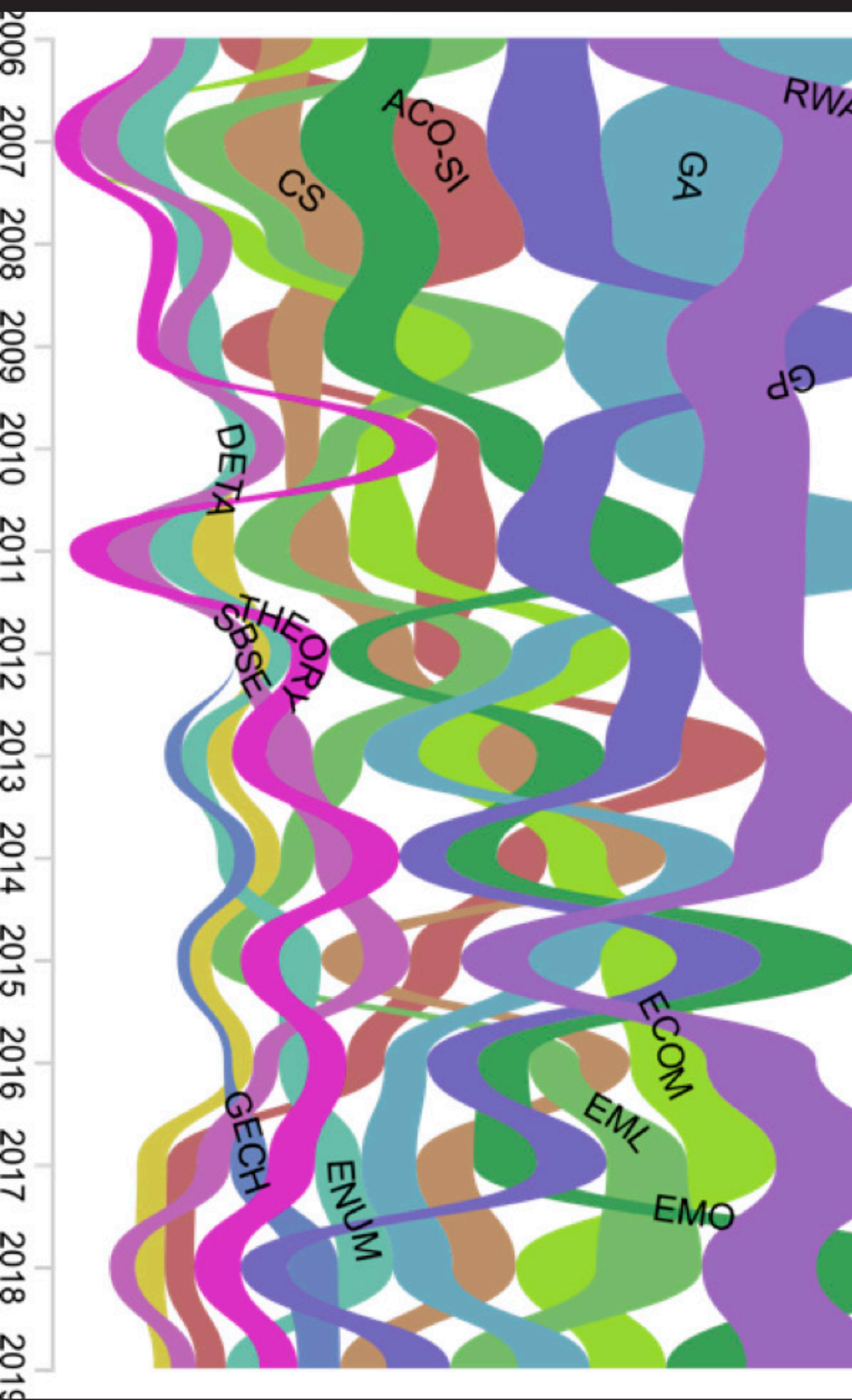


SIGEVolution

newsletter of the ACM Special Interest Group on Genetic and Evolutionary Computation

Volume 12
Issue 4



in this issue

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@ Prague:
Editor-in-Chief
Report

ACM
Transactions
on Evolutionary
Learning and
Optimization
(TELO)

Search-based
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Editorial

Welcome to the fourth (and last) 2019 SIGEVolution newsletter!

Many of you will have enjoyed the wonderfully organized GECCO 2019 in Prague this summer. As ever, the standard and variety of the work presented was fantastic. GECCO 2019 would not have been possible without the superb efforts of **Anne Auger** and **Thomas Stützle** (General Chairs), **Petr Pošík** (Local Chair), **Manuel López-Ibáñez** (Editor-in-Chief) and **Leslie Pérez Cáceres** (Proceedings Chair). You can find inside a report from **Manuel** with an overview of the GECCO structure and statistics. The article also gives a visual journey of the historical evolution of GECCO. Our cover reproduces one of the images in this report. Our next contribution, from two inspiring, hard-working and well-known members of our community, **Jürgen Branke** and **Darrell Whitley**, overviews the aims and scope of the new *Journal ACM Transactions on Evolutionary Learning and Optimization* (TELO). TELO is open for submissions! It publishes papers at the intersection of optimization and machine learning, making solid contributions to theory, method and applications in the field. Our third contribution is an inspiring and refreshing recount of 2019 search-based software engineering events, from a young insightful researcher, **Giovani Guizzo**, University College London.

As announced at the GECCO-2019 business meeting, SIGEVO is soliciting proposals for hosting FOGA-2021. The deadline for submitting hosting proposals is now set at February 15, 2020. Submissions should be electronically sent to **Darrell Whitley** (whitley@cs.colostate.edu) and **Kenneth De Jong** (kdejong@gmu.edu). Selection will be made by the SIGEVO board and notifications sent out by March 15, 2020.

Finally, we overview the major evolutionary computation events taking place in 2020, be ready with your submissions and do not miss the deadlines.

As ever, please get in touch if you would like to contribute an article for a future issue or have suggestions for the newsletter.

Gabriela Ochoa, Editor.

About the Cover

The cover image illustrates the dynamic of GECCO tracks' relative size (width) and rank (order from top to bottom) over the last 14 years using a so-called 'bump chart' or 'sorted stream graph'. By 'track size', we mean the number of published papers. Interestingly, the track ranks and sizes change over time. The plot reveals that the largest tracks have traditionally been GA (genetic algorithms, light blue), RWA (real world applications, light purple), and GP (genetic programming, purple). However, the GA and GP tracks have decreased in time, with EMO (evolutionary multi-objective optimization), ECOM (evolutionary combinatorial optimization and metaheuristics), and EML (evolutionary machine learning) – all in shades of green, in turn gaining in rank and size. The plot also shows an up trend in the odd years, which seems to loosely correlate with the geographical location of the conference in Europe (an exception is GECCO 2018 in Japan).

The visualization was produced by **Manuel López-Ibáñez** as part of his 2019 Editor-in-Chief report in this issue, inspired by a similar plot and dataset created in GECCO 2017 by **Nadarajen Veerapen** and **Gabriela Ochoa** ([SIGEVolution Volume 10, Issue 3](#)).

GECCO2019@Prague: Editor-in-Chief Report



By **Manuel López-Ibáñez**

<http://lopez-ibanez.eu>

Alliance Manchester Business School
University of Manchester, UK

The Genetic and Evolutionary Computation Conference (GECCO) took place on July 13th-17th 2019 in Prague, Czech Republic. This report provides statistics about submissions and authorship, and some comments about the evolution and growth of GECCO.

GECCO 2019 would not have been possible without the effort of **Anne Auger** and **Thomas Stützle** (General Chairs), **Petr Pošík** (Local Chair), **Leslie Pérez Cáceres** (Proceedings Chair) and many other organisers (<https://gecco-2019.sigevo.org/index.html/Organizers>), track chairs (<https://gecco-2019.sigevo.org/index.html/Program+Tracks>), and programme committee members (<https://gecco-2019.sigevo.org/index.html/Proceedings+Programme+Committee>).

In total, GECCO2019 received 617 abstract submissions in a first stage, 501 of them were actually submitted as full papers in the second stage, and 173 were finally accepted as full papers, giving an acceptance rate of 34.5%, which is typical of high-quality conferences. From the ones not accepted as full papers, 181 were accepted as posters. There were 72 additional poster submissions, of which 48 were accepted.

GECCO2019 was organised into 13 main tracks: Ant Colony Optimization and Swarm Intelligence (ACO-SI), Complex Systems (Artificial Life/Artificial Immune Systems/GenerativeSystems/Evolutionary Robotics/Evolvable Hardware) (CS), Digital Entertainment Technologies and Arts (DETA), Evolutionary Combinatorial Optimization and Metaheuristics (ECOM), Evolutionary Machine Learning (EML), Evolutionary Multiobjective Optimization (EMO), Evolutionary Numerical Optimization (ENUM), Genetic Algorithms (GA), General Evolutionary Computation and Hybrids (GECH), Genetic Programming (GP), Real World Applications (RWA), Search-Based Software Engineering (SBSE) and Theory. The number of submissions, the number of accepted full papers, and the acceptance rate of each track are shown in Fig 1. RWA and EML were the two most popular tracks. The overall acceptance rate of the conference (34.5%) is shown as the blue line, while the acceptance rate per track is shown as a red line, ranging from 20% (ENUM) to 46% (SBSE).

GECCO2019 submissions were authored by a total of 1604 authors affiliated to 58 different countries with 80% of authors affiliated to just 16 countries (see Fig. 2), with the UK and the USA having the largest number of authors.

A visualization of the authors per country and continent is given in Fig. 3. The area of the circles is proportional to the number of authors per country. Circles are colored and grouped by continent. Few submissions originated from South America and Africa, which suggests opportunities for growing the GECCO community.

In addition to submissions to the main conference, GECCO 2019 received 120 papers for 25 specialized workshops, and provided 33 tutorials, both introductory and advanced.

This edition of GECCO was very fortunate to have three fantastic keynote speakers: **Raia Hadsell** (Google DeepMind), **Robert Babuska** (TU Delft) and **Ingo Rechenberg** (TU Berlin). Videos from the keynote talks are available at <https://gecco-2019.sigevo.org/index.html/Keynotes>

Historical evolution of GECCO

Comparing the number of submissions and acceptance rate of GECCO219 to previous editions (Fig. 4), the number of submissions is over 500 whenever GECCO is held in Europe and it has been slightly increasing since 2016. The acceptance rate has been consistently lower than 40% since 2011.

The evolution of the main GECCO tracks is shown in Fig. 5, where the (vertical) width of each line is relative to the size of the track (number of accepted full papers) and the vertical position of the line give us the relative order (larger to smaller, from top to bottom).

Finally, the growth of GECCO is also clearly illustrated by the number of attendees, which achieved a historical maximum of 691 registrations in GECCO2018 (Kyoto, Japan) and a new maximum for Europe of 677 registrations in GECCO2019.

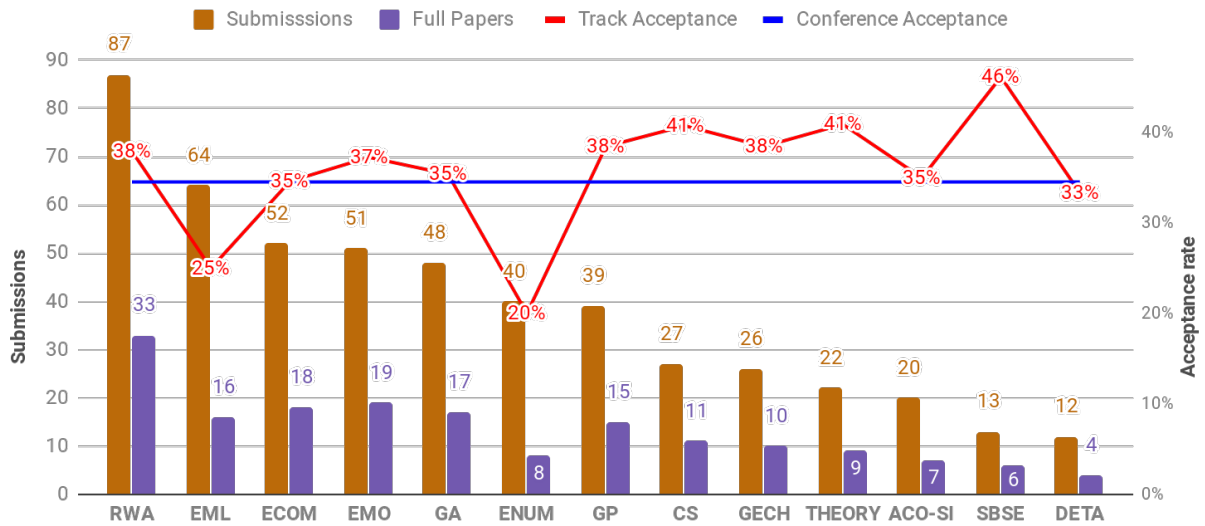


Fig. 1: GECCO 2019 full paper submission and acceptance per track.

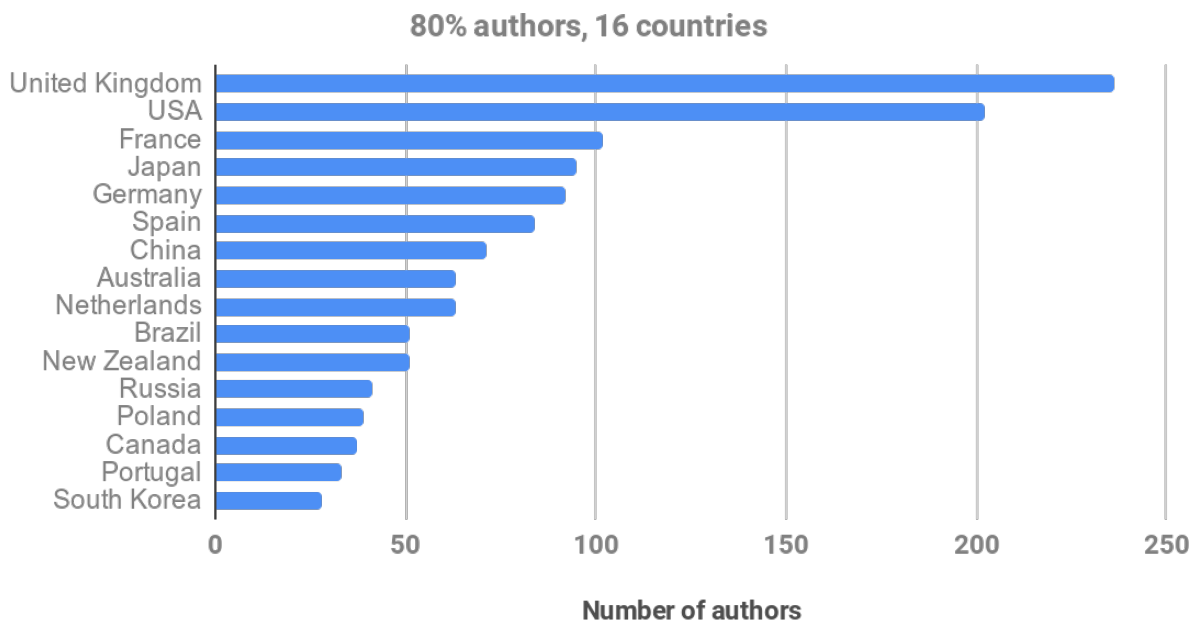


Fig. 2: List of countries from which 80% of authors originated.

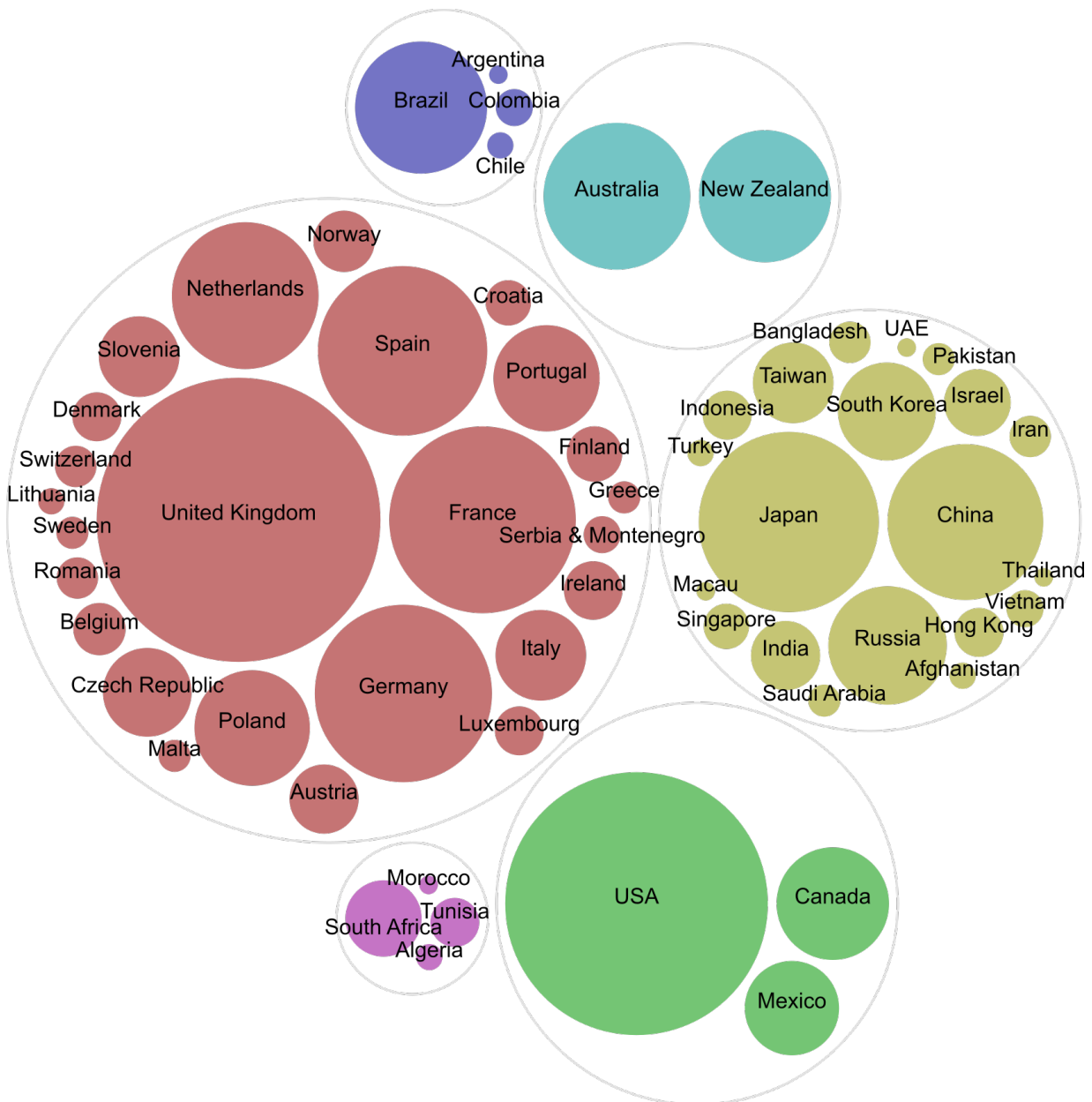


Fig. 3: Number of submission authors per country (grouped by continent).

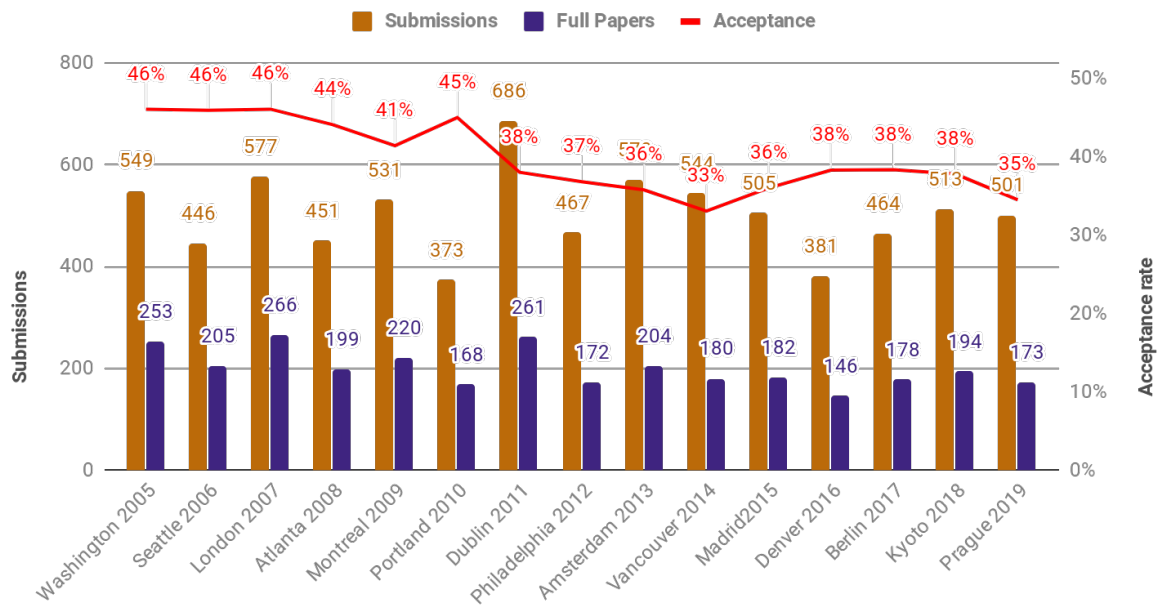


Fig. 4: Full-paper submissions and acceptance for past GECCO editions.

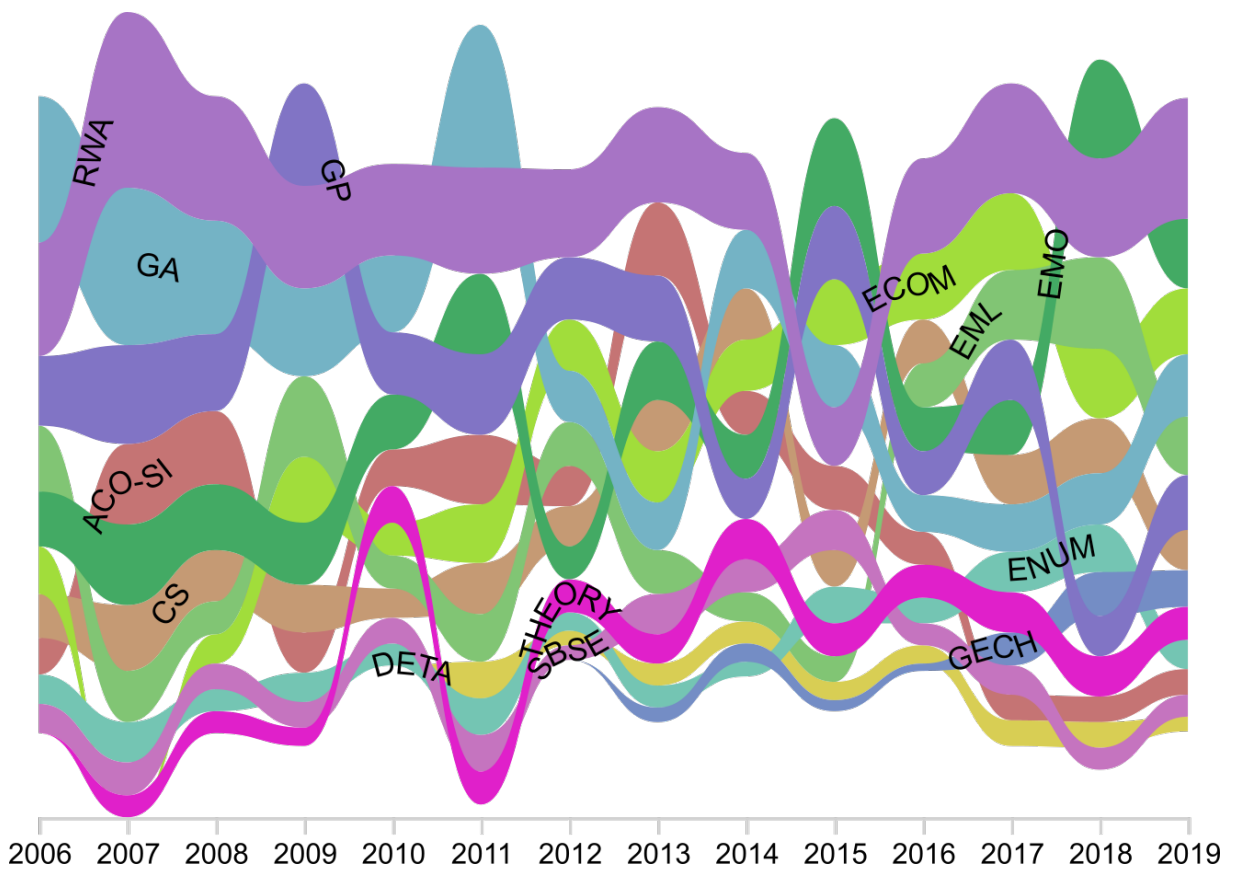


Fig. 5: Number of accepted full papers per track per year. The width of each line gives the relative size of the track, while the vertical position gives the ranking in terms of size (larger tracks are shown near the top).

ACM Transactions on Evolutionary Learning and Optimization (TELO)



Association for Computing Machinery

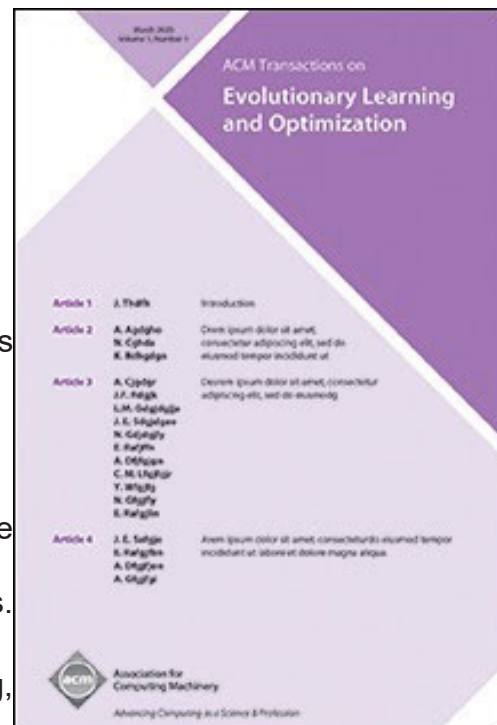
Advancing Computing as a Science & Profession

Co-Editors-in-Chief

[Juergen Branke](#), Warwick Business School, UK
[Darrell Whitley](#), Colorado State University, USA

The *ACM Transactions on Evolutionary Learning and Optimization* (TELO) publishes high-quality, original papers in all areas of evolutionary computation and related areas such as population-based methods, Bayesian optimization, or swarm intelligence.

We welcome papers that make solid contributions to theory, method and applications. Relevant domains include continuous, combinatorial or multi-objective optimization. Applications of interest include but are not limited to logistics, scheduling, healthcare, games, robotics, software engineering, feature selection, clustering as well as the open-ended evolution of complex systems. We are particularly interested in papers at the intersection of optimization and machine learning, such as the use of evolutionary optimization for tuning and configuring machine learning algorithms, machine learning to support and configure evolutionary optimization, and hybrids of evolutionary algorithms with other optimization and machine learning techniques.



TELO counts with the contribution of a strong and wide editorial board: <https://dlnext.acm.org/journal/telo/editorial-board>

All submissions will go through a rigorous double-blind review process. Authors may additionally submit their code and apply for an ACM reproducibility badge: www.acm.org/publications/policies/artifact-review-badging.

For questions please contact: telo-editors@acm.org.

For further information and to submit your paper please visit telo.acm.org.

Search-Based Software Engineering Events in 2019

Dr. Giovanni Guizzo¹

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The ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE) was held in Tallinn² -- Estonia, from the 28th to the 30th of August 2019. Additionally, the 11th Symposium on Search-Based Software Engineering (SSBSE)³ was co-located with ESEC/FSE on the 31st of August and 1st of September.

Search-based software engineering (SBSE) [1] investigates the usage of search based algorithms to solve hard software engineering problems. Among the applied techniques, evolutionary algorithms are the most commonly used. SBSE has matured along the years, and this can be seen in the visibility it has reached in top-tier software engineering venues such as ESEC/FSE, and of course, in top-tier evolutionary computation venues such as GECCO (which has a special SBSE track!). This year ESEC/FSE held an entire session for SBSE papers, while also being rich in artificial intelligence papers across all other sessions.

I had the pleasure to attend both events with a few colleagues from CREST and I can say that we all had a great experience there. In light of this, I decided to share my personal notes with you. Those are notes that I gathered throughout both events, mainly during keynotes, and are all based on my own views and experiences. I hope they provide you with meaningful insights.

1 ESEC/FSE 2019

FSE's program can be found at: <https://esec-fse19.ut.ee/program/overview/>.

All the keynotes' slides and recordings are available at: <https://esec-fse19.ut.ee/program/keynotes/>.

Some of the other talks also have slides and videos available at the program webpage.

1.1 Keynote 1 Living with Feature Interactions Dr. Joanne Atlee, University of Waterloo

In this keynote⁴, Dr. Joane Atlee presented the case study of the Boeing 737 Max 8 aeroplanes crashes. She focused on how feature interactions and prioritisation played a big role in the accident. The MCAS (Maneuvering Characteristics Augmentation System) is a component of the flight control system that automatically levels the plane during manoeuvres in certain conditions. The MCAS module played an unfortunate impactful role in the planes' crashes due to engineering decisions, miscommunication with the pilots, and feature interactions.

Personal notes:

1 E-mail: g.guizzo@ucl.ac.uk

2 <https://esec-fse19.ut.ee>

3 <http://ssbse19.mines-albi.fr/>

4 <https://esec-fse19.ut.ee/program/keynotes/#keynote1>

1. Internet of things is messy. Lots of things interact and while features are explicit, their interactions usually are not. Interaction treatment remains a problem, since specifying all feature interactions is infeasible;
2. There are several levels of severity in malfunctioning features coordination: a) whatever happens will not be critical; b) some of the interactions must be addressed; and c) each interaction can cause severe failures, thus they all must be addressed;
3. Treating feature interactions can be done in several ways, but it is definitely hard to do. Unfortunately, it is going to get worse as more things interact;
4. New features and requirements change the requirements of old features; hence we should be aware of how they evolve and how to update existing features based on new ones;
5. An aeroplane cockpit has TONS of switches. I do not want to be a pilot anymore!

As an evolutionary computation researcher myself, I started to wonder if feature interactions of critical systems can be modelled as a search problem, in which we try to minimise such interactions at the same time that we try to maintain the overall functionality of the system. Surely some feature interactions are necessary for the system to properly work, but they are also risky and sometimes unnecessary, hence this can be a problem hard enough to be solved with search algorithms.

1.2 Keynote 2

Safety and Robustness for Deep Learning with Provable Guarantees Professor Marta Kwiatkowska, Trinity College, University of Oxford

In this keynote⁵, Professor Marta Kwiatkowska presented her ongoing work on the security of machine learning algorithms. She focused on self-driving cars and how little changes in the environment can drastically affect the accuracy of algorithms. She presented some open challenges and the work she has done with her multiple grants on this topic.

Personal notes:

1. Machine learning algorithms can be fooled;
2. Self-driving cars are easily fooled by digital and physical obstacles. People are actually putting stickers on signs and on the road, consequently making self-driving cars deviate from their course and sometimes crash;
3. An open challenge is machine learning verification because it is a black box: we know what the model does, but we cannot easily understand why/how it is taking that decision;
4. By adding 3 green pixels in a red traffic light image, the neural network accuracy went from 95% to 0%;

1.3 Keynote 3

Insights from Open Source Software Supply Chains Dr. Audris Mockus, University of Tennessee

⁵ <https://esec-fse19.ut.ee/program/keynotes/#keynote2>

Dr. Audris Mockus talked⁶ about how open-source software can be seen as a supply chain, where each library being used is a supplier and the user is the client of the chain. As it happens with common products supply chains, if a supplier is malicious, the product can cause damage to the client. He talked about the NPM (the world's largest Software Registry) problem in which a small open-source library caused massive damage. This is especially scary because the average number of libraries required by a dependency can surpass 200. Personal notes:

1. The NPM problem: way too many dependencies that could be malicious;
2. Risk is high on dependencies that you do not manage;
3. It is important to dig repositories for information and better understanding of how software evolves;
4. World of Code --- Open Source Database: [url{https://dl.acm.org/citation.cfm?id=3341908}](https://dl.acm.org/citation.cfm?id=3341908);
5. Data Archaeology is a thing;
6. Increase supplier's transparency is a way of mitigating the malicious code risk.

1.4 ESEC/FSE Test-of-Time Award Talk Cross-project Defect Prediction: a Large Scale Experiment on Data vs. Domain vs. Process Dr. Thomas Zimmermann and Dr. Nachiappan Nagappan, Microsoft

In this talk⁷, the two authors talked about defect prediction considering different projects. Can a model trained in one software predict defects in a different software of the same domain? They discovered that: it depends. There are some characteristics that can identify if a software is good enough for this purpose. It is still a hard problem in large scale programs. Personal notes:

1. Training in some systems may reveal defects in other systems, but not the other way around, e.g., Firefox trained models predict Internet Explorer defects, but not the opposite;
2. Detecting defects of changes/commits instead of current source code can be helpful in assessing risks;
3. Defect frequency is not associated to the engineer's experience: risky code has more bugs, but risky code is also assigned to the best engineers. Therefore, the buggiest pieces of code are usually touched by the best engineers.

1.5 ACM SIGSOFT Impact Keynote Award Talk CUTE: a concolic unit testing engine for C Professor Koushik Sen, University of California

Professor Koushik Sen⁸ presented his awarded keynote on Concolic Testing for C, but at the very end he also talked about a trending topic right now in software engineering: *fuzz testing*. Briefly, fuzzing is a software testing technique that involves providing invalid, unexpected, or

6 <https://esec-fse19.ut.ee/program/keynotes/#keynote3>

7 <https://www.utv.ee/naita?id=28728>

8 <https://esec-fse19.ut.ee/wp-content/uploads/2019/09/koushik-CUTE-Impact-Award-Talk-FSE-2019.v2.pdf>

random data as inputs to a computer program. The program is then monitored for exceptions such as crashes, failing built-in code assertions, or potential memory leaks. A very well known fuzzing tool is American Fuzzy Lop (AFL)⁹.

I had the pleasure of talking to Professor **Koushik Sen** about his ongoing work on fuzzing after his presentation. I noticed that the fuzzing field is facing some problems that the optimisation community has probably solved before. The problems I have identified are:

1. Fuzzing is too random. The generated test cases are generated without guidance, so very few are useful. Maybe, Guiding the search with metaheuristic techniques could solve this problem?
2. Too many redundant test cases that cover the same branches of code. Maybe, whole test suite generation with branch coverage can solve this problem?
3. The mutators are way too simplistic. They usually flip one bit and they need a way of choosing the best mutator in an intelligent way. Maybe, using crossover operators with the best covering test cases as parents could solve this problem? Adaptive operator selection can also improve the quality of the results?

1.6 SBSE Session

I have attended all talks in the SBSE session. Pretty interesting SBSE papers with some interesting trends. I have also seen papers using SBSE techniques in other sessions, mostly for test data generation.

Personal notes:

1. Two Hyper-Heuristics presented with online learning;
2. Testing and debugging are still very relevant. Only one paper was not on these topics;
3. As usual, evolutionary algorithms are the most common techniques;
4. One of the papers was focused on vulnerability testing, which is a hard, important, and not well explored in SBSE.

1.7 General Notes

1. My supervisor and colleague, Dr. **Federica Sarro** presented the paper: "App Store Effects on Software Engineering Practices". I found it very interesting that programmers attribute the success of their app to User Interface (UI) design, even more than to code quality. In an unrelated paper, researchers found out that the performance of iOS apps is greatly affected by beautiful UI effects. Could we apply Genetic Improvement (GI) [2] to UI animations in Mobile Apps? Improving the performance of such an important feature can be very beneficial;
2. Multiple Mobile Apps research papers. Should we be combining mobile development and evolutionary computation more often?
3. Machine Learning is very popular in software engineering;
4. Estonian tacos are very small.

⁹ Official website: <http://lcamtuf.coredump.cx/afl/>

2 SSBSE 2019

Although ESEC/FSE is bigger and a more prestigious venue, I actually enjoyed SSBSE more. The papers are on our area of expertise and the people attending are doing research closely related to ours. Consequently, SSBSE papers seem more interesting, they give us more ideas, and are easily understandable. Furthermore, interactions during SSBSE feel more meaningful to me, the researchers seem more eager to collaborate, and we feel this friendship vibe as like everyone knows everyone else.

SSBSE 2019 had two keynotes¹⁰: 1) Professor Thomas Bäck -- “Automatic Configuration and Learning for Evolutionary Computation”; and 2) Dr. Federica Sarro -- “Search-Based Predictive Modelling for Software Engineering: How Far Have We Gone?”. Both keynotes were very insightful, but unfortunately I did not take notes because I was too concentrated on the talks (sorry!).

I had the chance to meet and talk to several researchers that I cited multiple times, while also chatting with some newcomers, all of which made me get back home with a notebook full of ideas. All in all, SSBSE was a great experience as always. If you want to know more about SBSE, I strongly encourage you to attend SSBSE 2020, which is going to be held in the beautiful city of Bari -- Italy on the 7th and 8th of October. Finally, Figure 1 shows CRESTies during SSBSE’s event dinner.



Figure 1: CRESTies from left to right: Giovanni, Vali, Federica, Rebecca, Dan and Aymeric.

[1] M. Harman, S. A. Mansouri, and Y. Zhang. Search-based Software Engineering: Trends, Techniques and Applications. *ACM Computing Surveys*, 45(1):11–61, 2012.

[2] Justyna Petke, Sæmundur Haraldsson, Mark Harman, William Langdon, David White, and John Wood-ward. Genetic improvement of software: a comprehensive survey. *IEEE Transactions on Evolutionary Computation*, PP:1–1, 04 2017.

10 <http://ssbse19.mines-albi.fr/keynotes.html>

Forthcoming Conferences



[GECCO 2020 @ Cancun](#)

The Genetic and Evolutionary Computation Conference

July 8th-12th 2020

[Important Dates](#)

[Call for Papers](#)

Abstract submission deadline: January 30, 2020
Full paper submission deadline: February 6, 2020

The Genetic and Evolutionary Computation Conference (GECCO) presents the latest high-quality results in genetic and evolutionary computation since 1999. Topics include: genetic algorithms, genetic programming, ant colony optimization and swarm intelligence, complex systems (artificial life/robotics/evolvable hardware/generative and developmental systems/artificial immune systems), digital entertainment technologies and arts, evolutionary combinatorial optimization and metaheuristics, evolutionary machine learning, evolutionary multiobjective optimization, evolutionary numerical optimization, real world applications, search-based software engineering, theory and more.



The IEEE World Congress on Computational Intelligence ([IEEE WCCI](#)) is the world's largest technical event in the field of computational intelligence. WCCI 2020 features the flagship conference of the Computational Intelligence Society: The 2020 International Joint Conference on Neural Networks (IJCNN 2020), the 2020 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE 2020), and the 2020 IEEE Congress on Evolutionary Computation (IEEE CEC 2020) under one roof. It encourages cross-fertilisation of ideas among the three big areas and provides a forum for intellectuals from all over the world to discuss and present their research findings on computational intelligence.

[Important Dates](#)

15 Dec 2019
15 Jan 2020
15 Mar 2020
15 April 2020

Competition and Tutorial Proposals Deadline
Paper Submission Deadline
Paper Acceptance Notification Date
Final Paper Submission and Early Registration Deadline

About this newsletter

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Contributing to SIGEVolution

We solicit contributions in the following categories:

Art: Are you working with Evolutionary Art? We are always looking for nice evolutionary art for the cover page of the newsletter.

Short surveys and position papers: We invite short surveys and position papers in EC and EC related areas. We are also interested in applications of EC technologies that have solved interesting and important problems.

Software: Are you are a developer of an EC software and you wish to tell us about it? Then, send us a short summary or a short tutorial of your software.

Lost Gems: Did you read an interesting EC paper that, in your opinion, did not receive enough attention or should be rediscovered? Then send us a page about it.

Dissertations: We invite short summaries, around a page, of theses in EC-related areas that have been recently discussed and are available online.

Meetings Reports: Did you participate to an interesting EC-related event? Would you be willing to tell us about it? Then, send us a short summary, around half a page, about the event.

Forthcoming Events: If you have an EC event you wish to announce, this is the place.

News and Announcements: Is there anything you wish to announce, such as an employment vacancy? This is the place.

Letters: If you want to ask or to say something to SIGEVO members, please write us a letter!

Suggestions: If you have a suggestion about how to improve the newsletter, please send us an email.

Contributions will be reviewed by members of the newsletter board.

We accept contributions in LATEX, MS Word, and plain text.

Enquiries about submissions and contributions can be emailed to editor@sigevolution.org

All the issues of SIGEVolution are also available online at: www.sigevolution.org

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