Dependent Mechanism
Naoya Ikushima, Keiko Ono, Erina Makihara, Sohei Yamakawa, Ryota Shinhma

Natural Gradient Evolution Strategies for Adaptive Sampling
Nixon Ronoh, Edna Milgo, Ambrose Kiprop, Bernard Manderick, Ann Nowe

Evolving a Cloud-Robust Water Index with Genetic Programming
João Batista, Sara Silva

Evaluation of Inverse Selection Operators on Maximum Flow Test Generation Problem
Egor Kurbatov, Vladimir Mironovich

Evolutionary Algorithms Meet Classical and Deep Machine Learning for Skin Detection in Color Images
Jakub Nalepa, Stanislaw Czembor, Wojciech Dudzik, Michal Kawulok

PIACERE Project: Description and Prototype for Optimizing Infrastructure as Code Deployment Configurations
Eneko Osaba, Josu Diaz-de-Arcaya, Leire Orue-Echevarria, Juncal Alonso, Jesus Lobo, Gorka Benguria, Íñaki Etxaniz

A Genetic Algorithm for Classifying Metagenomic Data
Jolanta Kawulok, Michal Kawulok

Hereditary Stratigraphy: Genome Annotations to Enable Phylogenetic Inference over Distributed Populations
Matthew Moreno, Emily Dolson, Charles Ofria

Biology Inspired Growth in Meta-Learning
Cullen LaKemper, Cehong Wang, Jason Yoder
Humies, Competitions, Evolutionary Computation in Practice, and Job Market
Techniques of genetic and evolutionary computation are being increasingly applied to difficult real-world problems — often yielding results that are not merely academically interesting, but competitive with the work done by creative and inventive humans. Starting at the Genetic and Evolutionary Computation Conference (GECCO) in 2004, cash prizes have been awarded for human-competitive results that had been produced by some form of genetic and evolutionary computation in the previous year.

This prize competition is based on published results. The publication must be a refereed publication in the open literature (e.g., the GECCO conference, any another reviewed conference or workshop, journal, or chapter in edited book). Submission of more than one entry by a single person or team is allowed.

The rules under which the Humies operate are given on the Humies website, www.human-competitive.org, and all of this year's entries are listed there, as well. Entries for this year are closed and eight finalists have been chosen from among 18 entries. Please attend the final presentation session either virtually or in person on July 11.

**Website** [https://www.human-competitive.org/](https://www.human-competitive.org/)

**Judging Panel**

- Erik Goodman
- Una-May O’Reilly
- Wolfgang Banzhaf
- Darrell Whitley
- Lee Spector
- Stephanie Forrest
Competitions

All sessions will be held in Pacific A.

AbstractSwarm Multi-Agent Logistics Competition

Organizers: Daan Apeldoorn, Alexander Dockhorn, Lars Hadidi, Torsten Panholzer

Time: Sunday, July 10, 13:40–15:30

This competition aims to motivate work in the broad field of logistics. We have prepared a benchmarking framework which allows the development of multi-agent swarms to process a variety of test environments. Those can be extremely diverse, highly dynamic and variable of size. The ultimate goal of this competition is to foster comparability of multi-agent systems in logistics-related problems (e.g., in hospital logistics). Many such problems have good accessibility and are easy to comprehend, but hard to solve. Problems of different difficulty have been designed to make the framework interesting for educational purposes. However, finding efficient solutions for different a priori unknown test environments remains a challenging task for practitioners and researchers alike.

Following these ideas, in the AbstractSwarm Multi-Agent Logistics Competition, participants must develop agents that are able to cooperatively solve different a priori unknown logistics problems. A logistics problem is given as a graph containing agents and stations. An agent can interact with the graph (1) by deciding which station to visit next, (2) by communicating with other agents, and (3) by retrieving a reward for its previous decision. While simulating a scenario, a timetable in the form of a Gantt-chart is created according to the decisions of all agents. Submissions will be ranked according to the total number of idle time of all agents in several different a priori unknown problem scenarios in conjunction with the number of iterations needed to come to the solution.

Website: https://abstractswarm.gitlab.io/abstractswarm_competition/

Competition on Real Parameter Single Objective Bound Constrained Optimization

Organizers: Ponnuthurai Suganthan, Ali Wagdy, Kenneth V. Price, Anas Hadi, Abhishek Kumar

Time: Sunday, July 10, 13:40–15:30

The goals are to evaluate the current state of the art in single objective numerical optimization with bound constraints with an increased number of maximum function evaluations. In the past, a maximum number of function evaluations did not scale with increasing dimensions while the complexity of the problems increased exponentially with the increasing dimensions. In addition, we will also consider several transformations such as translation, rotation, shearing, etc. in order to highlight the importance of these transformations. Although there are 100s of newly proposed metaheuristics in recent years, most have been evaluated on classical problems without rotation and with the global solution at the origin or very near the origin. We anticipate that this benchmark will help identify metaheuristics with various built-in biases to solve the classical problems effectively. In addition, we will also propose a novel scoring method to compare the algorithms.

Website: https://www3.ntu.edu.sg/home/epnsugan/index_files/cec-benchmarking.htm

Dynamic Stacking Optimization in Uncertain Environments

Organizers: Andreas Beham, Stefan Wagner, Sebastian Leitner, Johannes Karder, Bernhard Werth

Time: Sunday, July 10, 13:40–15:30

Stacking problems are central to multiple billion-dollar industries. The container shipping industry needs to stack millions of containers every year. In the steel industry the stacking of steel slabs, blooms, and coils needs to be carried out efficiently, affecting the quality of the final product. The immediate availability of data – thanks to the continuing digitalization of industrial production processes – makes the optimization of stacking problems in highly dynamic environments feasible.

There are two tracks in this competition, same as in the last competition.
In the first track a dynamic environment is provided that represents a simplified stacking scenario. Blocks arrive continuously at a fixed arrival location from which they have to be removed swiftly. If the arrival location is full, the arrival of additional blocks is not possible. To avoid such a state, there is a range of buffer stacks that may be used to store blocks. Each block has a due date before which it should be delivered to the customer. However, blocks may leave the system only when they become ready, i.e., some time after their arrival. To deliver a block it must be put on the handover stack – which must contain only a single block at any given time. There is a single crane that may move blocks from arrival to buffer, between buffers, and from buffer to handover. The optimization must control this crane in that it reacts to changes with a sequence of moves that are to be carried out. The control does not have all information about the world. A range of performance indicators will be used to determine the winner. The second track represents another stacking scenario that is derived from real-world scenarios. It features two cranes and two different handovers. The cranes have a capacity of larger than one which represents an additional challenge for the solver. The solver may just provide the moves and the cranes will sort out the order in which these are performed (not optimal though) or the solver may optimize both the moves and the assignment and schedule of the cranes. In this scenario, not the arrival stack is the critical part, but the handover stacks and thus the downstream process must not run empty.

The dynamic environments are implemented in form of a realtime simulation which provides the necessary change events. The simulation runs in a separate process and publishes its world state and change events via message queuing (ZeroMQ), and also listens for crane orders. Thus, control algorithms may be implemented as standalone applications using a wide range of programming languages. Exchanged messages are encoded using protocol buffers – again libraries are available for a large range of programming languages. As in the 2021 competition a website will be used that participants can use to create experiment and test their solvers. In addition, the simulation models are available at GitHub for offline testing and development at https://github.com/dynstack/dynstack. We gladly accept pull requests for new starter kits, existing algorithms and approaches, as well as additions to the bibliography on works that have used the competition for scientific research.

Website: https://dynstack.adaptop.at/

Evolutionary Computation in the Energy Domain: Risk-based Energy Scheduling

Organizers: Joao Soares, Fernando Lezama, José Almeida, Bruno Canizes, Zita Vale
Time: Sunday, July 10, 13:40–15:30

Following the success of the previous editions at IEEE PES; CEC; GECCO, WCCI, we are launching another challenging edition of competition at major conferences in the field of computational intelligence. This edition of GECCO 2022 competition proposes one track in the energy domain:

Track 1) Risk-based optimization of aggregators’ day-ahead energy resource management (ERM) considering uncertainty associated with the high penetration of distributed energy resources (DER). This test bed is constructed under the same framework of past competitions (therefore, former competitors can adapt their algorithms to this new track), representing a centralized day-ahead ERM in a smart grid with a 13-bus distribution network using a 150-scenario case study with 10 scenarios considering extreme events (high impact, and low probability). A conditional value-at-risk (CVaR) mechanism is used to measure the risk associated with the extreme events for a confidence level (α) of 95%. We also add some restrictions to the initialization of the initial solution and the allowed repairs and tweak-heuristics.

Note: The track is developed to run under the same framework of past competitions.

Competition goals: The GECCO 2022 competition on “Evolutionary Computation in the Energy Domain: Risk-based Energy Scheduling” has the purpose of bringing together and testing the more advanced Computational Intelligence (CI) techniques applied to energy domain problems, namely a risk-based optimal day-ahead ERM considering the uncertainty associated with high penetration of DER. The competition provides a coherent framework where participants and practitioners of CI can test their algorithms to solve a real-world optimization problem in the energy domain. The participants have the opportunity to evaluate if their algorithms can rank
well in the proposed problem since we understand the validity of the "no-free lunch theorem", making this contest a unique opportunity worth to explore the applicability of the developed approaches in a real-world problem beyond the typical benchmark and standardized CI problems.

Website: http://www.gecad.isep.ipp.pt/ERM-competitions/

**Evolutionary Submodular Optimisation**

**Organizers:** Aneta Neumann, Frank Neumann, Chao Qian  
**Time:** Sunday, July 10, 13:40–15:30

Submodular functions play a key role in the area of optimisation as they allow to model many real-world optimisation problem. Submodular functions model a wide range of problems where the benefit of adding solution components diminishes with the addition of elements. They form an important class of optimization problems, and are extensively studied in the literature. Problems that may be formulated in terms of submodular functions include influence maximization in social networks, maximum coverage, maximum cut in graphs, sensor placement problem, and sparse regression. In recent years, the design and analysis of evolutionary algorithms for submodular optimisation problems has gained increasing attention in the evolutionary computation and artificial intelligence community.

The aim of the competition is to provide a platform for researchers working evolutionary computing methods and interested in benchmarking them on a wide class of combinatorial optimization problems. The competition will benchmark evolutionary computing techniques for submodular optimisation problems and enable performance comparison for this type of problems. It provides an idea vehicle for researchers and students to design new algorithms and/or benchmark their existing approaches on a wide class of combinatorial optimization problems captured by submodular functions.

The description of the benchmark and evaluation process will be available on the competition webpage (by latest 15 April 2022).

Website: https://cs.adelaide.edu.au/~optlog/CompetitionESO2022.php

**Interpretable Symbolic Regression for Data Science**

**Organizers:** William La Cava, Marco Virgolin, Fabricio Olivetti de França, Michael Kommenda, Maimuna Majumder  
**Time:** Sunday, July 10, 16:00–17:50

Symbolic regression methods have made tremendous advances in the past decade, and have recently gained interest as the broader scientific community has recognized the importance of interpretable machine learning. Despite this, there is little agreement in the field about which algorithms are “state-of-the-art”, and how to best design symbolic regression methods for use in the real world. This competition seeks to distill algorithmic design choices and improve the practice of symbolic regression by evaluating the submitted symbolic regression methods on previously unseen, real-world and synthetic datasets. These datasets will be sourced mainly from the domains of physics, epidemiology and bioinformatics.

Participants are asked to adapt and submit their symbolic regression algorithms to SRBench, following the contributing guidelines. SRBench will automatically test these methods for conformance with the competition.

After the submission deadline, methods will be tested on previously unseen datasets. These datasets cover synthetic and real-world problems, and in each case, either an exact model or a human-designed model will be used for comparison. Notice that these will be new benchmarks specifically curated for this competition. The current version of SRBench will serve as a first-pass filter for candidate entries. As such, participants are free to test and fine-tune their algorithms on the current version of SRBench. Algorithm submissions will be judged by their ability to discover the ground-truth models, or, in the case of real-world data, approximate or outperform the
expert models with similar or lower complexity. Winners will be determined based on the accuracy and simplicity of the generated models, both individually and in the Pareto efficient sense. After competition, the submitted methods, evaluation procedure, and new datasets will be made publicly available.

Website: https://cavalab.org/srbench/competition-2022/

**Minecraft Open-Endedness Challenge**

- **Organizers:** Djordje Grbic, Rasmus Berg Palm, Elias Najarro, Claire Glanois, Shyam Sudhakaran, Sebastian Risi
- **Time:** Sunday, July 10, 16:00–17:50

The purpose of the second contest on open-endedness is to highlight the progress in algorithms that can create novel and increasingly complex artefacts. While most experiments in open-ended evolution have so far focused on simple toy domains, we believe Minecraft—with its almost unlimited possibilities—is the perfect environment to study and compare such approaches. While other popular Minecraft competitions, like MineRL, have an agent-centric focus, in this competition the goal is to directly evolve Minecraft builds.

As part of this competition, we introduce the EvoCraft API. EvoCraft is implemented as a mod for Minecraft that allows clients to manipulate blocks in a running Minecraft server programmatically through an API. The framework is specifically developed to facilitate experiments in artificial evolution. The competition framework also supports the recently added “redstone” circuit components in Minecraft, which allowed players to build amazing functional structures, such as bridge builders, battle robots, or even complete CPUs. Can an open-ended algorithm running in Minecraft discover similarly complex artefacts automatically?

In addition to the general Open-Ended competition, we will add an Open-Ended Play track. With this track, we would like to encourage research that leads to new and surprising Minecraft machines, that more directly make use of the unique Minecraft physics. Here agents must build Minecraft machines to score a goal against their opponent, which must build machines to counter it, while simultaneously trying to score their own goal, all with a limited budget of blocks.

Website: https://evocraft.life/

**Open Optimization Competition 2022: Better Benchmarking of Sampling-Based Optimization Algorithms**

- **Organizers:** Carola Doerr, Olivier Teytaud, Jérémy Rapin, Thomas Bäck, Hao Wang, Diederick Vermetten
- **Time:** Sunday, July 10, 16:00–17:50

Our Nevergrad and IOHprofiler environments aim at building and establishing open-source, user-friendly, and community-driven platforms for comparing different optimization techniques. The goal of this competition is to make benchmarking even more accessible, reproducible and fairer. All submissions that contribute towards these goals are most welcome!

There is no restriction on what to submit. All submissions that contribute to building and establishing open-source, user-friendly, and community-driven platforms for comparing different optimization techniques are welcome. Typical submissions fall into one of these categories: new benchmark problems, additional performance measures or statistics, visualization of benchmark data, extending or improving the functionalities of our benchmarking environments, interfaces to other existing benchmarking platforms, etc. Your creativity is the only limit ;-)
Optimization of a simulation model for a capacity and resource planning task for hospitals under special consideration of the COVID-19 pandemic

**Organizers:** Sowmya Chandrasekaran, Frederik Rehbach, Thomas Bartz-Beielstein

**Time:** Sunday, July 10, 16:00–17:50

Similar to the many previous competitions, the team of the Institute of Data Science, Engineering, and Analytics at the TH Cologne (IDE+A), hosts the ‘Industrial Challenge’ at the GECCO 2022.

Based on the 2021 GECCO industrial challenge an updated more advanced problem is provided. This year’s industrial challenge is again in cooperation with an IDE+A partner from health industry and with Bartz-Bartz GmbH.

Simulation models are valuable tools for resource usage estimation and capacity planning. Your goal is to determine improved simulation model parameters for a capacity and resource planning task for hospitals. The simulator, babysim.hospital, explicitly covers difficulties for hospitals caused by the COVID-19 pandemic. The simulator can handle many aspects of resource planning in hospitals: - various resources such as ICU beds, ventilators, personal protection equipment, staff, pharmaceuticals - several cohorts (based on age, health status, etc.).

The task represents an instance of an expensive, high-dimensional computer simulation-based optimization problem and provides an easy evaluation interface that will be used for the setup of our challenge. The simulation will be executed through an interface and hosted on one of our servers (similar to our last year’s challenge). The task is to find an optimal parameter configuration for the babysim.hospital simulator with a very limited budget of objective function evaluations. The best-found objective function value counts. There will be multiple versions of the babysim.hospital simulations, with slightly differing optimization goals, so that algorithms can be developed and tested before they are submitted for the final evaluation in the challenge.

The participants will be free to apply one or multiple optimization algorithms of their choice.

Thus, we enable each participant to apply his/her algorithms to a real problem from health industry, without software setup or licensing that would usually be required when working on such problems.


**SpOC: Space Optimisation Competition**

**Organizers:** Emmanuel Blazquez, Dario Izzo, Pablo Gomez, Alexander Hadjivanov, Marcus Märtens

**Time:** Sunday, July 10, 16:00–17:50

SpOC (Space optimisation Competition) is a new optimisation competition proposed by the Advanced concepts Team of the European Space Agency in the context of GECCO 2022. The competition will have several teams of experts around the world compete to find the best solution to multiple optimization problems applied to advanced space scenarios, with a focus on metaheuristics and black-box optimization.

Several highly complex optimisation problems will be simultaneously released and submitted to the scientific community who will have roughly one month to solve them. Participants will compete to find the best solution for each individual problem, but also to be the best overall team. Similar to multi-sport events, SpOC will award global points to the best performing teams for each problem. These points will be used to establish a global ranking that will decide the winner of the competition. In short, if GTOC is the America’s Cup of trajectory optimization, SpOC aims to be the Ironman race of space optimization.

Each individual problem will be inspired by a promising advanced space concept and a global inspiring context will be provided for the competition. All problems will differ in nature and objective, so that a single solution approach should not be easily applicable to all of them, and be complex enough to make for a challenging competition. The organizers may provide if needed a codebase for the participants to be used as a black-box for output analysis and optimization.
The competition will be open to everybody worldwide. The target audience for the challenge is experienced aerospace engineers and mathematicians but graduate students are also highly encouraged to participate.

Website: https://www.esa.int/gsp/ACT/projects/gecco-2022-competition/
# Schedule for Competitions

**Organizers:** Marcella Scoczynski Ribeiro Martins  
**Room:** Pacific A

## Session 1  
**Time:** Sunday, July 10, 13:40–15:30

**Introduction**  
Marcella Scoczynski Ribeiro Martins

### AbstractSwarm Multi-Agent Logistics Competition  
Daan Apeldoorn, Alexander Dockhorn, Lars Hadidi, Torsten Panholzer

### Competition on Real Parameter Single Objective Bound Constrained Optimization  
Ponnuthurai Suganthan, Ali Wagdy, Kenneth V. Price, Anas Hadi, Abhishek Kumar

### Dynamic Stacking Optimization in Uncertain Environments  
Andreas Beham, Stefan Wagner, Sebastian Leitner, Johannes Karder, Bernhard Werth

### Evolutionary Computation in the Energy Domain: Risk-based Energy Scheduling  
Joao Soares, Fernando Lezama, Jose Almeida, Bruno Canizes, Zita Vale

### Evolutionary Submodular Optimisation  
Aneta Neumann, Frank Neumann, Chao Qian

**Closing**  
Marcella Scoczynski Ribeiro Martins

## Session 2  
**Time:** Sunday, July 10, 16:00–17:50

**Introduction**  
Marcella Scoczynski Ribeiro Martins

### Interpretable Symbolic Regression for Data Science  
William La Cava, Marco Virgolin, Fabricio Olivetti de França, Michael Kommenda, Maimuna Majumder

### Minecraft Open-Endedness Challenge  
Djordje Grbic, Rasmus Berg Palm, Elias Najarro, Claire Glanois, Shyam Sudhakaran, Sebastian Risi

### Open Optimization Competition 2022: Better Benchmarking of Sampling-Based Optimization Algorithms  
Carola Doerr, Olivier Teytaud, Jérémy Rapin, Thomas Bäck, Hao Wang, Diederick Vermetten

### Optimization of a simulation model for a capacity and resource planning task for hospitals under special consideration of the COVID-19 pandemic  
Sowmya Chandrasekaran, Frederik Rehbach, Thomas Bartz-Beielstein

### SpOC: Space Optimisation Competition  
Emmanuel Blazquez, Dario Izzo, Pablo Gomez, Alexander Hadjivanov, Marcus Märtens

**Closing**  
Marcella Scoczynski Ribeiro Martins
Competition Posters
These posters will be presented during the Poster Sessions.

Applying Ring Cellular Encode-Decode UMDA to Risk-based Energy Scheduling
Ansel Rodríguez González, Ramón Aranda, Miguel Álvarez Carmona, Yoan Martínez López, Julio Madera Quintana

Zeroth-Order Covariance Matrix Adaptation Evolution Strategy for Single Objective Bound Constrained Numerical Optimization Competition
Yue Ning, Daohong Jian, Hua Wu, Jun Zhou

Abstract Swarm Multi-Agent Logistics Competition Entry: QPlus
Patrick Winkel

NL-SOMA-CLP for Real Parameter Single Objective Bound Constrained Optimization
Hao Ding, Yongfeng Gu, Hua Wu, Jun Zhou

Implementing the Cumulative Difference Plot in the IOHanalyzer
Etor Arza, Josu Ceberio, Ekhiñe Irurozki, Aritz Pérez

Opposite Learning and Multi-Migrating Strategy-Based Self-Organizing Migrating Algorithm with the Convergence Monitoring Mechanism
Yongfeng Gu, Hao Ding, Hua Wu, Jun Zhou
Job Market

**Organizers:** Boris Naujoks, *TH Köln - Cologne University of Applied Sciences*

Tea Tušar, *Jožef Stefan Institute*

**Time:** Monday, July 11, 11:50-12:50 in Pacific D-E

The GECCO Job Market is an event where people offering jobs can advertise open positions and meet with potential candidates. Any kind of positions are eligible (PhD, Postdoc, Professor, Engineer, etc.) - from the academia as well as the industry.

The Job Market will be organized as a hybrid session during the lunch break on Monday, July 11. After brief presentations of the available positions (onsite and over Zoom), participants will have the possibility to join face-to-face meetings for further discussions (onsite and in Gather).

The collection of positions on offer can be found at the SIGEVO web site:

Papers
### GECH 1

**Chair:** TBD  
*(Best Paper nominees are marked with a star)*

<table>
<thead>
<tr>
<th>Title</th>
<th>Time</th>
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<tbody>
<tr>
<td><strong>Theory-inspired Parameter Control Benchmarks for Dynamic Algorithm Configuration</strong></td>
<td>10:30</td>
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<td>André Biedenkapp, Nguyen Dang, Martin Krejca, Frank Hutter, Carola Doerr</td>
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<td><strong>Black-Box Min–Max Continuous Optimization Using CMA-ES with Worst-case Ranking Approximation</strong></td>
<td>10:50</td>
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<td>Atsuhiro Miyagi, Kazuto Fukuchi, Jun Sakuma, Youhei Akimoto</td>
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<td><strong>Using Phylogenetic Analysis to Enhance Genetic Improvement</strong></td>
<td>11:10</td>
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<td>Penny Rainford, Barry Porter</td>
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<td><strong>On Optimal Static and Dynamic Parameter Choices for Fixed-Target Optimization</strong></td>
<td>11:30</td>
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<td>Dmitry Vinokurov, Maxim Buzdalov</td>
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### ENUM 1 - Theory 1

**Chair:** TBD  
*(Best Paper nominees are marked with a star)*

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<tr>
<th>Title</th>
<th>Time</th>
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<tbody>
<tr>
<td><strong>Crossover for Cardinality Constrained Optimization</strong></td>
<td>10:30</td>
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<tr>
<td>Tobias Friedrich, Timo Kötzing, Aishwarya Radhakrishnan, Leon Schiller, Martin Schirneck, Georg Tennigkeit, Simon Wietheger</td>
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<tr>
<td><strong>CMA-ES with Margin: Lower-Bounding Marginal Probability for Mixed-Integer Black-Box Optimization</strong></td>
<td>10:50</td>
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<tr>
<td>Ryoki Hamano, Shota Saito, Masahiro Nomura, Shinichi Shirakawa</td>
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<tr>
<td><strong>The Compact Genetic Algorithm Struggles on Cliff Functions</strong></td>
<td>11:10</td>
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<td>Frank Neumann, Dirk Sudholt, Carsten Witt</td>
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### NE 1

**Chair:** TBD  

<table>
<thead>
<tr>
<th>Title</th>
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<tr>
<td><strong>RankNEAT: Outperforming Stochastic Gradient Search in Preference Learning Tasks</strong></td>
<td>10:30</td>
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<tr>
<td>Kosmas Pinitas, Konstantinos Makantasis, Antonios Liapis, Georgios Yannakakis</td>
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<td><strong>Diversity Policy Gradient for Sample Efficient Quality-Diversity Optimization</strong></td>
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<td>Thomas Pierrat, Valentin Macé, Felix Chalumeau, Arthur Flajolet, Geoffrey Cideron, Karim Beguir, Antoine Cully, Olivier Sigaud, Nicolas Perrin-Gilbert</td>
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<tr>
<td><strong>Approximating Gradients for Differentiable Quality Diversity in Reinforcement Learning</strong></td>
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<tr>
<td>Bryon Tjanaka, Matthew Fontaine, Julian Togelius, Stefanos Nikolaidis</td>
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<tr>
<td><strong>Surrogate-Assisted Neuroevolution</strong></td>
<td>11:30</td>
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<td>Bryson Greenwood, Tyler McDonnell</td>
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</table>
### EMO 1

**Unsupervised Comment-based Multi-document Extractive Summarization**
Vishal Roha, NAVEEN SAINI, SRIPARNA SAHA, JOSE MORENO

**A Bounded Archive Based for Bi-objective Problems based on Distance and epsilon-dominance to avoid Cyclic Behavior**
Oliver Schuetze, Carlos Hernandez

**A Classification-Assisted Level-based Learning Evolutionary Algorithm for Expensive Multiobjective Optimization Problems**
Zhuo Liu, Xiaolin Xiao, Feng-Feng Wei, Wei-Neng Chen

**Better Approximation Guarantees for the NSGA-II by Using the Current Crowding Distance**
Weijie Zheng, Benjamin Doerr

### GP 1

**Graph-based Linear Genetic Programming: A Case Study of Dynamic Scheduling**
Zhixing Huang, Yi Mei, Fangfang Zhang, Mengjie Zhang

**Exploring Hidden Semantics in Neural Networks with Symbolic Regression**
Yuanzhen Luo, Qiang Lu, Xilei Hu, Jake Luo, Zhiguang Wang

**Measuring Failed Disruption Propagation in Genetic Programming**
william langdon, Afnan Al-Subaihin, David Clark

**Taylor Genetic Programming for Symbolic Regression**
Baihe He, Qiang Lu, Qingyun Yang, Jake Luo, Zhiguang Wang

### ECOM 1

**Improved Regression Models for Algorithm Configuration**
Marcelo de Souza, Marcus Ritt

**On Funnel Depths and Acceptance Criteria in Stochastic Local Search**
Sarah Thomson, Gabriela Ochoa

**What Makes The Dynamic Capacitated Arc Routing Problem Hard To Solve: Insights From Fitness Landscape Analysis**
Hao Tong, Leandro Minku, Stefan Menzel, Bernhard Sendhoff, Xin Yao

**Understanding the Cost of Fitness Evaluation for Subset Selection: Markov Chain Analysis of Stochastic Local Search**
Ole Jakob Mengshoeil, Eirik Flogard, Tong Yu, Jon Riege

### ACO-SI 1

**Measuring Optimiser Performance on a Conical Barrier Tree Benchmark**
Itshak Tkach, Tim Blackwell
**A new Ant Colony Optimization metaheuristic based on Pheromone guided Local Search instead of Constructive approach**

Samia Sammoud, Inès Alaya

10:50

**Social Learning Particle Swarm Optimization with Two-surrogate Collaboration for Offline Data-driven Multiobjective Optimization**

Qi-Te Yang, Zhi-Hui Zhan, Yun Li, Jun Zhang

11:10

**Progressive Sampling Surrogate-Assisted Particle Swarm Optimization for Large-Scale Expensive Optimization**

Hong-Rui Wang, Chun-Hua Chen, Yun Li, Jun Zhang, Zhi-Hui Zhan

11:30

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### GP 2*

Chair: TBD

*(Best Paper nominees are marked with a star)*

<table>
<thead>
<tr>
<th>Session Title</th>
<th>Time</th>
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<tbody>
<tr>
<td>Evolvability Degeneration in Multi-Objective Genetic Programming for Symbolic Regression*</td>
<td>12:50</td>
<td>Atlantic 1</td>
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<tr>
<td>Dazhuang Liu, Marco Virgolin, Tanja Alderliesten, Peter Bosman</td>
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<td>Transformation-Interaction-Rational Representation for Symbolic Regression*</td>
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<tr>
<td>Fabrice de França</td>
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<tr>
<td>Lexi²: Lexicase Selection with Lexicographic Parsimony Pressure</td>
<td>13:30</td>
<td>Atlantic 1</td>
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<tr>
<td>Allan de Lima, Samuel Carvalho, Douglas Dias, Enrique Naredo, Joseph Sullivan, Conor Ryan</td>
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### EML 1*

Chair: TBD

*(Best Paper nominees are marked with a star)*

<table>
<thead>
<tr>
<th>Session Title</th>
<th>Time</th>
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<tbody>
<tr>
<td>Multi-objective Framework for Quantile Forecasting in Financial Time Series Using Transformers*</td>
<td>12:50</td>
<td>Atlantic 2</td>
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<tr>
<td>Samuel López-Ruiz, Katya Rodríguez-Vázquez, Carlos Ignacio Hernández Castellanos</td>
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<tr>
<td>Absumption based on Overgenerality and Condition-Clustering based Specialization for XCS with Continuous-Valued Inputs*</td>
<td>13:10</td>
<td>Atlantic 2</td>
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<tr>
<td>Hiroki Shiraishi, Yohei Hayamizu, Hiroyuki Sato, Keiki Takadama</td>
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<tr>
<td>Diversifying behaviors for learning in Asymmetric Multiagent Systems*</td>
<td>13:30</td>
<td>Atlantic 2</td>
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<tr>
<td>Gaurav Dixit, Everardo Gonzalez, Kagan Tumer</td>
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### NE 2

Chair: TBD

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<th>Session Title</th>
<th>Time</th>
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<tr>
<td>Procedural Content Generation using Neuroevolution and Novelty Search for Diverse Video Game Levels</td>
<td>12:50</td>
<td>Atlantic 3</td>
</tr>
<tr>
<td>Michael Beukman, Christopher Cleghorn, Steven James</td>
<td></td>
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</tr>
<tr>
<td>Neuroevolution-Enhanced Multi-Objective Optimization for Mixed-Precision Quantization</td>
<td>13:10</td>
<td>Atlantic 3</td>
</tr>
<tr>
<td>Santiago Miret, Vui Seng Chua, Mattias Marder, Mariano Phielipp, Nilesh Jain, Somdeb Majumdar</td>
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</tbody>
</table>
**RWA 1**  
*Monday, July 11, 12:50–14:10, Pacific A*

Chair: TBD

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**Evolving Constructions for Balanced, Highly Nonlinear Boolean Functions**  
Claude Carlet, Marko Djurasevic, Domagoj Jakobovic, Luca Mariot, Stjepan Picek  
12:50

**Bug Report Summarization using Multi-View Multi-Objective Optimization Framework**  
Santosh Mishra, Kundarapu Harshavardhan, Sayantan Mitra, Sriparna Saha, Pushpak Bhattacharyya  
13:10

**EvoIsland: Interactive Evolution via an Island-Inspired Spatial User Interface Framework**  
Alexander Ivanov, Wesley Willett, Christian Jacob  
13:30

**Addressing Tactic Volatility in Self-Adaptive Systems Using Evolved Recurrent Neural Networks and Uncertainty Reduction Tactics**  
Aizaz Ul Haq, Niranjana Deshpande, AbdElRahman ElSaid, Travis Desell, Daniel Krutz  
13:50

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**HOP 1**  
*Monday, July 11, 12:50–14:10, Pacific B-C*

Chair: TBD

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**Evolutionary Generation of Metamorphic Relations for Cyber-Physical Systems**  
Jon Ayerdi, Valerio Terragni, Aitor Arrieta, Paolo Tonella, Goiuria Sagardui, Maite Arratibel  
12:50

**Highlights of Semantics in Multi-objective Genetic Programming**  
Edgar Galván, Leonardo Trujillo, Fergal Stapleton  
13:00

**Program Synthesis with Evolutionary Algorithms: Status Quo**  
Dominik Sobania, Dirk Schweim, Franz Rothlauf  
13:10

**Long-Term Evolution Experiment with Genetic Programming [Hot of the Press]**  
William Langdon, Wolfgang Banzhaf  
13:20

**Empirical linkage learning for non-binary discrete search spaces in the optimization of a large-scale real-world problem**  
Michal Przewozniczek, Marcin Komarnicki  
13:30

**Generating Failing Test Suites for Quantum Programs with Search (Hot Off the Press track at GECCO 2022)**  
Xinyi Wang, Paolo Arcaini, Tao Yue, Shaukat Ali  
13:40

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**RWA 2**  
*Monday, July 11, 12:50–14:10, Caspian*

Chair: TBD

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**Identifying the source of an epidemic using particle swarm optimization**  
John MaGee, Viplove Arora, Mario Ventresca  
12:50

**Evolutionary Bi-objective Optimization for the Electric Vehicle Charging Stand Infrastructure Problem**  
Rolando Armas, Hernan Aguirre, Daniel Orellana  
13:10

**Optimising Autonomous Robot Swarm Parameters for Stable Formation Design**  
Daniel Stolfi, Grégoire Danoy  
13:30
Automated Algorithm Selection for Radar Network Configuration
Quentin Renau, Johann Dreo, Alain Peres, Yann Semet, Carola Doerr, Benjamin Doerr

CS 1*
Chair: TBD
(Best Paper nominees are marked with a star)

Hierarchical Quality-Diversity for Online Damage Recovery*
Maxime Allard, Simón Smith, Konstantinos Chatzilygeroudis, Antoine Cully

Evolving Modular Soft Robots without Explicit Inter-Module Communication using Local Self-Attention*
Federico Pigozzi, Yujin Tang, Eric Medvet, David Ha

Multi-Objective Quality Diversity Optimization
Thomas Pierrot, Guillaume Richard, Karim Beguir, Antoine Cully

Relevance-guided Unsupervised Discovery of Abilities with Quality-Diversity Algorithms
Luca Grillotti, Antoine Cully

GA 1*
Chair: TBD
(Best Paper nominees are marked with a star)

The Influence of Noise on Multi-Parent Crossover for an Island Model GA*
Brahim Aboutaib, Andrew Sutton

Local Optima Organize into Lattices Under Recombination; An example using the Traveling Salesman Problem*
L. Darrell Whitley, Gabriela Ochoa

Simple Genetic Operators are Universal Approximators of Probability Distributions (and other Advantages of Expressive Encodings)*
Elliot Meyerson, Xin Qiu, Risto Miikkulainen

Reducing the Cost of Partition Crossover on Large MAXSAT Problems: The PX-Preprocessor
Preston Dunton, Darrell Whitley

EML 2
Chair: TBD

Understanding AutoML Search Spaces with Local Optima Networks
Matheus Teixeira, Gisele Pappa

The Bayesian Learning Classifier System: Implementation, Replicability, Comparison with XCSF
David Pätzel, Jörg Hähner

Multi-modal multi-objective model-based genetic programming to find multiple diverse high-quality models
Evi Sijben, Tanja Alderliesten, Peter Bosman
Coevolutionary Generative Adversarial Networks for Medical Image Augmentation at Scale
Diana Flores, Erik Hemberg, Jamal Toutouh, Una-May O’Reilly

RTune: A RocksDB Tuning System with Deep Genetic Algorithm
HUIJUN JIN, Jieun Lee, Sanghyun Park

Effects of Imputation Strategy on Genetic Algorithms and Neural Networks on a Binary Classification Problem
Esteban Segarra Martinez, Stephen Maldonado, Annie Wu, Ryan McMahan, Xinliang Liu, Blake Oakley

An Evolutionary Fragment-based Approach to Molecular Fingerprint Reconstruction
Tim Cofala, Oliver Kramer

Adapting Novelty towards Generating Antigens for Antivirus systems
Ritwik Murali, Shunmuga Velayutham C

IOHanalyzer: Detailed Performance Analyses for Iterative Optimization Heuristics
Hao Wang, Diederick Vermetten, Furong Ye, Carola Doerr, Thomas Bäck

Tag-based Module Regulation for Genetic Programming
Alexander Lalejini, Matthew Moreno, Charles Ofria

Efficient Configuration of Optimization Algorithms
Marcelo de Souza, Marcus Ritt, Manuel López-Ibáñez

What Can Phylogenetic Metrics Tell us About Useful Diversity in Evolutionary Algorithms?
Jose Hernandez, Alexander Lalejini, Emily Dolson

Measuring the ability of lexicase selection to find obscure pathways to optimality
Jose Hernandez, Alexander Lalejini, Charles Ofría

A Verified Application of Genetic Programming: QoS Time Series Modeling and Forecasting for Web Services
Yang Syu, Chien-Min Wang, Yong-Yi Fanjiang

Multi-Point Acquisition Function for Constraint Parallel Efficient Multi-Objective Optimization
Roy de Winter, Bas van Stein, Thomas Bäck

Region of Interest Based Non-dominated Sorting Genetic Algorithm-II: An Invite and Conquer Approach
Manu Manuel, Benjamin Hien, Simon Conrady, Arne Kredlig, Nguyen Anh Vu Doan, Walter Stechele
Cost-vs-Accuracy of Sampling in Multi-objective Combinatorial Exploratory Landscape Analysis 15:20
Raphaël Cosson, Bilel Derbel, Arnaud Liefooghe, Sébastien Verel, Hernan Aguirre, Zhang Qingfu, Kiyoshi Tanaka

An Enhanced Adaptive Geometry Evolutionary Algorithm Using Stochastic Diversity Mechanism 15:40
Fodil Benali, Damien Bodénès, Cyril De Runz, Nicolas Labrobe

ECOM 2 Monday, July 11, 14:40–16:00, Pacific F
Chair: TBD

On turning Black- into Dark Gray-optimization with the Direct Empirical Linkage Discovery and Partition Crossover 14:40
Michał Przewozniczek, Renato Tinós, Bartosz Frej, Marcin Komarnicki

Exploring the Feature Space of TSP Instances Using Quality Diversity 15:00
Jakob Bossek, Frank Neumann

Guided Local Search with an Adaptive Neighbourhood Size Heuristic for Large Scale Vehicle Routing Problems 15:20
João Guilherme Cavalcanti Costa, Yi Mei, Mengjie Zhang

GP 3 Monday, July 11, 14:40–16:00, Caspian
Chair: TBD

Functional Code Building Genetic Programming 14:40
Edward Pantridge, Thomas Helmuth, Lee Spector

Genetic Programming for Structural Similarity Design at Multiple Spatial Scales 15:00
Illya Bakurov, Marco Buzzelli, Mauro Castelli, Raimondo Schettini, Leonardo Vanneschi

Evolving Generalizable Multigrid-Based Helmholtz Preconditioners with Grammar-Guided Genetic Programming 15:20
Jonas Schmitt, Harald Köstler

Co-evolutionary Probabilistic Structured Grammatical Evolution 15:40
Jessica Mégane, Nuno Lourenço, Penousal Machado

SBSE 1 - NE 3* Tuesday, July 12, 12:40–14:00, Atlantic 1
Chair: TBD
(Best Paper nominees are marked with a star)

Evolutionary Neural Cascade Search across Supernetworks* 12:40
Alexander Chebykin, Tanja Alderliesten, Peter Bosman

Mutation-Based Test Generation for Quantum Programs with Multi-Objective Search* 13:00
Xinyi Wang, Tongxuan Yu, Paolo Arcaini, Tao Yue, Shaukat Ali

RWA 4 Tuesday, July 12, 12:40–14:00, Atlantic 2
Chair: TBD

Analyzing Multi-Agent Reinforcement Learning and Coevolution in Cybersecurity 12:40
Matthew Turner, Erik Hemberg, Una-May O’Reilly
Genetic Algorithm for Qubits Initialisation in Noisy Intermediate-Scale Quantum Machines: The IBM Case Study  
Zakaria Abdelmoiz Dahi, Francisco Chicano, Gabriel Luque, Enrique Alba

Towards Explainable Real Estate Valuation via Evolutionary Algorithms  
Sebastian Angrick, Ben Bals, Niko Hasrich, Maximilian Kleissl, Jonas Schmidt, Vanja Doskoč, Maximilian Katzmann, Louise Molitor, Tobias Friedrich

**EML 3**  
Tuesday, July 12, 12:40–14:00, Atlantic 3  
Chair: TBD

DiBB: Distributing Black-Box Optimization  
Giuseppe Cuccu, Luca Rolshoven, Fabien Vorpe, Philippe Cudré-Mauroux, Tobias Glasmachers

Can the Same Rule Representation Change its Matching Area? Enhancing Representation in XCS for Continuous Space by Probability Distribution in Multiple Dimension  
Hiroki Shiraishi, Yohei Hayamizu, Hiroyuki Sato, Keiki Takadama

Evolving Transferable Neural Pruning Functions  
Yuchen Liu, Sun-Yuan Kung, David Wentzlaff

Fitness Shaping For Multiple Teams  
Joshua Cook, Kagan Tumer

**GECH 2**  
Tuesday, July 12, 12:40–14:00, Pacific A  
Chair: TBD

MBORE: Multi-objective Bayesian Optimisation by Density-Ratio Estimation  
George De Ath, Tinkle Chugh, Alma Rahat

Coevolutionary Pareto Diversity Optimization  
Aneta Neumann, Denis Antipov, Frank Neumann

High Performance Evolutionary Computation with Tensor-based Acceleration  
Jonatan Kłosko, Mateusz Benecki, Grzegorz Wcisło, Jacek Dajda, Wojciech Turek

**EMO 3**  
Tuesday, July 12, 12:40–14:00, Pacific G-H  
Chair: TBD

MOLE: Digging Tunnels Through Multimodal Multi-Objective Landscapes  
Lennart Schäpermeier, Christian Grimme, Pascal Kerschke

Parallelization of Corner Sort with CUDA for Many-Objective Optimization  
Vandana Bharti, Aryan Singhal, Anant Saxena, Bhaskar Biswas, Kaushal Kumar Shukla

Multi-objective QUBO Solver: Bi-objective Quadratic Assignment Problem  
Mayowa Ayodele, Richard Allmendinger, Manuel López-Ibáñez, Matthieu Parizy

**ECOM 3**  
Tuesday, July 12, 12:40–14:00, Pacific F  
Chair: TBD

Evolving Labelings of Graceful Graphs  
Luke Branson, Andrew Sutton
<table>
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<th>Papers</th>
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<tr>
<td><strong>DRILS Revisited: On the Combination of Perturbation with Graybox Optimization Techniques</strong></td>
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<tr>
<td>Lorenzo Canonne, Bilel Derbel</td>
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<td>13:00</td>
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<tr>
<td><strong>Metaheuristic Algorithms for the Bus Driver Scheduling Problem with Complex Break Constraints</strong></td>
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<tr>
<td>Lucas Kletzander, Tommaso Mannelli Mazzoli, Nysret Musliu</td>
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<td>13:20</td>
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<td><strong>Negative Learning Ant Colony Optimization for Network Alignment</strong></td>
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<td>Guillem Rodríguez Corominas, Christian Blum, Maria J. Blesa</td>
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**GP 4**

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| Comparing Optimistic and Pessimistic Constraint Evaluation in Shape-constrained Symbolic Regression |
| Christian Haider, Fabricio De França, Gabriel Kronberger, Bogdan Burlacu |
| 12:40 |
| Novel ensemble collaboration method for dynamic scheduling problems |
| Marko Durasević, Lucija Planinić, Francisco Javier Gil Gala, Domagoj Jakobović |
| 13:00 |
| Choose Your Programming Copilot: A Comparison of the Program Synthesis Performance of GitHub Copilot and Genetic Programming |
| Dominik Sobania, Martin Briesch, Franz Rothlauf |
| 13:20 |
| Automated Grammar-based Feature Selection in Symbolic Regression |
| Muhammad Sarmad Ali, Meghana Kshirsagar, Enrique Naredo, Conor Ryan |
| 13:40 |

**EMO 4**

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<tr>
<td>Chair: TBD</td>
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<tr>
<td>(Best Paper nominees are marked with a star)</td>
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| Component-wise Analysis of Automatically Designed Multiobjective Algorithms on Constrained Problems* |
| Yuri Lavinas, Marcelo Ladeira, Gabriela Ochoa, Claus Aranha |
| 14:30 |
| Multi-objective NK Landscapes with Heterogeneous Objectives* |
| Raphael Cosson, Roberto Santana, Bilel Derbel, Arnaud Liefooghe |
| 14:50 |
| The $(1+(λ,λ))$ Global SEMO Algorithm* |
| Benjamin Doerr, Omar El Hadri, Adrien Pinard |
| 15:10 |

**RWA 5**

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<td>(Best Paper nominees are marked with a star)</td>
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| Learning the Characteristics of Engineering Optimization Problems with Applications in Automotive Crash* |
| Fu Xing Long, Bas van Stein, Moritz Frenzel, Peter Krause, Markus Gitterle, Thomas Bäck |
| 14:30 |
| Adaptive Objective Configuration in Bi-Objective Evolutionary Optimization for Cervical Cancer Brachytherapy Treatment Planning* |
| Leah Dickhoff, Ellen Kerkhof, Heloisa Deuzeman, Carien Creutzberg, Tanja Alderliesten, Peter Bosman |
| 14:50 |
High-performance Evolutionary Algorithms For Online Neuronal Control

Binxu Wang, Carlos Ponce

Defending Active Directory by Combining Neural Network based Dynamic Program and Evolutionary Diversity Optimisation

Diksha Goel, Max Ward-Graham, Aneta Neumann, Frank Neumann, Hung Nguyen, Mingyu Guo

EML 4

Tuesday, July 12, 14:30–15:50, Atlantic 3
Chair: TBD

Pittsburgh Learning Classifier Systems for Explainable Reinforcement Learning: Comparing with XCS

Jordan Bishop, Marcus Gallagher, Will Browne

Hyperparameter Tuning in Echo State Networks

Filip Matzner

GECH 3

Tuesday, July 12, 14:30–15:50, Pacific A
Chair: TBD

Guiding Surrogate-Assisted Multi-Objective Optimisation With Decision Maker Preferences

Finley Gibson, Richard Everson, Jonathan Fieldsend

Hard Problems are Easier for Success-based Parameter Control

Mario Hevia Fajardo, Dirk Sudholt

Improving LSHADE by means of a pre-screening mechanism

Mateusz Zaborski, Jacek Mańdziuk

Are Evolutionary Algorithms Safe Optimizers?

Youngmin Kim, Richard Allmendinger, Manuel López-Ibáñez

ENUM 2

Tuesday, July 12, 14:30–15:50, Pacific B-C
Chair: TBD

The Importance of Landscape Features for Performance Prediction of Modular CMA-ES Variants

Ana Kostovska, Diederick Vermetten, Sašo Džeroski, Carola Doerr, Peter Korošec, Tome Eftimov

Learning Rate Adaptation by Line Search in Evolution Strategies with Recombination

Armand Gissler, Anne Auger, Nikolaus Hansen

SELECTOR: Selecting a Representative Benchmark Suite for Reproducible Statistical Comparison

Gjorgjina Cenikj, Ryan Lang, Andries Engelbrecht, Carola Doerr, Peter Korošec, Tome Eftimov

A Collection of Deep Learning-based Feature-Free Approaches for Characterizing Single-Objective Continuous Fitness Landscapes

Moritz Seiler, Raphael Prager, Pascal Kerschke, Heike Trautmann

CS 2

Tuesday, July 12, 14:30–15:50, Pacific G-H
Chair: TBD

Minimal Neural Network Models for Permutation Invariant Agents

Joachim Pedersen, Sebastian Risi
Hybridizing Bio-Inspired Strategies with Infotaxis through Genetic Programming
João Macedo, Lino Marques, Ernesto Costa

Deep Surrogate Assisted MAP-Elites for Automated Hearthstone Deckbuilding
Yulun Zhang, Matthew Fontaine, Amy Hoover, Stefanos Nikolaidis

Evolving Programmable Computational Metamaterials
Atoosa Parsa, Dong Wang, Corey O’Hern, Mark Shattuck, Rebecca Kramer-Bottiglio, Josh Bongard

ECOM 4
Chair: TBD
Tuesday, July 12, 14:30–15:50, Pacific F

A Biased Random Key Genetic Algorithm Applied to Target Set Selection in Viral Marketing
Albert López Serrano, Christian Blum

Efficient Heuristics and Metaheuristics for the Unrelated Parallel Machine Scheduling Problem With Release Dates and Setup Times
Mohamed Elamine Athmani, Taha Arbaoui, Younes Mimene, Farouk Yalaoui

Theory 2
Chair: TBD
Tuesday, July 12, 14:30–15:50, Caspian

Self-adaptation via Multi-objectivisation: A Theoretical Study
Per Kristian Lehre, Xiaoyu Qin

Runtime Analysis of Competitive co-Evolutionary Algorithms for Maximin Optimisation of a Bilinear Function
Per Kristian Lehre

Fast Non-elitist Evolutionary Algorithms with Power-law Ranking Selection
Duc-Cuong Dang, Anton Eremeev, Per Kristian Lehre, Xiaoyu Qin

SBSE 2
Chair: TBD
Tuesday, July 12, 16:20–17:40, Atlantic 1

Is the Revisited Hypervolume an Appropriate Quality Indicator to Evaluate Multi-Objective Test Case Selection Algorithms?
Aitor Arrieta

Multi-Objective Metamorphic Follow-up Test Case Selection for Deep Learning Systems
Aitor Arrieta

Improving Source-Code Representations to Enhance Search-based Software Repair
Pemma Reiter, Antonio Espinoza, Ruoyu "Fish" Wang, Adam Doupe, Westley Weimer, Stephanie Forrest

ECOM 5*
Chair: TBD
(Best Paper nominees are marked with a star)
Tuesday, July 12, 16:20–17:40, Atlantic 2

Iterated Local Search with Perturbation based on Variables Interaction for Pseudo-Boolean Optimization*
Renato Tinós, Michal Przewozniczek, Darrell Whitley
**Local Ranking Explanation for Genetic Programming Evolved Routing Policies for Uncertain Capacitated Arc Routing Problems**
Shaolin Wang, Yi Mei, Mengjie Zhang

**On the Use of Quality Diversity Algorithms for The Traveling Thief Problem**
Adel Nikfarjam, Aneta Neumann, Frank Neumann

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**ACO-SI 2**
Chair: TBD

**Environment induced emergence of collective behaviour in evolving swarms with limited sensing**
Fuda van Diggelen, Tugay Alperen Karagüzel, Jie Luo, Eliseo Ferrante, Nicolas Cambier, A.E. Eiben

**PLAN: A Leafcutter Ant Colony Optimization Algorithm for Ride-Hailing Services**
Anoushka Alavilli, Mai Vu

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**GECH 4**
Chair: TBD

**Expensive Optimization with Production-Graph Resource Constraints: A First Look at a New Problem Class**
Stefan Pricopie, Richard Allmendinger, Manuel López-Ibáñez, Clyde Fare, Matt Benatan, Joshua Knowles

**Boomerang-shaped Neural Embeddings for NK Landscapes**
Roberto Santana, Arnaud Liefooghe, Bilel Derbel

**Analyzing the Impact of Undersampling on the Benchmarking and Configuration of Evolutionary Algorithms**
Diederick Vermetten, Hao Wang, Carola Doerr, Manuel López-Ibáñez, Thomas Bäck

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**HOP 3**
Chair: TBD

**Targeting Requirements Violations of Autonomous Driving Systems by Dynamic Evolutionary Search (HOP at GECCO’22)**
Yixing Luo, Xiao-Yi Zhang, Paolo Arcaini, Zhi Jin, Haiyan Zhao, Fuyuki Ishikawa, Rongxin Wu, Tao Xie

**A comparison of Rule Compaction Algorithms for Michigan Style Learning Classifier Systems**
Yi Liu, Will Browne, Bing Xue

**Genetic Programming Convergence**
William Langdon

**Archivers for Single- and Multi-objective Evolutionary Optimization Algorithms**
Oliver Schuetze, Carlos Hernández Castellanos

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**CS 3**
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**EvoRobogami: Co-designing with Humans in Evolutionary Robotics Experiments**
Huang Zonghao, Quinn Wu, David Howard, Cynthia Sung
Adaptive Phototaxis of a Swarm of Mobile Robots using Positive and Negative Feedback Self-Alignment
Yoones Mirhosseini, Matan Yah Ben Zion, Olivier Dauchot, Nicolas Bredeche

Solving Multi-Structured Problems by Introducing Linkage Kernels into GOMEA
Arthur Guijt, Dirk Thierens, Tanja Alderliesten, Peter Bosman

Effective Mutation Rate Adaptation through Group Elite Selection
Akarsh Kumar, Bo Liu, Risto Miikkulainen, Peter Stone

GPU-Accelerated Parallel Gene-Pool Optimal Mixing in a Gray-Box Optimization Setting
Anton Bouter, Peter Bosman

LUCIE: An Evaluation and Selection Method for Stochastic Problems
Erwan Lecarpentier, Paul Templier, Emmanuel Rachedson, Dennis Wilson

Towards a Stronger Theory for Permutation-based Evolutionary Algorithms
Benjamin Doerr, Yassine Ghannane, Marouane Ibn Brahim

Monotone Improvement of Information-Geometric Optimization Algorithms with a Surrogate Function
Youhei Akimoto

Simulated Annealing is a Polynomial-Time Approximation Scheme for the Minimum Spanning Tree Problem
Benjamin Doerr, Amirhossein Rajabi, Carsten Witt

Analysis of a Gray-Box Operator for Vertex Cover
Samuel Baguley, Tobias Friedrich, Timo Kötzing, Xiaoyue Li, Marcus Pappik, Ziena Zeif

PRE-NAS: Predictor-assisted Evolutionary Neural Architecture Search
Yameng Peng, Andy Song, Vic Ciesielski, Haytham Fayek, Xiaojun Chang

Dynamics-Aware Novelty Search With Behavior Repulsion
Kang Xu, Yan Ma, Wei Li

Neural Architecture Search Using Progressive Evolution
Nilotpal Sinha, Kuan-Wen Chen

A Multi-objective Evolutionary Algorithm with New Reproduction and Decomposition Mechanisms for the Multi-Point Dynamic Aggregation Problem
Guanqiang Gao, Bin Xin, Yi Mei, Shengyu Lu, Shuxin Ding
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<tr>
<td>09:00</td>
<td>Evolutionary Feature Selection: A Novel Wrapper Feature Selection Architecture Based on Evolutionary Strategies</td>
<td>Aaryan Dubey, Alexandre Inoue, Pedro Birmann, Sammuel Silva</td>
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<td>09:20</td>
<td>On genetic programming representations and fitness functions for interpretable dimensionality reduction</td>
<td>Thomas Uriot, Marco Virgolin, Tanja Alderliesten, Peter Bosman</td>
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<td>09:40</td>
<td>Assessing Evolutionary Terrain Generation Methods for Curriculum Reinforcement Learning</td>
<td>David Howard, Humphrey Munn, Davide Dolcetti, Joshua Kannemeyer, Nicole Robinson</td>
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<td><strong>EMO 5</strong></td>
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<td>09:00</td>
<td>Reproducibility and Baseline Reporting for Dynamic Multi-objective Benchmark Problems</td>
<td>Daniel Herring, Michael Kirley, Xin Yao</td>
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<tr>
<td>09:20</td>
<td>An Improved Pareto Front Modeling Algorithm for Large-scale Many-Objective Optimization</td>
<td>Annibale Panichella</td>
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<td>09:40</td>
<td>A Two-phase Framework with a Bezier Simplex-based Interpolation Method for Computationally Expensive Multi-objective Optimization</td>
<td>Ryoji Tanabe, Youhei Akinoto, Ken Kobayashi, Hiroshi Umeki, Shinichi Shirakawa, Naoki Hamada</td>
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<td>09:00</td>
<td>Precise Runtime Analysis for Plateau Functions</td>
<td>Denis Antipov, Benjamin Doerr</td>
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<td>09:10</td>
<td>Automated Configuration of Genetic Algorithms by Tuning for Anytime Performance</td>
<td>Furong Ye, Carola Doerr, Hao Wang, Thomas Bäck</td>
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<td>09:20</td>
<td>Choosing the Right Algorithm With Hints From Complexity Theory (Hot-off-the-Press Track at GECCO 2022)</td>
<td>Shouda Wang, Weijie Zheng, Benjamin Doerr</td>
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<td>09:30</td>
<td>Modular Grammatical Evolution for the Generation of Artificial Neural Networks (Hot-off-the-Press Track at GECCO 2022)</td>
<td>Khabat Soltanian, Ali Ebnenasir, Mohsen Afsharchi</td>
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<td>09:40</td>
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<td>Weijie Zheng, Yufei Liu, Benjamin Doerr</td>
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<td>09:00</td>
<td>CS + IMPACT</td>
<td>Plasticity and Evolvability Under Environmental Variability: the Joint Role of Fitness-based Selection and Niche-limited Competition</td>
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<td>Learning to Walk Autonomously via Reset-Free Quality-Diversity</td>
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<td>Illuminating Diverse Neural Cellular Automata for Level Generation</td>
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<td>09:00</td>
<td>GA 3</td>
<td>Evolutionary Diversity Optimisation for The Traveling Thief Problem</td>
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<td>09:40</td>
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<td>Niching-based Evolutionary Diversity Optimization for the Traveling Salesperson Problem</td>
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Stephen Chen, Shanshan Lao, Irene Moser

Ant Colony Optimization for Feature Selection via a Filter-Randomized Search Heuristic
Alberto Ortega, Juan José Escobar, Miguel Damas, Andrés Ortiz, Jesús González

A Chaotic Parallel Antlion Optimization Algorithm for Feature Selection
Xun Zhou, Hongwei Chen, Deiwei Shi

Cooperative Attack-Defense Evolution of Large-Scale Agents: A Multi-Population High-Dimensional Mean-Field Game Approach
Guofang Wang, Xiao Zhang, Wang Yao, Lu Ren

Ant Colony Optimization with Shortest Route Biased Dispatch for Visiting Constrained Multiple Traveling Salesmen Problem
Cong Bao, Qiang Yang, Xu-Dong Gao, Zhen-Yu Lu, Jun Zhang

Dropout Topology-Assisted Bidirectional Learning Particle Swarm Optimization for Neural Architecture Search
Ye-Qun Wang, Chun-Hua Chen, Jun Zhang, Zhi-Hui Zhan

Complex Systems (Artificial Life/Artificial Immune Systems/Generative and Developmental Systems/Evolutionary Robotics/Evolvable Hardware) (CS)

Comparison of Evolutionary Multi-Objective Optimization Algorithms Using Imitation Game
Yuji Sato, Yoshihisa Murakawa

Minimize Surprise MAP-Elites: A Task-Independent MAP-Elites Variant for Swarms
Tanja Katharina Kaiser, Heiko Hamann

Do Harsher Environments cause Selfish or Altruistic Behavior?
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CoBEA: Framework for Evolving Hardware by Direct Manipulation of FPGA Bitstreams
Joern Hoffmann, Clemens Fritzsch, Martin Bogdan

QDax: On the Benefits of Massive Parallelization for Quality-Diversity
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Geodesics, Non-linearities and the Archive of Novelty Search
Achkan Salehi, Alexandre Coninx, Stephane Doncieux

Using Evolutionary Game Theory to Understand Scalability in Task Allocation
Mostafa Rizk, Julian Garcia, Aldeida Aleti, David Green

A Comparative Analysis on Genome Pleiotropy for Evolved Soft Robots
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De-redundancy in a Random Boolean Network Using Knockout
Junxiu Liu, Jufang Dai, Min Su, Shunsheng Zhang, Yifan Hua, Yanhu Wang, Haiping Shu

AutoMoDe-Pomodoro: An Evolutionary Class of Modular Designs
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Selecting Continuous Life-Like Cellular Automata for Halting Unpredictability: Evolving for Abiogenesis
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Growth-Based Morphological Development: A Natural Approach to Fitness Landscape Shaping
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A Single Neural Cellular Automaton for Body-Brain Co-evolution
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Empowered Neural Cellular Automata
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Effects of encodings and quality-diversity on evolving 2D virtual creatures
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Evolving Robot Bodies with a Sense of Direction
Emiel Maarten Willem Kempen, Agoston E. Eiben

Diversification Techniques and Distance Measures in Evolutionary Design of 3D Structures
Adam Klejda, Maciej Komosinski, Agnieszka Mensfelt

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Cooperative Co-Evolutionary Memetic Algorithm for Pickup and Delivery Problem with Time Windows
Miroslaw Blocho, Tomasz Jastrzab, Jakub Nalepa

On the Fitness Landscapes of Interdependency Models in the Travelling Thief Problem
Mohamed El Yafrani, Marcella Martins, Myriam Delgado, Ricardo Lüders, Peter Nielsen, Markus Wagner

Neighbours Similar Fitness and the Effectiveness of Restarting Local Search
Aldeida Aleti, Mark Wallace, Markus Wagner

Exact and Sequential Penalty Weights in Quadratic Unconstrained Binary Optimisation with a Digital Annealer
Marcos Diez García, Mayowa Ayodele, Alberto Moraglio

Policy Network for Solving Flexible Job Shop Scheduling Problem With SetupTimes and Rescourage Constraints
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Xiang-Ling Chen, Zhi-Xuan Zhang, Ming-Can Geng, Wei-Neng Chen

External Archive Hybrid Genetic Algorithm for Unequal Area Facility Layout Problem
Ailing Shen, Juan Lin, Yiwen Zhong

Towards Evolutionary Self-Optimization of Large Multi-Agent Systems
Franciszek Seredyński, Tomasz Kulpa, Rolf Hoffmann

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**On stochastic evolving algorithms**
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**Evolvable Hybrid Ensembles for Musical Genre Classification**
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**Cascades of Evolutionary Support Vector Machines**
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**DEvS: Data Distillation Algorithm Based on Evolution Strategy**
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**Binary and Multinomial Classification through Evolutionary Symbolic Regression**
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**Evolving Convolutional Neural Networks for Intrusion Detection System Using Hybrid Multi-Strategy Aquila Optimizer**
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**Comparing different Metaheuristics for Model Selection in a Supervised Learning Classifier System**
Jonathan Wurth, Michael Heider, Helena Stegherr, Roman Sraj, Jörg Hähner

**Chaotic Genetic Bee Colony: Combining Chaos Theory and Genetic Bee Algorithm for Feature Selection in Microarray Cancer Classification**
Samuel Silva, Jadson Gertrudes

**Multi-task Optimisation for Multi-objective Feature Selection in Classification**
Jiabin Lin, Qi Chen, Bing Xue, Mengjie Zhang

**Particle Swarm Optimisation for Sparsity-based Feature Selection in Multi-label Classification**
Kaan Demir, Bach Nguyen, Bing Xue, Mengjie Zhang

**A Distributed Particle Swarm Optimization Algorithm for Distributed Clustering**
Zi-Xing Li, Xiao-Qi Guo, Wei-Neng Chen

**Scalable Evolutionary Hierarchical Reinforcement Learning**
Geoff Nitschke, Sasha Abramowitcz

Jack Saunders, Alex Freitas

**Interpretable pipelines with evolutionarily optimized modules for reinforcement learning tasks with visual inputs**
Leonardo Custode, Giovanni Iacca

**Accelerated Pattern Search with Variable Solution Size for Simultaneous Instance Selection and Generation**
Lam Le, Ferrante Neri, Dario Landa-Silva, Isaac Triguero

**Cost-sensitive Classification Tree Induction as a Bi-level Optimization Problem**
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Separating Rule Discovery and Global Solution Composition in a Learning Classifier System
   Michael Heider, Helena Stegherr, Jonathan Wurth, Roman Sraj, Jörg Hähner

Fairness in Generative Modeling: do it Unsupervised!
   Mariia Zameshina, Fabien Teytaud, Vlad Hosu, Nathanael Carraz, Laurent Najman, Olivier Teytaud, Markus Wagner

Entropy-Based Local Fitnsses for Evolutionary Multiagent Systems
   Ayhan Alp Aydeniz, Anna Nickelson, Kagan Tumer

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   Francisco Baeta, João Correia, Tiago Martins, Penousal Machado

A Comparative Study of GP-based and State-of-the-art Classifiers on a Synthetic Machine Learning Benchmark
   Patryk Orzechowski, Paweł Renc, William La Cava, Jason Moore, Arkadiusz Sitek, Jarosław Wąs, Joost Wagenaar

Multi-fidelity optimization method with Asynchronous Generalized Island Model for AutoML
   Israel Campero Jurado, Joaquín Vanschoren

MOPINNs: An Evolutionary Multi-Objective Approach to Physics-Informed Neural Networks
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Bootstrapped Fitness Critics with Bidirectional Temporal Difference
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   Abhiram Tirumala, Rishi Bhatnager, Sriram Mudireddy, Pranav Manjunath, Jason Zutty

KDE-GAN: Enhancing Evolutionary GAN With Knowledge Distillation and Transfer Learning
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BOBEA: A Bi-Objective Biclustering Evolutionary Algorithm for Genome-Wide Association Analysis
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A Computationally Fast but Approximate MIP-DoM Calculation for Multi-Objective Optimization
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On the Potential of Automated Algorithm Configuration on Multi-Modal Multi-Objective Optimization Problems
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Fair Feature Subset Selection using Multiobjective Genetic Algorithm
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Distributed Evolution Strategies for Large Scale Optimization
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A Layered Learning Estimation of Distribution Algorithm
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A Hybrid Self-Adapting Multi-Swarm Algorithm Based on PSO and CMA-ES for Continuous Dynamic Optimization
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Dynamic Perturbation for Population Diversity Management in Differential Evolution
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A Novel Dynamic Analysis on Multi-scale Quantum Harmonic Oscillator Algorithm Using Double-well Function
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Improving the Differential Evolution Strategy by coupling it with CMA-ES  
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Initialization method of genetic algorithm based on improved clustering algorithm  
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Neural Architecture Search Using Genetic Algorithm for Facial Expression Recognition  
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Black-Box Adversarial Attack via Overlapped Shapes  
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Improving DSMGA-II Performance on Hierarchical Problems by Introducing Preservative Back Mixing  
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Quantum-Enhanced Selection Operators for Evolutionary Algorithms  
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A GA based Approach for Solving Ring Design Telecommunication Network  
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Clodomir Santana, Edward Keedwell, Ronaldo Menezes

The pole balancing problem from the viewpoint of system flexibility  
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An Edge Quality Aware Crossover Operator for Application to the Capacitated Vehicle Routing Problem  
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Quantum Strategy of Population Initialization in Genetic Algorithm  
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A Surrogate Model-based Genetic Algorithm for the Optimal Policy in Cart-pole Balancing Environments
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Independent Influence of Exploration and Exploitation for Metaheuristic-based Recommendations
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Localized Distance and Time-based Differential Evolution for Multimodal Optimization Problems
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Benchmarking Algorithm Portfolio Construction Methods
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Using Domain Knowledge in Coevolution and Reinforcement Learning to Simulate a Logistics Enterprise
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Improved data clustering using multi-trial vector-based differential evolution with Gaussian crossover
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Enhancing MOEA/D with Learning: Application to Routing Problems with Time Windows
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Implementing and Evaluating Parallel Evolutionary Algorithms in Modern GPU Computing Libraries
Patrik Valkovič, Martin Pilát

Dynamic evaluation of Decomposition Methods for Large-Scale Optimization Problems using an Island Model
Grasiele Duarte, Beatriz Lima

Reduction of Genetic Drift in Population-Based Incremental Learning via Entropy Regularization
Ryoki Hamano, Shinichi Shirakawa

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Kamil Basiukajc, Maciej Komosinski, Konrad Miazga

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A preliminary study of Prediction Interval Methods with Genetic Programming
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On the Effect of Embedding Hierarchy within Multi-Objective Optimization for Evolving Symbolic Regression Models
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Active Learning Improves Performance on Regression Tasks in StackGP  
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Large Scale Image Classification Using GPU-based Genetic Programming  
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Imbalanced Classification with TPG Genetic Programming: Impact of Problem Imbalance and Selection Mechanisms  
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Analyzing Optimized Constants in Genetic Programming on a Real-World Regression Problem  
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Genetic programming for electric vehicle routing problem with soft time windows  
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Genetic Programming for Understanding Cognitive Biases that Generate Polarization in Social Networks
Chathika Gunaratne, Robert Patton

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Accelerating Neural Architecture Exploration Across Modalities Using Genetic Algorithms
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Towards Optimizing Neural Networks’ Connectivity and Architecture Simultaneously with Feature Selection
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Synaptic Pruning with MAP-Elites
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