Genetic Improvement of Software: a Comprehensive Survey

Supplemental Material: Core Papers on Genetic Improvement

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TABLE I: Core papers on genetic improvement.

No.	Ref.	Title	Year	Venue	Authors	Improvement Criterion	Search	Representation	Fitness	Modified Language	Type
1	[2]	A Genetic Programming Approach to Automated Software Repair	2009	GECCO	Forrest et al.	repair	GP	tree	test cases	C	Empirical study
2	[99]	A Novel Co-evolutionary Approach to Automatic Software Bug Fixing	2008	CEC	Arcuri and Yao	repair	GP	tree	test cases	Java	Empirical study
3	[3]	A Systematic Study of Automated Program Repair: Fixing 55 out of 105 Bugs for $8 Each	2012	ICSE	Le Goues et al.	repair	GP	tree-based edits	test cases	C	Empirical study
4	[163]	Applying Genetic Improvement to MiniSAT	2013	SSBSE	Petke et al.	runtime	GP	line-level edits	test cases	C++	Empirical study
5	[193]	Automated Design of Algorithms and Genetic Improvement: Contrast and Commonalities	2015	GI	Haraldsson and Woodward	-	-	-	-	-	Position paper
6	[156]	Automated Program Repair through the Evolution of Assembly Code	2010	ASE	Schulte et al.	repair	GP	sequence of assembly code	test cases	C; Haskell; Java	Empirical study
7	[157]	Automated Repair of Binary and Assembly Programs for Cooperating Embedded Devices	2013	ASPLOS	Schulte et al.	repair	GP	sequence of assembly code and ELF binary instructions	test cases	C; C++	Empirical study
8	[1]	Automated Software Transplantation	2015	ISSTA	Barr et al.	new functionality	GP	variable mapping; list of statements	test cases	C	Empirical study
9	[133]	Automated Transplantation of Call Graph and Layout Features into Kate	2015	SSBSE	Marginean et al.	new functionality	GP	variable mapping; list of statements	test cases	C	Empirical study
10	[96]	Automatic Conversion of Programs from Serial to Parallel Using Genetic Programming - The Paragen System	1995	ParCo	Walsh and Ryan	parallelisation	GP	tree-based edits	test cases	Fortran	Empirical study
11	[142]	Automatic Parallelization of Arbitrary Programs	1999	EuroGP	Ryan and Ivan	parallelisation	GP	sequence of transformations	test cases with data dependency analysis	Fortran	Empirical study
12	[134]	Automatic Program Repair Using Genetic Programming	2013	TR	Le Goues	repair	GP	tree	test cases	C	PhD thesis
13	[127]	Automatic Software Generation and Improvement through Search Based Techniques	2009	TR	Arcuri	runtime; repair	GP	tree	test cases; minimisation wrt. original; multi-objective	Java	PhD thesis
14	[5]	Automatically Finding Patches Using Genetic Programming	2009	ICSE	Weimer et al.	repair	GP	tree	test cases	C	Empirical study
15	[7]	Babel Pidgin: SBSE Can Grow and Graft Entirely New Functionality into a Real World System	2014	SSBSE	Harman et al.	new functionality	GP	variable mapping; list of statements	test cases with human-provided constraints	C	Empirical study
16	[136]	Coevolutionary Automated Software Correction	2010	GECCO	Wilkerson and Tauritz	repair	GP	tree	test cases	C++	Empirical study
17	[94]	Current challenges in automatic software repair	2013	SQJ	Le Goues et al.	-	-	-	-	-	Overview
18	[162]	Deep Parameter Optimisation	2015	GECCO	Fan et al.	runtime; memory consumption	GP	integer vector	test cases	C	Empirical study
19	[131]	Designing Better Fitness Functions for Automated Program Repair	2010	GECCO	Fast et al.	repair	GP	tree	test cases	C	Empirical study
20	[132]	Efficient Automated Program Repair through Fault-Recorded Testing Prioritization	2013	ICSM	Qi et al.	repair	random	tree-based edit	test cases	C	Empirical study
21	[185]	Embedded Dynamic Improvement	2015	GI	Burles et al.	-	-	-	-	-	Position paper
22	[184]	Embedding Adaptivity in Software Systems using the ECSELR framework	2015	GI	Yeboah-Antwi and Baudry	slimming	GP	bytecode blocks	test cases	Java	Empirical study

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No.	Ref.	Title	Year	Venue	Authors	Improvement Criterion	Search	Representation	Fitness	Modified Language	Type
23	[172]	Energy Optimisation via Genetic Improvement: A SBSE technique for a new era in Software Development	2015	GI	Bruce	-	-	-	-	-	Position paper
24	[100]	Evolutionary Improvement of Programs	2011	TEVC	White et al.	runtime	GP	tree	test cases; multi-objective	C	Empirical study
25	[154]	Evolutionary Repair of Faulty Software	2011	ASOC	Arcuri	repair	GP; HC; random	tree	test cases with tree minimisation wrt. the original	Java	Empirical study
26	[180]	Evolving a CUDA Kernel from an nVidia Template	2010	CEC	Langdon and Harman	parallelisation	GP	tree	test cases	C++; CUDA	Empirical study
27	[160]	Evolving Patches for Software Repair	2011	GECCO	Ackling et al.	repair	GP; random	tree edit sequence	test cases and minimisation wrt. the original	Python	Empirical study
28	[176]	Fitness as Task-relevant Information Accumulation	2015	GI	Johnson and Woodward	-	-	-	-	-	Position paper
29	[186]	Genetic Improvement for Adaptive Software Engineering	2014	SEAMS	Harman et al.	-	-	-	-	-	Keynote
30	[177]	Genetic Improvement for Software Product Lines: An Overview and a Roadmap	2015	GI	Lopez-Herrejon et al.	-	-	-	-	-	Position paper
31	[171]	Genetic Improvement of Energy Usage is only as Reliable as the Measurements are Accurate	2015	GI	Haraldsson and Woodward	-	-	-	-	-	Position paper
32	[166]	Genetic Improvement of Programs	2014	SYNASC	Langdon	-	-	-	-	-	Overview
33	[167]	Genetic Improvement of Software for Multiple Objectives	2015	SSBSE	Langdon	-	-	-	-	-	Overview
34	[179]	Genetic Improvement Using Higher Order Mutation	2015	GI	Jia et al.	-	-	-	-	-	Position paper
35	[128]	Genetic Programming for Low-Resource Systems	2009	TR	White	runtime; energy consumption	GP	tree	test cases; multi-objective	C	PhD thesis
36	[139]	Genetic Programming for Reverse Engineering	2013	WCRE	Harman et al.	-	-	-	-	-	Overview
37	[129]	Genetic Programming for Shader Simplification	2011	TOG	Sitthi-amorn et al.	runtime	GP	tree	test cases	HLSL; Cg	Empirical study
38	[164]	Genetically Improved CUDA C++ Software	2014	EuroGP	Langdon and Harman	runtime	GP	line-level edits	test cases	CUDA	Empirical study
39	[147]	GenProg: A Generic Method for Automatic Software Repair	2012	TSE	Le Goues et al.	repair	GP	tree-based edits	test cases	C	Empirical study
40	[175]	GI4GI: Improving Genetic Improvement Fitness Functions	2015	GI	Harman and Petke	-	-	-	-	-	Position paper
41	[130]	Grow and Graft a Better CUDA pknotsRG for RNA Pseudoknot Free Energy Calculation	2015	GI	Langdon and Harman	parallelisation	GP	line-level edits	test cases	CUDA	Empirical study
42	[141]	Grow and Serve: Growing Django Citation Services Using SBSE	2015	SSBSE	Jia et al.	new functionality	GP	variable mapping; list of statements	test cases with human-provided constraints	Python	Empirical study
43	[168]	Improving 3D Medical Image Registration CUDA Software with Genetic Programming	2014	GECCO	Langdon et al.	runtime	GP	line-level edits	test cases	CUDA	Empirical study
44	[169]	Improving CUDA DNA Analysis Software with Genetic Programming	2015	GECCO	Langdon et al.	runtime	GP	line-level edits	test cases	C	Empirical study
45	[182]	locoGP: Improving Performance by Genetic Programming Java Source Code	2015	GI	Brendan Cody-Kenny et al.	runtime	GP	tree	test cases	Java	Empirical study

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46	[159]	Multi-Objective Coevolutionary Automated Software Correction	2012	GECCO	Wilkerson et al.	repair	GP	tree	test cases; multi-objective	C++	Empirical study
47	[155]	Multi-objective Improvement of Software Using Co-evolution and Smart Seeding	2008	SEAL	Arcuri et al.	runtime	GP	tree	test cases	Java	Empirical study
48	[158]	Neutral Networks of Real-World Programs and Their Application to Automated Software Evolution	2014	TR	Schulte	repair; energy consumption	GP	tree edits; assembly code; ELF instructions	test cases	C; C++	PhD thesis
49	[135]	On Search Based Software Evolution	2009	SSBSE	Arcuri	-	-	-	-	-	Overview
50	[146]	On the Automation of Fixing Software Bugs	2008	ICSE	Arcuri	-	-	-	-	-	Overview
51	[181]	Optimizing Existing Software With Genetic Programming	2015	TEVC	Langdon and Harman	runtime	GP	line-level edits	test cases	C	Empirical study
52	[115]	Paragen: A Novel Technique for the Autoparallelisation of Sequential Programs Using GP	1996	GP	Walsh and Ryan	parallelisation	GP	tree-based edits	test cases	Fortran	Empirical study
53	[170]	Performance of Genetic Programming Optimised Bowtie2 on Genome Comparison and Analytic Testing (GCAT) Benchmarks	2015	BDM	Langdon	-	-	-	-	-	Empirical study
54	[173]	Post-Compiler Software Optimization for Reducing Energy	2014	ASPLOS	Schulte et al.	energy consumption	GP	sequence of assembly code instructions	test cases	C; C++	Empirical study
55	[174]	Reducing Energy Consumption Using Genetic Improvement	2015	GECCO	Bruce et al.	energy consumption	GP	line-level edits	test cases	C++	Empirical study
56	[178]	Removing the Kitchen Sink from Software	2015	GI	Landsborough et al.	slimming	GP	sequence of binary instructions	test cases	C	Empirical study
57	[145]	Repairing COTS Router Firmware without Access to Source Code or Test Suites: A Case Study in Evolutionary Software Repair	2015	GI	Schulte	repair	GP	sequence of ELF binary instructions	test cases	unknown	Empirical study
58	[148]	Representations and Operators for Improving Evolutionary Software Repair	2012	GECCO	Le Goues et al.	repair	GP	tree-based edits	test cases	C	Empirical study
59	[138]	Rethinking Genetic Improvement Programming	2015	GI	White and Singer	-	-	-	-	-	Position paper
60	[126]	Software is Not Fragile	2015	CS-DC	Langdon and Petke	runtime	GP	single line-level edit	test cases	C; C++; CUDA	Empirical study
61	[165]	The Emergence of Useful Bias in Self-focusing Genetic Programming for Software Optimisation	2013	SSBSE	Cody-Kenny and Barrett	runtime	GP	tree	test cases	Java	Empirical study
62	[143]	The Evolution of Provable Parallel Programs	1997	GP	Ryan and Walsh	parallelisation	GP	sequence of transformations	test cases with data dependency analysis	Fortran	Empirical study
63	[101]	The GISMOE Challenge: Constructing the Pareto Program Surface Using Genetic Programming to Find Better Programs	2012	ASE	Harman et al.	-	-	-	-	-	Keynote
64	[153]	The Strength of Random Search on Automated Program Repair	2014	ICSE	Qi et al.	repair	random	tree-based edit	test cases	C	Empirical study
65	[149]	Using Execution Paths to Evolve Software Patches	2009	SBST	Nguyen et al.	repair	GP	tree	test cases	C	Empirical study
66	[4]	Using Genetic Improvement and Code Transplants to Specialise a C++ Program to a Problem Class	2014	EuroGP	Petke et al.	runtime; specialisation	GP	line-level edits	test based	C++	Empirical study