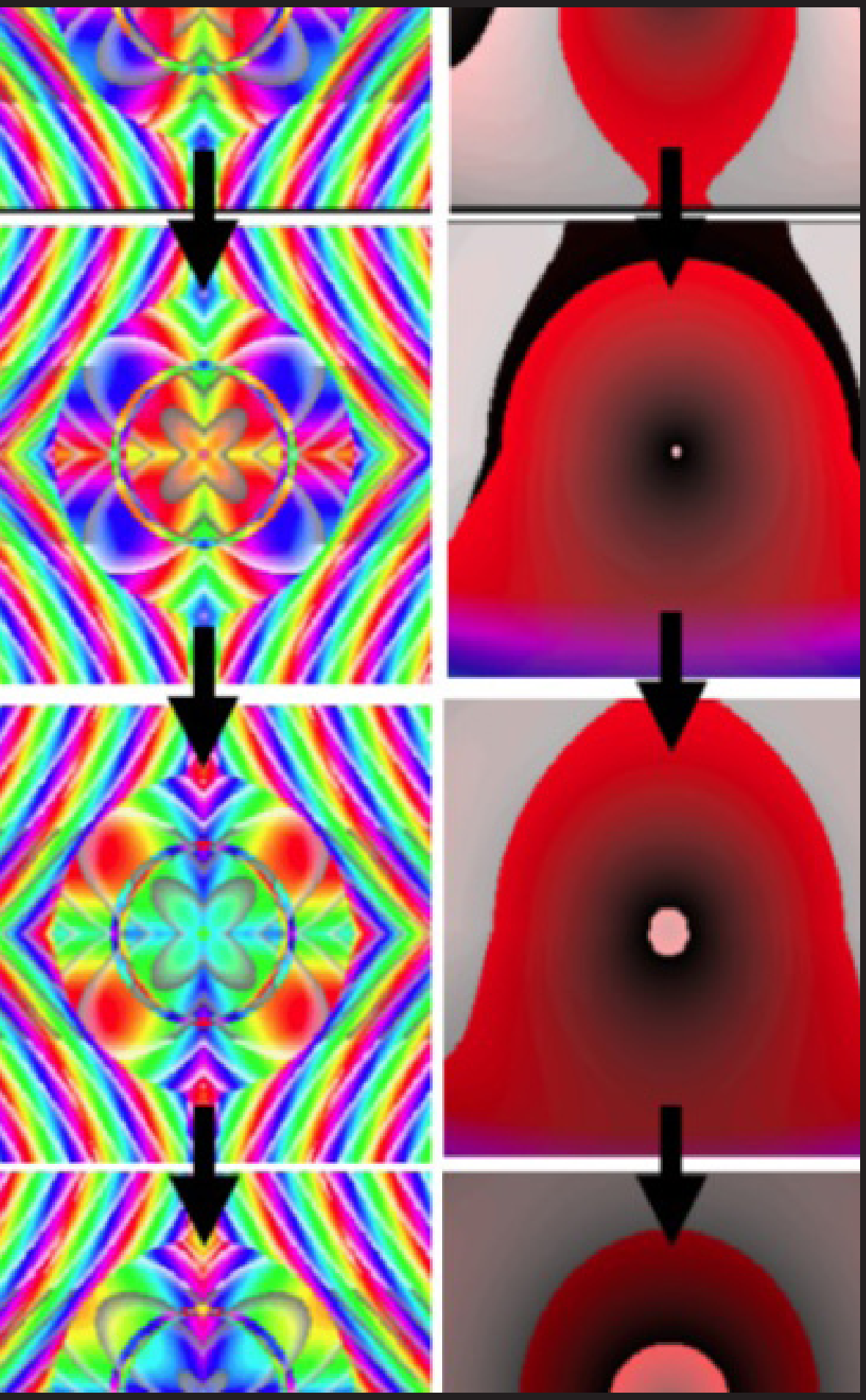
SIGEVOlution

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

Volume 11
Issue 4



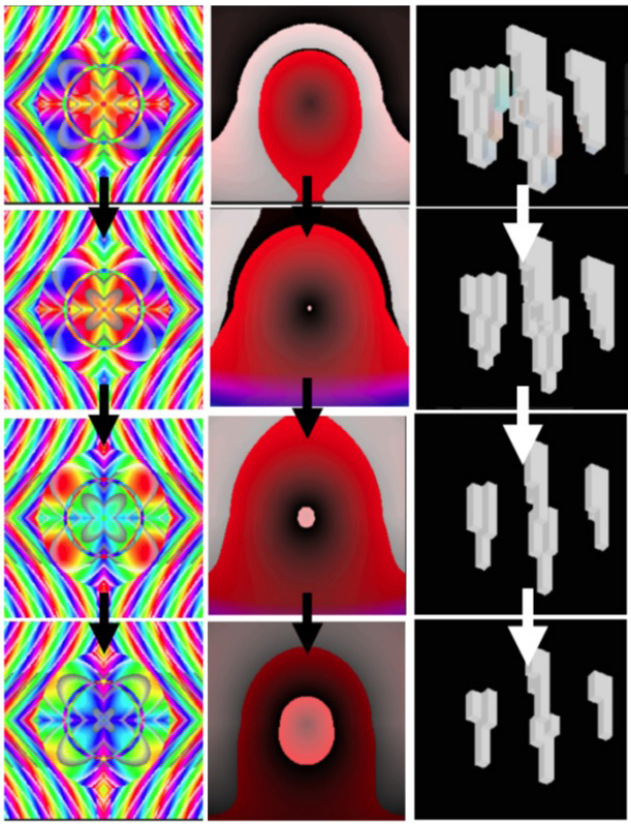
in this issue

Human-Competitive Awards 2018

Genetic Improvement Events in 2018

Welcome to the fourth and last 2018 newsletter. Our cover illustrates pieces of art (evolved animations) produced by generative models and interactive breeding. Bill Langdon presents an overview of the 2018 “Humies” awards; a traditional competition ran within the Genetic and Evolutionary Computation Conference (GECCO), where entries report human-competitive results that were produced by any form of evolutionary computation. This number also reports on two 2018 events devoted to the emerging topic of “Genetic Improvement”, which can be seen as a branch of Genetic Programming, where the idea is to automatically improve an existing program instead than creating a new program from scratch. Finally, we quickly overview the major evolutionary computation events taking place in 2019. 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 ideas for the newsletter.

Gabriela Ochoa, Editor



The front cover demonstrates selected pieces of art from AnimationBreeder and 3DAnimationBreeder, two generative art programs which expand upon the work of PicBreeder and Endless Forms to interactively evolve dynamic animations. Each column is a small portion of one animation evolved by a user through selective breeding. Each frame of animation is generated by a Compositional Pattern Producing Network (CPPN), a special type of neural network that queries coordinates and uses a variety of activation functions to produce symmetrical, asymmetrical, and repeating patterns. However, the individual frames of animation are created by adding a time input to the CPPNs so that they can be queried across time.

This work appeared at GECCO 2018 in the paper “Querying Across Time to Interactively Evolve Animations” by **Isabel Tweraser**, **Lauren E. Gillespie**, and **Jacob Schrum** of Southwestern University in Georgetown, TX, USA. To see the actual animations, go to the following website where you can browse results evolved by 40 users in a human subject study described in the paper: https://people.southwestern.edu/~schrum2/SCOPE/EvolvedArt/cppnart.php .

Human-Competitive Awards 2018

W. B. Langdon

The GECCO 2018 conference in Kyoto, Japan hosted the 15th annual "Humies" Awards.

The first annual "Humies" competition was held at the 2004 Genetic and Evolutionary Computation Conference (GECCO-2004) in Seattle (USA). With its generous prize money (provided by **John Koza**) it has become a staple of the Genetic and Evolutioary Computing calendar. The Humies offer the opportunity to the EC community to showcase its best work, work, which by definition, is better than human.

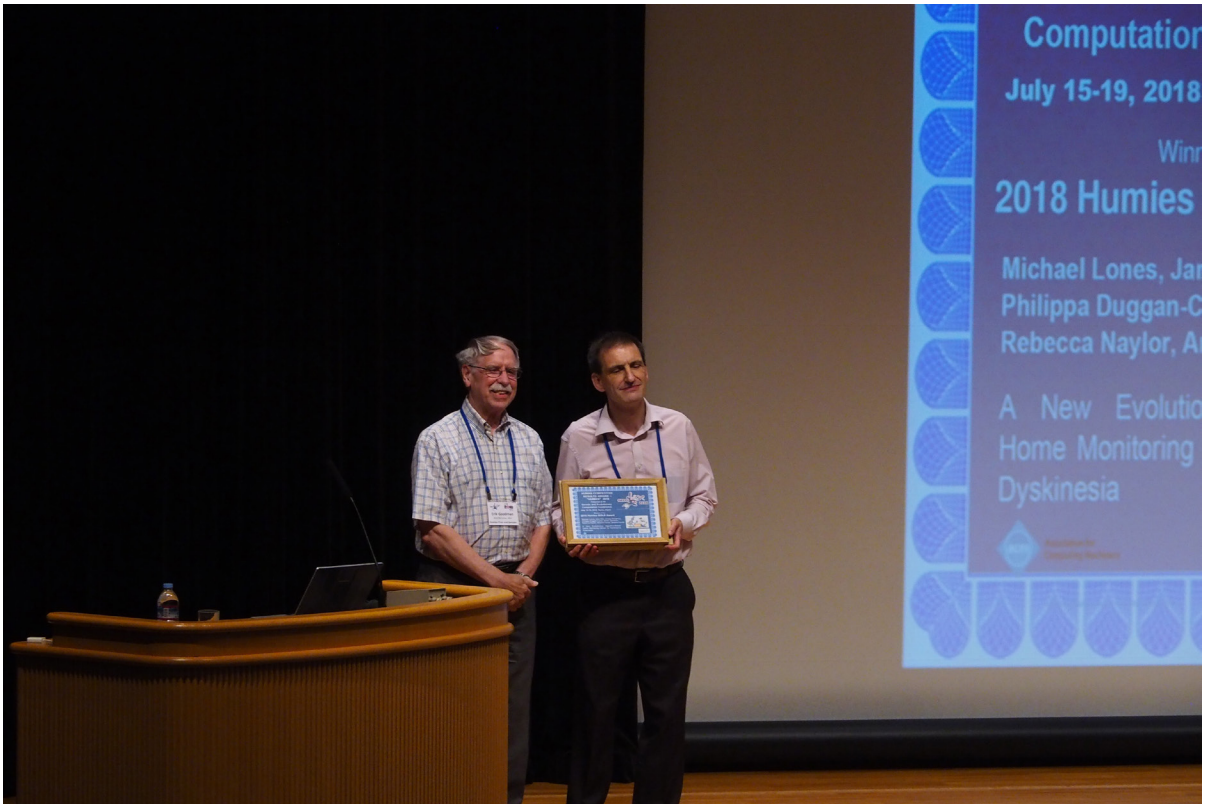


Figure 1: **Erik Goodman** presenting the first prize (and $5 000) to Steve Smith for "A New Evolutionary Algorithm-Based Home Monitoring Device for Parkinson's Dyskinesia" Journal of Medical Systems (2017) [1]. (Photo from **Zdenek Vasicek**. More photos at http://www.cs.ucl.ac.uk/staff/W.Langdon/ gecco2018).

1 What it means to be Human-Competitive: Eight Criteria

Although the judges will eventually have to deliberate and then decide, to run a competition we need to be reasonably precise by what we mean by "Human- Competitive". So to enter the Humie competition it is necessary to show that you satisfy one of the following 8 criteria, which where originally proposed by Koza in the 10th anniversary issue of GP+EM [5][1]:

- (A) The result was patented as an invention in the past, is an improvement over a patented invention, or would qualify today as a patentable new invention
- (B) The result is equal to or better than a result that was accepted as a new scientific result at the time when it was published in a peer-reviewed scientific journal.
- (C) The result is equal to or better than a result that was placed into a database or archive of results maintained by an internationally recognized panel of scientific experts.
- (D) The result is publishable in its own right as a new scientific result independent of the fact that the result was mechanically created.
- (E) The result is equal to or better than the most recent human-created solution to a long-standing problem for which there has been a succession of increasingly better human-created solutions.
- (F) The result is equal to or better than a result that was considered an achievement in its field at the time it was first discovered.
- (G) The result solves a problem of indisputable difficulty in its field.
- (H) The result holds its own or wins a regulated competition involving human contestants (in the form of either live human players or human- written computer programs).

2 Judges

Eric Goodman

Una-May O'Reilly

Wolfgang Banzhaf

Darrell Whitley

Lee Spector

[1]We are now approaching the 10th anniversary of "Genetic Programming and Evolvable Machines" and there will be a special issue to celebrate.

3 Results

This year there were 16 entries. The judges selected nine to be finalists. The finals where held in front of the judges at this year's GECCO conference. As a result they awarded

First prize: the Gold Award, $5 000, to

- Michael Lones (Heriot-Watt University, Edinburgh, UK),
- Jane Alty (Consultant in Neurology, Leeds Teaching Hospitals),
- Jeremy Cosgrove (Leeds Teaching Hospitals NHS Trust),
- Philippa Duggan-Carter (Department of Neurology, Leeds General Infirmary),
- Stuart Jamieson (Department of Neurology, Leeds General Infirmary),
- Rebecca Naylor (York University),
- Andrew Turner (York University), and
- Stephen Smith (York University)

for "A New Evolutionary Algorithm-Based Home Monitoring Device for Parkinson's Dyskinesia" Journal of Medical Systems (2017) [1]

Second prize: the Silver award, $3 000, went to

- Stephen Kelly (PhD student at Dalhousie University, Canada) and Malcolm I. Heywood (Dalhousie University)

for "Emergent Solutions to High-Dimensional Multi-Task Reinforcement Learning" Evolutionary Computation (2018) [2].

Finally the judges decided to split the third prize, the Bronze award, evenly between two finalists ($1,000 each):

- Emma Hart (Napier University, Edinburgh, UK)
- Kevin Sim (Napier University),
- Barry Gardiner (INRA, Bordeaux, France) and
- Kana Kamimura (Shinshu University, Japan)

for "A Hybrid Method for Feature Construction and Selection to Improve Wind-damage Prediction in the Forestry Sector" (GECCO 2017) [3]

- Milan Ceska (Brno University of Technology, Czech Republic),
- Jiri Matyas (PhD student at Brno University of Technology),
- Vojtech Mrazek (PhD student at Brno University of Technology),
- Lukas Sekanina (Brno University of Technology),
- Zdenek Vasicek (Brno University of Technology), and
- Tomas Vojnar (Brno University of Technology)

for "Approximating Complex Arithmetic Circuits with Formal Error Guarantees: 32-bit Multipliers Accomplished" Proceedings of International Conference On Computer Aided Design (ICCAD 2017) [4].

Details of all the Humie entries can be found on http://www.human-competitive.org/awards

3.1 Winner

Parkinson's Dyskinesia is an incurable severe form of Parkinson's disease where the patient suffers from involuntary jerking movements and muscle spasms (dyskinesia). However it can be treated with drugs, e.g. Levodopa. Lones et al. [1] were awarded first prize for the invention of a home based monitoring device that allows dyskinesia to be measured as a patient goes about their daily routine (Figure 2). The degree of shaking helps doctors to recommend drug dosage. The patented monitor uses a predictive model which was trained using Cartesian Genetic Programming [6]. It has been approved for European clinical use and is already in routine use internationally (three large UK Hos- pitals, Leeds, Harrogate and Scarborough) and one in China (Ruijin Hospital, Shanghai).
To paraphrase the winning entry, they showed the successful application of evolutionary computing (CGP) to resolve a challenging and life-affecting clinical condition (i.e. Parkinson's dyskinesia). They have published a health economic assessment [7] which shown that not only will the introduction of the technology
significantly improve the quality of life but also has the potential to save the UK's National Health Service over £84m per year.

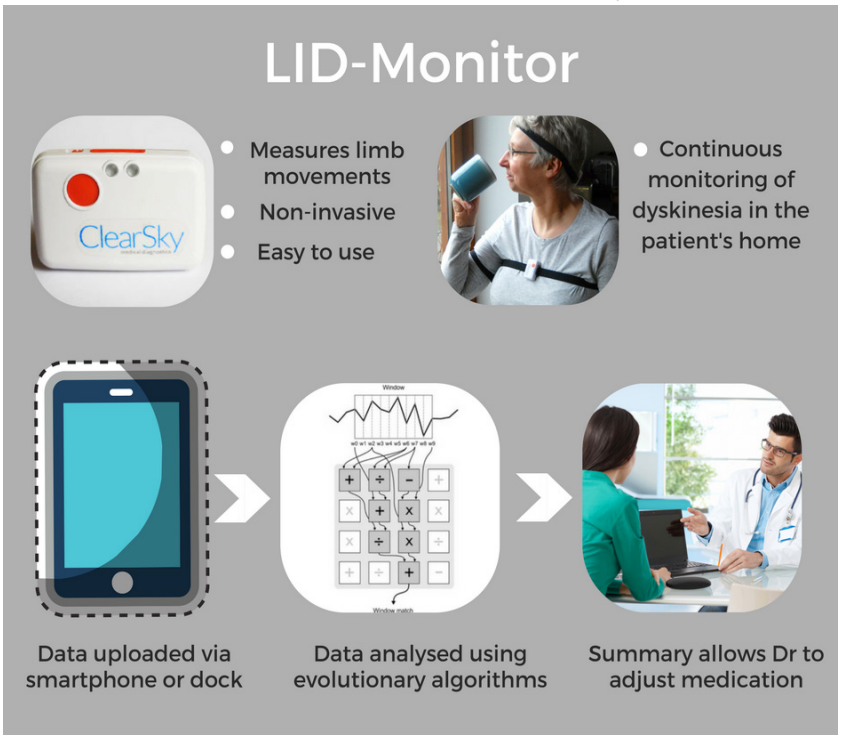


Figure 2: Schematic of ClearSky's Parkinson's Disease system which won the Gold Humie at GECCO-2018. Monitoring Levodopa–induced dyskinesia (LID) gives the patient's doctor information about the severity and frequency of pa- tient shaking (dyskinesia) events and so allows them to better adjust the dosage of Levodopa. Top left: the mobile monitor and logging system. These are worn at home by Parkinson's patient (Top Right). Bottom Centre: the logged data are analysed by an algorithm evolved using Cartesian Genetic Programming and the results are presented to the patient's doctor (Bottom Right).

3.2 Runner up

Google's successfully application of Deep Learning on highly parallel hardware (GPUs) to games, particularly GO, is well known. More recently they have have success with applying it to play computer based video games using only the visual cues available to human players (i.e. the pixels on the screen). A particular benchmark is the Atari 2600 suite of games [8].
To paraphrase Kelly and Heywood, they applied Genetic Programming [9] and were able to match the quality of deep learning but their evolved model was at least three orders of magnitude smaller allowing real time performance without specialized hardware support. This means the evolved solutions execute on a laptop computer faster than any form of solution employing Deep Learning.

3.3 Bronze Prize: Storm Damage to Forests

Storms can cause severe damage to trees. For example, in 2009, a storm lead to losses of ≈1.8 10^9 euros to forests in south-west France. Genetic Programming [9] gave much better models of storm damage, giving better predictions of the causes leading to damage and so leading to improved forest management [10].

3.4 Bronze Prize: Evolving an Approximate 32-bit multiplier

Many very clever people have worked on digital electronic circuits to do arith- metic for many years. In just a few hours, using Cartesian Genetic Program-ming [6], Milan Ceska et al. were able to evolve arithmetic circuits (e.g. for addition or multiplication) which trade-off circuit size versus accuracy in a principled way, with formal guarantees on the maximum permitted error.

4 Next year

The 16th Humie awards will be held next year together with GECCO in Prague, the capital of the Czech Republic, 13-17 July 2019. Do not forget to enter the competition http://www.human-competitive.org

References

[1] Michael A. Lones, Jane E. Alty, Jeremy Cosgrove, Philippa Duggan-Carter, Stuart Jamieson, Rebecca F. Naylor, Andrew J. Turner, and Stephen L. Smith. A new evolutionary algorithm-based home monitoring device for Parkinson's Dyskinesia. Journal of Medical Systems, 41(11):176, November 2017.
[2] Stephen Kelly and Malcolm I. Heywood. Emergent solutions to high-dimensional multi-task reinforcement learning. Evolutionary Computation, 26(3), Fall 2018. In press.
[3] Emma Hart, Kevin Sim, Barry Gardiner, and Kana Kamimura. A hybrid method for feature construction and selection to improve wind-damage prediction in the forestry sector. In Proceedings of the Genetic and Evoutionary Computation Conference, GECCO '17, pages 1121–1128, Berlin, Germany, 15-19 July 2017. ACM.

[4] Milan Ceska, Jiri Matyas, Vojtech Mrazek, Lukas Sekanina, Zdenek Vasicek, and Tomas Vojnar. Approximating complex arithmetic circuits with formal error guarantees: 32-bit multipliers accomplished. In Iris Bahar and Sri Parameswaran, editors, Proceedings of 36th IEEE/ACM International Conference On Computer Aided Design (ICCAD), pages 416–423, Irvine, CA, USA, November 13-16 2017. Institute of Electrical and Electronics Engineers.
[5] John R. Koza. Human-competitive results produced by genetic program- ming. Genetic Programming and Evolvable Machines, 11(3/4):251–284, September 2010. Tenth Anniversary Issue: Progress in Genetic Program- ming and Evolvable Machines.
[6] Julian Miller and Andrew Turner. Cartesian genetic programming. In Anabela Simoes, editor, GECCO 2015 Introductory Tutorials, pages 179– 198, Madrid, Spain, 11-15 July 2015. ACM.
[7] A. Filby, L. Lewis, M. Taylor, S. L. Smith, P. W. Dettmar, S. D. Jamieson, and J. E. Alty. PMD80 - cost effectiveness analysis of a device to monitor Levodopa-induced Dyskinesia in Parkinson's patients. Value in Health, 18(7):A358, November 2015.
[8] Volodymyr Mnih, Koray Kavukcuoglu, David Silver, Andrei A. Rusu, Joel Veness, Marc G. Bellemare, Alex Graves, Martin Riedmiller, Andreas K. Fidjeland, Georg Ostrovski, Stig Petersen, Charles Beattie, Amir Sadik, Ioannis Antonoglou, Helen King, Dharshan Kumaran, Daan Wierstra, Shane Legg, and Demis Hassabis. Human-level control through deep rein- forcement learning. Nature, 518(529–533):26 Feb, 2015.
[9] John R. Koza. Genetic Programming: On the Programming of Computers by Natural Selection. MIT press, 1992.
[10] Emma Hart and Barry Gardiner. Storm damage to forests costs billions: here's how artificial intelligence can help. The Conversation, page 1.33pm BST, April 23 2018.

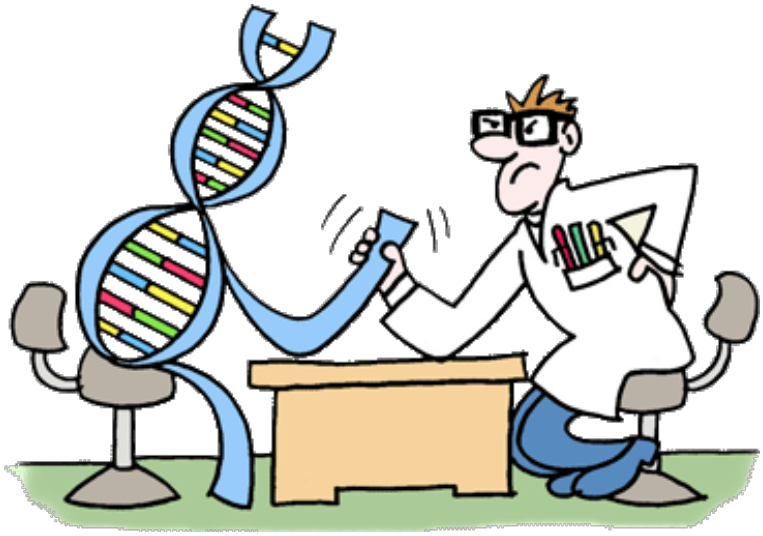


Figure 3: The Humies logo shows evolutionary computation, in the shape of an artificial intelligence double spiral DNA, arm wrestling a human expert (shown as a white coated "boffin"). The goal of the "Humies" Awards is to show case human competitive results, produced by genetic or evolutionary computation

Genetic Improvement Events in 2018

Genetic improvement uses optimisation and machine learning techniques, particularly heuristic search and evolutionary algorithms, to improve existing software. The main application is automatic bug fixing, where reducing or eliminating buggy behaviour improves a program. Other applications involve automatically producing a better program that runs faster, uses less memory, uses less energy, or runs on a different type of computer.

This article summarise two international events exclusively devoted to this topic in 2018.

Dagstuhl: Seminar on Genetic Improvement of Software

By **Benjamin Danglot**

The Dagstuhl Seminar on Genetic Improvement of Software (Dagstuhl Seminar 18052), was held on January 20th – February 2nd, 2018. The event attracted researchers from various software engineering areas related to this topic in order to identify what can currently be achieved, and what are the limitations that should be addressed by future research. The seminar alternated 12 talks and 7 breakout group discussions. The formal talks ranged from automatic software repair to automatic parallelization of programs.

Participants of Dagstuhl Seminar 18052

Wolfgang Banzhaf showed a Java bug repair technique, based on "knowledge-enhanced" operators. **Bobby R. Bruce** presented his preliminary result on automatically parallelization of programs. **Myra B. Cohen** discussed the dynamic, evolving aspects of GI systems, which she called "Organic Programs". I presented my own work, a tool using GI on Java test suites. **Nicolas Harrand** explained the "plastic code regions", code portions that can be modified without changing the behavior of the program. **Michael Prade**l presented DeepBugs, a machine learning tool for detecting bugs. Joseph Renzullo talked about epistasis, i.e. interactions between multiple edits in programs, with a brilliant suggestion to use methods from biology. Approximate computing aims to improve a system by relaxing its requirements, **Lukas Sekanina** proposed to use GI in this domain. Marija Selakovic exposed two profiling approaches to fix performance issues in JavaScript programs. **Shin Hwei Tan** presented a new crash repair tool for Android applications based on specific transformation operators according to an empirical study of crashes and their root causes. Datasets are always required in research to elaborate and reproduce experiments, **Christopher Timperley** showed BugZoo, an open-source platform to study historical software bugs. Finally **Sergi Valverde** gave a philosophical talk on the "Major Transitions in Information Technology"

Formal presentations were inspiring and informative, but the discussions and breakout sessions were the most fruitful aspects of the seminar. Some examples of intensely discussed ideas and topics are the following:

- Pseudo neutrality, that is, program variants that exhibit the same functionality and yet a slight different behavior represent a challenge for GI.
- DevOps, as a suitable framework to apply GI.
- Benchmarks and corpus, what is required by GI experiments and how to build adequate benchmarks?
- Mechanisms for maintaining diversity in GI systems
- Energy consumption is a real GI challenge particularly in electric circuits and mobile applications.
- The fitness function is a key component in GI systems. How can we improve it?

More importantly, participants planned future work and collaboration around the various topics discussed. The seminar produced also a list of references, tools and datasets for further research.

About the author

Benjamin Danglot is a PhD student at Inria Lille. His research topics include test suite amplification for DevOps and chaos engineering. His is part of the Horizon 2020 European project called STAMP: Software Testing AMPlification.

Genetic Improvement Workshop at ICSE 2018

By **Gabin An**

In Gothenburg, on 2nd June 2018, the fourth edition of Genetic Improvement (GI) Workshop was co-located with this year's ICSE (International Conference on Software Engineering), the biggest and probably the most prestigious software engineering conference. Dr. **Claire Le Goues** gave a keynote speech, and eight authors presented their long and short papers, covering various and interesting topics in GI such as topological landscape analysis, Turing test for GI, and Learning to Synthesis techniques.

In the early morning, Dr. **Justyna Petke**, one of the co-organisers, opened the workshop, and Dr. **Le Goues** followed it up with the keynote entitled "Evolving Software Quality." In the talk, she surveyed the research advances that have recently made significant progress in the field and subsequently highlighted the ongoing research opportunities as well as the challenges of measuring and assuring the quality of automatically and constantly evolving artifacts.

The next session began with **Joseph Renzullo**'s presentation of the paper "Neutrality and Epistasis in Program Space". They translated biological concepts such as Neutrality and Epitasis to computational context. They characterized the topology of the neutral space of programs with respect to fitness metric and also studied interactions between independent single-edits, known as epistasis. Up next, Alexander Wild described an approach towards the use of GI to bring about fully emergent software, which can adapt itself to its environment, without the need for designer's involvement. Finally, Jeremy Lacomis proposed a Turing Test for GI, where a GI system competes with a human to generate human-like patches.

After the lunch, **Bill Langdon** opened the third session. I, as a speaker, introduced the new lightweight GI framework, PyGGI, and also showed the results of a comparison study between Line and Statement granularity levels for software repair. **Brendan Cody-Kenny** presented a mutation-based approach for highlighting where performance improvements are likely to exist. The results showed that mutation-based analysis can be more accurate than profiling even though it is more expensive to perform. The last presenter of the session was **Nicolas Harrand**: he talked about the DevOps, which aims at unifying software development (Dev) and software operations (Ops), an environment which is ripe for the adoption and deployment of GI techniques.

In the last session, **Bo Wang** proposed Learning to Synthesis (L2S), a general framework to address program estimation, which is a sub-problem of program synthesis. The experiments showed that L2S can predict patches that are outside the search space of ACS, a state-of-the-art condition synthesis system. Next, **Jason Landsborough** showed that an application of fuzz testing could greatly enhance the effectiveness of GI algorithms because of the ability to generate high quality and high coverage tests.

After the workshop, the speakers were invited to Cafe du Nord for the best Swedish meatballs (allegedly!). By audiences' voting, the best presentation award was given to **Joseph Renzullo** and the best paper award to **Christopher McGowan et al.** for their paper "Experiments in Genetic Divergence for Emergent Systems".

The workshop was filled with plentiful topics on GI. We saw that many techniques can be adapted to improve GI performance, and also, those GI techniques can be adapted to a wide range of software development environments.

About the author

Gabin An is currently a master student in the Computational Intelligence for Software Engineering laboratory (COINSE) at KAIST, Republic of Korea

Forthcoming Conferences

GI 2019
Co-located with the 41th International Conference on Software Engineering, Montreal, Canada, 25-31 May 2019

Paper Submission Deadline: 1 February 2019

Call for Submissions

We invite submissions that discuss recent developments in all areas of research on, and applications of, Genetic Improvement.

GI is the premier workshop in the field and provides an opportunity for researchers interested in automated program repair and software optimisation to disseminate their work, exchange ideas and discover new research directions.

Topics of interest include both the theory and practice of Genetic Improvement. Applications include, but are not limited to, using GI to:

- repair bugs
- improve efficiency
- decrease memory consumption
- decrease energy consumption
- transplant new functionality
- specialise software
- translate between programming languages
- generate multiple versions of software

Research & Position Papers

We invite submissions of two types of paper:

- Research papers (limit eight pages)
- Position papers (limit two pages)

We encourage authors to submit early and in-progress work. The workshop emphasises interaction and discussion.

All papers should be submitted via EasyChair double-blind as PDFs (in the ACM conference format as per the ICSE 2019 information).

All accepted papers must be presented at GI-2019 and will appear in the ICSE workshops volume. The official publication date of the workshop proceedings is the date the proceedings are made available by IEEE. This date may be up to two weeks prior to the first day of ICSE 2019.

Workshop Chairs

Justyna Petke j.petke@ucl.ac.uk
Shin Hwei Tan tansh3@sustc.edu.cn
Bill Langdon w.langdon@cs.ucl.ac.uk
Westley Weimer weimerw@umich.edu

Web pages: **Bobby R. Bruce**

Key Dates

Submission: 1 February 2019
Notification: 1 March 2019
Camera-ready: 15 March 2019
Workshop: 25-31 June 2019

Genetic Improvement 2019

6th International Workshop on the Repair and Optimisation of Software using Computational Search
25-31 May 2019

geneticimprovementofsoftware.com

Evostar 2019

The Leading European Event on Bio-Inspired Computation. Leipzig, Germany.
24-26 April 2019.

http://www.evostar.org/2019/

Important Dates
- Submission Deadline: November 1st 2018
- Notification: January 7th 2019
- Conference: 24-26 April 2019

Organizers

EuroGP programme chairs:
- **Lukas Sekanina**, Brno University of Technology, Czech Republic
- **Ting Hu**, Memorial University, Canada

EvoApps coordinator
- **Paul Kaufmann**, Mainz University, Germany

EvoCOP Programme Chairs
- **Arnaud Liefooghe**, University of Lille, France
- **Luís Paquete**, University of Coimbra, Portugal

EvoMUSART Conference chairs
- **Anikó Ekart**, Aston University, UK
- **Antonios Liapis**, Institute of Digital Games, University of Malta

CEC 2019

The IEEE Congress on Evolutionary Computation. Wellington, New Zealand.
10-13 June 2019

http://cec2019.org/

The annual IEEE Congress on Evolutionary Computation (IEEE CEC) covers all topics in evolutionary computation from theory to real-world applications. CEC is organized by the IEEE Computational Intelligence Society in cooperation with the Evolutionary Programming Society.

Important Dates
- Paper submission: 7 January, 2019
- Decision notification: 7 March, 2019
- Camera ready paper due: 31 March, 2019
- Registration: 31 March, 2019
- Conference: 10 June, 2019
- Note: all deadlines are 11:59pm US pacific time

Organizers
- **Mengjie Zhang**, University of Wellington, New Zeland (General Co-Chair)
- **Kay Chen Tan** City University of Hong Kong, Hong Kong (General Co-Chair)
- **Carlos A. Coello Coello,**CINVESTAV-IPN, Mexico (Program Co-Chair)

GECCO 2019

The Genetic and Evolutionary Computation Conference. Prague, Czech Republic.
13-17 July 2019.

https://gecco-2019.sigevo.org/

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.

Important Dates

- Abstract Deadline: January 30, 2019
- Submission of Full Papers: February 6, 2019
- Submission of Poster-only papers: February 6, 2019
- Notification: March 20, 2019
- Conference: July 13-17, 2019

Organizers

- **Thomas Stützle**, Université Libre de Bruxelles, Belgium (General Chair)
- **Anne Auger, Inria Saclay** - Île-de-France (General Chair)
- **Manuel López-Ibáñez**, University of Manchester, UK (Editor-in-Chief)
- **Petr Pošík**, Czech Technical University, Czech Republic (Local Chair)

FOGA XV

The 15th ACM/SIGEVO Workshop on Foundations of Genetic Algorithms.
Potsdam, Germany. 26-29 August 2019.

http://www.hpi.de/foga2019

The FOGA workshop series aims at advancing our understanding of the working principles behind evolutionary algorithms and related randomized search heuristics, such as local search algorithms, differential evolution, ant colony optimization, particle swarm optimization, artificial immune systems, simulated annealing, and other Monte Carlo methods for search and optimization. Connections to related areas, such as Bayesian optimization and direct search, are of interest as well. FOGA is the premier event to discuss advances on the theoretical foundations of these algorithms, tools needed to analyze them, and different aspects of comparing algorithms' performance.

Important Dates (all dates AoE)

- Deadline for paper submission: April 17, 2019 (non-extensible)
- Author rebuttal phase: May 21-23, 2019 Notification of authors: June 5, 2019
- Conference: 26-29 August 2019

Organizers

- **Tobias Friedrich**, Hasso Plattner Institute, Potsdam, Germany (General Chair)
- **Carola Doerr**, CNRS and Sorbonne University, Paris, France (Program co-Chair)
- **Dirk Arnold**, Dalhousie University, Halifax, Nova Scotia, Canada (Program co-Chair)

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

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