10th Genetic Improvement Workshop (GI 2021 @ ICSE)

Chairs' Welcome

It is our great pleasure to welcome you to the tenth international Genetic Improvement workshop, GI-2021, to take place at ICSE-2020 on 30 May 2021. As with last year, GI @ ICSE 2021 is an entirely online virtual event being held on the Internet due to the COVID-19 pandemic. Genetic Improvement uses automated search to find improved versions of existing software. Be it for automatically repairing programs or optimizing existing source, byte, assembler or machine code to improve its results or operation, such as running faster or using less resources (e.g. energy). Since 2015, the GI workshop has been held annually as part of the Genetic and Evolutionary Computation Conference (GECCO). We are very pleased that the workshop will also be held at the International Conference on Software Engineering for the fourth time. It's first edition at ICSE 2018 in Göteborg Sweden (and 4th workshop edition overall), showed that there is great interest in genetic improvement in the software engineering community. Since starting to hold the GI workshop at ICSE, the workshop has also been run several times at GECCO (2018 Kyoto, Japan, 2019 Prague, Czech Republic and 2020 Cancún, Mexico). Indeed last year (2020) a special session on Genetic Improvement was held at the Congress on Evolutionary Computation, CEC 2020, as part of the IEEE World Congress on Computational Intelligence (WCCI 2020) in Glasgow, Scotland. Although all three 2020 conferences were hit by the pandemic and actually held online. In addition several GI tutorials have been given at conferences, such as at PPSN 2020 and ASE 2020 and another is planned for GECCO 2021 later this summer. In the winter of 2018 a week long Genetic Improvement of Software seminar was held at Dagsthul in Germany. Finally there have been three 2 day CREST Open Workshops on Genetic Improvement. They are archived http://crest.cs.ucl.ac.uk/cow/past_events/

The GI workshops continue to bring together researchers from across the world to exchange ideas about using optimisation techniques, particularly evolutionary computation such as genetic programming, to improve existing software. We invited short two page position papers to encourage the discussion of new ideas and recent work in addition to longer and more concrete research submissions. The call for participation invited GI work on improving efficiency; decreasing memory consumption; reducing energy consumption; transplanting new functionality; specialising software; translating between programming languages; generating multiple versions of software and repairing bugs. As you will see, half the papers are position papers proposing new ideas and half are full length research papers. Most of the submissions came from the USA or the UK but there were also submissions from Chile and Brazil.

Putting together GI-2021 was a team effort. Firstly we thank the authors for providing the content of the program. We would like to thank Professor Stephanie Forrest head of ASU's Biodesign Institute for her keynote talk. We are grateful to the program committee who worked very hard in reviewing papers and providing great feedback for authors. Finally, we thank our sponsors: The Engineering and Physical Sciences Research Council (EPSRC).

We hope that you will find these papers thought provoking, and that the workshop will provide you with an opportunity to share ideas with people across the globe. We hope that you will notice many areas of software engineering that are not yet covered. Our primary aim remains to encourage you to participate. Go one step beyond being a better programmer, get the AI to program for you!

Sincerely,
Bill, Justyna, Bobby, Yu, Aymeric, and Wes
March 2021

Invited Keynote GI 2021

Genetic Improvement Keynote Speaker

Professor Stephanie Forrest (Arizona State University) gave the keynote speech at GI@ICSE 2021.

Prof. Stephanie Forrest gained her PhD in Michigan University as a student of John Holland. She holds numerous awards including: NSF Presidential Young Investigator Award (considered to be one of the highest honors granted by the National Science Foundation), The IFIP TC2 Manfred Paul Award for Excellence in Software: Theory and Practice for her 2009 ICSE paper "Automatically Finding Patches Using Genetic Programming" and in 2011 the ACM/AAAI Allen Newell Award. Her works includes the theoretical underpinnings of Genetic Algorithms (such as fitness landscapes), Computer Security, particularly applying AI in the form of Artificial Immune Systems (AIS) and Genetic Improvement, particularly applying Genetic Programming to automatic bug fixing and software repair (APR).

Since returning to New Mexico from Ann Arbor she worked in Industry and Los Alamos and the University of New Mexico where she rose to become the head of the Computer Science Department. She is also a long time member of the world famous Santa Fe Institute and has served a term as its Vice President. From 2013 to 2014 she was a Jefferson Science Fellow advising the USA Department of State and continues to chair the Computing Research Association's Government Affairs Committee. More recently Prof. Forrest has joined Arizona State University to direct the Biodesign Center for Biocomputation, Security and Society in the School of Computing, Informatics and Decision Sciences Engineering (CIDSE). The new centre continues her studies of the biology of computation and the computation of biology, including work on computational immunology, computer security, automated software repair, evolutionary computation, and biological modeling.

It is rare for anyone to found a new scientific field and yet Prof. Forrest has founded both artificial immune systems (AIS) and Automated Program Repair (APR) !

Organising Committee for the 10th Genetic Improvement Workshop (GI 2021 @ ICSE)
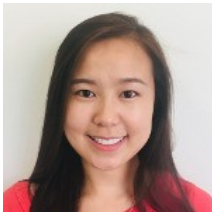
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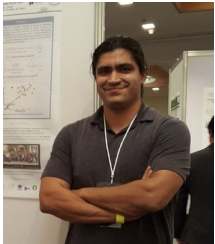

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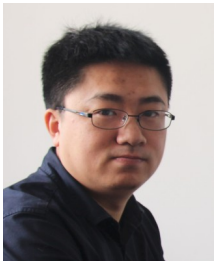[Christopher Timperley](#)

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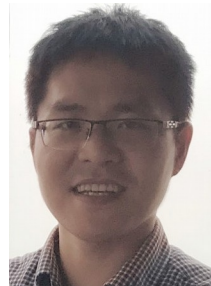InstitutoTecnológico de Tijuana

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