

# **2021 IEEE/ACM International Workshop on Genetic Improvement (GI 2021)**

**Virtual Conference  
22 – 30 May 2021**



**IEEE Catalog Number: CFP21Q22-POD  
ISBN: 978-1-6654-4467-5**

**Copyright © 2021 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP21Q22-POD
ISBN (Print-On-Demand):	978-1-6654-4467-5
ISBN (Online):	978-1-6654-4466-8

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# 2021 IEEE/ACM International Workshop on Genetic Improvement (GI) **GI 2021**

## Table of Contents

Message from the Chairs .vii	.....
Organizing Committee .viii	.....
Program Committee .ix	.....
Keynote .x	.....

## 2021 IEEE/ACM International Workshop on Genetic Improvement

Uniform Edit Selection for Genetic Improvement: Empirical Analysis of Mutation Operator Efficacy .1	.....
<i>Marta Smigielska (University College London, United Kingdom), Aymeric Blot (University College London, United Kingdom), and Justyna Petke (University College London, United Kingdom)</i>	
Optimising SQL Queries Using Genetic Improvement .9	.....
<i>James Callan (University College London, United Kingdom) and Justyna Petke (University College London, United Kingdom)</i>	
Exploring the Accuracy - Energy Trade-off in Machine Learning .11	.....
<i>Alexander E.I. Brownlee (University of Stirling, UK), Jason Adair (University of Stirling, UK), Saemundur O. Haraldsson (University of Stirling, UK), and John Jabbo (University of Stirling, UK)</i>	
Partial Specifications for Program Repair .19	.....
<i>Linsey Kitt (Iowa State University, USA) and Myra B. Cohen (Iowa State University, USA)</i>	
Applying Automated Program Repair to Dataflow Programming Languages .21	.....
<i>Yu Huang (University of Michigan), Hammad Ahmad (University of Michigan), Stephanie Forrest (Arizona State University), and Westley Weimer (University of Michigan)</i>	
CRNRepair: Automated Program Repair of Chemical Reaction Networks .23	.....
<i>Ibrahim Mesecan (Iowa State University, USA), Michael C. Gerten (Iowa State University, USA), James I. Lathrop (Iowa State University, USA), Myra B. Cohen (Iowa State University, USA), and Tomas Haddad Caldas (Pontifical Catholic University of Rio Grande do Sul, Brazil)</i>	
Using Genetic Improvement to Retarget Quantum Software on Differing Hardware .31	.....
<i>George O'Brien (University of Sheffield, UK) and John A. Clark (University of Sheffield, UK)</i>	

(Genetically) Improving Novelty in Procedural Story Generation .39.....  
*Erik M. Fredericks (Grand Valley State University, USA) and Byron DeVries (Grand Valley State University, USA)*

A Permutation Representation of Covering Arrays .41.....  
*Ryan E. Dougherty (United States Military Academy, USA) and Xi Jiang (Colgate University, USA)*

Open Challenges in Genetic Improvement for Emergent Software Systems .43.....  
*Penelope Faulkner Rainford (Lancaster University, UK) and Barry Porter (Lancaster University, UK)*

Generating Object-Oriented Source Code Using Genetic Programming .45.....  
*Vicente Illanes (Universidad of Chile) and Alexandre Bergel (Universidad of Chile)*

**Author Index 51** .....