Claire Le Goues

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Research Interests and Approach

My research interests span software engineering and programming languages, and especially in how to construct, maintain, evolve, improve/debug, and assure high-quality software systems.

Appointments

Carnegie Mellon University ..... Pittsburgh, PA, USA

2013 – present	Assistant Professor School of Computer Science (SCS) Institute for Software Research (ISR)

Education

University of Virginia ..... Charlottesville, VA, USA

2013	**Doctor of Philosophy in Computer Science** Dissertation: Automatic Program Repair Using Genetic Programming Advisor: Westley Weimer
2009	**Master of Science in Computer Science** Thesis: Specification Mining With Few False Positives

Harvard University ..... Cambridge, MA, USA

2006	**Bachelor of Arts in Computer Science** Thesis: Algebraic Type Isomorphisms Advisor: Greg Morrisett

Industrial Employment

Microsoft Research ..... Redmond, WA, USA

2009	**Research Intern**, Research in Software Engineering (RiSE) group	

IBM ..... *(various)*

2006–2007	**Software Engineer**, XML Technologies/Compilation	Cambridge, MA, USA
2005	**Research Intern**, Collaborative User Experience (CUE)	Cambridge, MA, USA
2004	**Research Intern**, Architect's Workbench	Hawthorne, NY, USA

Honors, Awards, Fellowships

2015	Featured Article, IEEE Transactions on Software Engineering
2015	Distinguished Reviewer, Intl. Conference on Automated Software Engineering (ASE)
2013	Google Faculty Research Award
2012	Bronze, ACM SIGEVO "Humies" for Human-Competitive Results Produced by Genetic and Evolutionary Computation
2012	Featured Article, IEEE Transactions on Software Engineering
2009	Gold, ACM SIGEVO "Humies" for Human-Competitive Results Produced by Genetic and Evolutionary Computation
2009	IFIP TC2 Manfred Paul Award, Intl. Conference on Software Engineering
2009	Best Paper, Genetic and Evolutionary Computation Conference
2009	ACM Distinguished Paper, Intl. Conference on Software Engineering
2009	Best Short Paper, Workshop on Search-Based Software Testing
2009–2012	Graduate Research Fellow, National Science Foundation

Professional Service and Affiliations

Local Service at Carnegie Mellon University

Co-Director, REUSE@CMU 2016–present
Director, Undergraduate Minor in Software Engineering 2014–present
Member, SE Faculty Hiring Committee 2015–2016
Member, SE PhD Graduate Admissions Committee 2013–present

International Service

Organization

2017	Graduate Track Program Chair, Symposium on Search Based Software Engineering (SSBSE)
2016	Review Process Chair, Automated Software Engineering (ASE)
2015	Local Arrangements Chair, Systems, Programming, Languages and Applications: Software for Humanity (SPLASH)
2014–present	Steering Commitee Member, Symposium on Search Based Software Engineering (SSBSE)
2014	PC Co-chair, Symposium on Search Based Software Engineering (SSBSE)

Program Committee Membership

	2017
ICSE	Intl. Conference on Software Engineering
	2016
ICSE	Intl. Conference on Software Engineering
ISSTA	Intl. Symposium on Software Testing and Analysis
MSR	Working Conference on Mining Software Repositories
SSBSE	Intl. Symposium on Search-Based Software Engineering
GECCO-GI	GECCO Workshop on Genetic Improvement
	2015
ASE	IEEE/ACM Intl. Conference on Automated Software Engineering
Onward!	Onward! Essays
SSBSE	Intl. Symposium on Search-Based Software Engineering
ICST/Tools	Tools Track, Intl. Conference on Software Testing
ICSME/Tools	Tools Track, Intl. Conference on Software Maintenance and Evolution
ICSME	Intl. Conference on Software Maintenance and Evolution
NasBASE	North American Conference on Search-Based Software Engineering
ICSE/Tools	Tools Track, Intl. Conference on Software Engineering
ICSE NIER	New Ideas and Emerging Results, Intl. Conference on Software Engineering
GECCO-GI	GECCO Workshop on Genetic Improvement
	2014
ICSME	Intl. Conference on Software Maintenance and Evolution
ICSE NIER	New Ideas and Emerging Results, Intl. Conference on Software Engineering

Refereeing and Reviewing

	2016
ACM TSE	IEEE Transactions on Software Engineering
	2015
ACM TOSEM	ACM Transactions on Software Engineering and Methodology
JSEP	Journal of Software: Evolution and Process
ACM TSE	IEEE Transactions on Software Engineering
Computing	Journal of Computing
	2014
IEEE SW	IEEE Software
JSS	Journal of Systems and Software
JSEP	Journal of Software: Evolution and Process
TOSEM	Transactions on Software Engineering and Methodology

Research Funding

Listed amounts denote the CMU portion of multi-institutional awards.

SHF: Small: Evolution of Self-adaptive Systems using Stochastic Search
NSF: The National Science Foundation
Duration: July 1, 2016–June 30, 2020
With: David Garlan (CMU)
Amount: $499,948

SHF: Medium: Collaborative Research: Semi and fully automated program repair and synthesis via semantic code search
NSF: The National Science Foundation
Duration: July 1, 2016–June 30, 2020
With: Yuriy Brun (UMass-Amherst)
Kathryn Stolee (NCSU)
Amount: $411,996

CMU REU Site in Interdisciplinary Software Engineering
NSF: The National Science Foundation
Duration: 1/16–12/18
With: Joshua Sunshine (CMU)
Amount: $360,000

Intelligent Model-Based Adaptation for Mobile Robotics
DARPA: The Defense Advanced Research Projects Agency
Duration: 11/15 – 9/19
With: Jonathan Aldrich (CMU)
Joydeep Biswass (UMass-Amherst)
David Garlan (CMU)
Christian Kaestner (CMU)
Manuela Velosa (CMU)
Amount: $7,996,519

Cooperative, Trusted Repair for Cyber Physical System Resiliency
AFRL: Air Force Research Lab
Duration: 01/15–09/17
With: Stephanie Forrest (UNM)
Miryung Kim (UCLA)
Westley Weimer (UVA)
Amount: $215,972

Demonstrating the Feasibility of Automatic Program Repair Guided by Semantic Code Search
NSF: National Science Foundation
Duration: 07/14–06/16
With: Yuriy Brun (UMass-Amherst)
Kathryn Stolee (Iowa State)
Amount: $95,932

Human-friendly automatic bug repair via source code and repository mining
Google: Faculty Research Award
Duration: 01/14–01/15
With: *Sole PI*
Amount: $81,924

Publications

Books and chapters

[B2] Claire Le Goues and Shin Yoo, eds. *Search-Based Software Engineering - 6th International Symposium, SSBSE 2014, Fortaleza, Brazil, August 26-29, 2014. Proceedings*. Vol. 8636. Lecture Notes in Computer Science. Springer, 2014. ISBN: 978-3-319-09939-2. DOI: 10.1007/978-3-319-09940-8.

[B1] Claire Le Goues, Anh Nguyen-Tuong, Hao Chen, Jack W. Davidson, Stephanie Forrest, Jason Hiser, John C. Knight, and Matthew Van Gundy. "Moving Target Defenses in the Helix Self-Regenerative Architecture". In: *Moving Target Defense II - Application of Game Theory and Adversarial Modeling*. Ed. by Sushil Jajodia, Anup K. Ghosh, V. S. Subrahmanian, Vipin Swarup, Cliff Wang, and Xiaoyang Sean Wang. Vol. 100. Advances in Information Security. Springer, 2013, pp. 117–149. ISBN: 978-1-4614-5415-1. DOI: 10.1007/978-1-4614-5416-8_7.

Refereed Journal Articles

[J5] Claire Le Goues, Neal Holtschulte, Edward K. Smith, Yuriy Brun, Premkumar Devanbu, Stephanie Forrest, and Westley Weimer. "The ManyBugs and IntroClass Benchmarks for Automated Repair of C Programs". In: *IEEE Transactions on Software Engineering (TSE), in press, 22 pages* (2015). ISSN: 0098-5589. DOI: 10.1109/TSE.2015.2454513.

[J4] Claire Le Goues, Stephanie Forrest, and Westley Weimer. "Current challenges in automatic software repair". In: *Software Quality Journal* 21.3 (2013), pp. 421–443. DOI: 10.1007/s11219-013-9208-0.

[J3] Claire Le Goues, ThanhVu Nguyen, Stephanie Forrest, and Westley Weimer. "GenProg: A Generic Method for Automatic Software Repair". In: *IEEE Trans. Software Eng.* 38.1 (2012), pp. 54–72. DOI: 10.1109/TSE.2011.104.

[J2] Claire Le Goues and Westley Weimer. "Measuring Code Quality to Improve Specification Mining". In: *IEEE Trans. Software Eng.* 38.1 (2012), pp. 175–190. DOI: 10.1109/TSE.2011.5.

[J1] Westley Weimer, Stephanie Forrest, Claire Le Goues, and ThanhVu Nguyen. "Automatic program repair with evolutionary computation". In: *Communications of the ACM Research Highlight* 53.5 (May 2010), pp. 109–116.

Refereed Conference Publications

[C17] Tien-Duy B. Le, David Lo, Claire Le Goues, and Lars Grunske. "A Learning-to-rank Based Fault Localization Approach Using Likely Invariants". In: *Proceedings of the 25th International Symposium on Software Testing and Analysis*. ISSTA 2016. Saarbrucken, Germany: ACM, 2016, pp. 177–188. ISBN: 978-1-4503-4390-9. DOI: 10.1145/2931037.2931049. URL: http://doi.acm.org/10.1145/2931037.2931049.

[C16] Y. Tian, D. Wijedasa, D. Lo, and C. Le Goues. "Learning to rank for bug report assignee recommendation". In: *2016 IEEE 24th International Conference on Program Comprehension (ICPC)*. 2016, pp. 1–10. DOI: 10.1109/ICPC.2016.7503715.

[C15] R. van Tonder and C. Le Goues. "Defending against the attack of the micro-clones". In: *IEEE 24th International Conference on Program Comprehension (ICPC)*. 2016, pp. 1–4. DOI: 10.1109/ICPC.2016.7503736.

[C14] Mary Beth Kery, Claire Le Goues, and Brad A. Myers. "Examining Programmer Practices for Locally Handling Exceptions". In: *Proceedings of the 13th International Conference on Mining Software Repositories*. MSR '16. Austin, Texas: ACM, 2016, pp. 484–487. ISBN: 978-1-4503-4186-8. DOI: 10.1145/2901739.2903497. URL: http://doi.acm.org/10.1145/2901739.2903497.

[C13] Mauricio Soto, Ferdian Thung, Chu-Pan Wong, Claire Le Goues, and David Lo. "A Deeper Look into Bug Fixes: Patterns, Replacements, Deletions, and Additions". In: *Proceedings of the 13th International Conference on Mining Software Repositories*. MSR '16. Austin, Texas: ACM, 2016, pp. 512–515. ISBN: 978-1-4503-4186-8. DOI: 10.1145/2901739.2903495. URL: http://doi.acm.org/10.1145/2901739.2903495.

[C12] X. B. D. Le, D. Lo, and C. Le Goues. "History Driven Program Repair". In: *IEEE 23rd International Conference on Software Analysis, Evolution, and Reengineering (SANER)*. Vol. 1. 2016, pp. 213–224. DOI: 10.1109/SANER.2016.76.

[C11] Zack Coker, Michael Maass, Tianyuan Ding, Claire Le Goues, and Joshua Sunshine. "Evaluating the Flexibility of the Java Sandbox". In: *Annual Computer Security Applications Conference (ACSAC)*. 2015.

[C10] Yalin Ke, Kathryn T. Stolee, Claire Le Goues, and Yuriy Brun. "Repairing Programs with Semantic Code Search". In: *Proceedings of the 30th IEEE/ACM International Conference on Automated Software Engineering (ASE)*. (ASE). Lincoln, NE, USA, 13, 9, pp. 295–306. DOI: 10.1109/ASE.2015.60.

[C9] Edward K. Smith, Earl Barr, Claire Le Goues, and Yuriy Brun. "Is the Cure Worse than the Disease? Overfitting in Automated Program Repair". In: *Proceedings of the 10th Joint Meeting of the European Software Engineering Conference and ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE)*. (ESEC/FSE). Bergamo, Italy, 4, 2, pp. 532–543. DOI: 10.1145/2786805.2786825.

[C8] Zack Coker, David Garlan, and Claire Le Goues. "SASS: Self-Adaptation Using Stochastic Search". In: *10th IEEE/ACM International Symposium on Software Engineering for Adaptive and Self-Managing Systems, SEAMS 2015, Florence, Italy, May 18-19, 2015*. Ed. by Paola Inverardi and Bradley R. Schmerl. IEEE, 2015, pp. 168–174. ISBN: 978-0-7695-5567-6. DOI: 10.1109/SEAMS.2015.16.

[C7] Claire Le Goues, Stephanie Forrest, and Westley Weimer. "Representations and Operators for Improving Evolutionary Software Repair". In: *Genetic and Evoluationary Computation Conference*. 2012, pp. 959–966.

[C6] Claire Le Goues, Michael Dewey-Vogt, Stephanie Forrest, and Westley Weimer. "A Systematic Study of Automated Program Repair: Fixing 55 out of 105 bugs for $8 Each". In: *International Conference on Software Engineering*. 2012, pp. 3–13.

[C5] Claire Le Goues, K. Rustan M. Leino, and Michal Moskal. "The Boogie Verification Debugger (Tool Paper)". In: *Software Engineering and Formal Methods - 9th International Conference, SEFM 2011, Montevideo, Uruguay, November 14-18, 2011. Proceedings*. Ed. by Gilles Barthe, Alberto Pardo, and Gerardo Schneider. Vol. 7041. Lecture Notes in Computer Science. Springer, 2011, pp. 407–414. ISBN: 978-3-642-24689-0. DOI: 10.1007/978-3-642-24690-6_28.

[C4] Ethan Fast, Claire Le Goues, Stephanie Forrest, and Westley Weimer. "Designing better fitness functions for automated program repair". In: *Genetic and Evolutionary Computation Conference*. 2010, pp. 965–972.

[C3] Stephanie Forrest, Westley Weimer, ThanhVu Nguyen, and Claire Le Goues. "A genetic programming approach to automated software repair". In: *Genetic and Evolutionary Computation Conference*. 2009, pp. 947–954. ISBN: 978-1-60558-325-9.

[C2] Westley Weimer, ThanhVu Nguyen, Claire Le Goues, and Stephanie Forrest. "Automatically Finding Patches Using Genetic Programming". In: *International Conference on Software Engineering*. 2009, pp. 364–367.

[C1] Claire Le Goues and Westley Weimer. "Specification Mining with Few False Positives." In: *Tools and Algorithms for the Construction and Analysis of Systems*. 2009, pp. 292–306. ISBN: 978-3-642-00767-5.

Refereed Workshop Publications

[W2] Claire Le Goues, Stephanie Forrest, and Westley Weimer. "The case for software evolution". In: *Proceedings of the Workshop on Future of Software Engineering Research, FoSER 2010, at the 18th ACM SIGSOFT International Symposium on Foundations of Software Engineering, 2010, Santa Fe, NM, USA, November 7-11, 2010*. Ed. by Gruia-Catalin Roman and Kevin J. Sullivan. ACM, 2010, pp. 205–210. ISBN: 978-1-4503-0427-6. DOI: 10.1145/1882362.1882406.

[W1] ThanhVu Nguyen, Westley Weimer, Claire Le Goues, and Stephanie Forrest. "Using Execution Paths to Evolve Software Patches". In: *Second International Conference on Software Testing Verification and Validation, ICST 2009, Denver, Colorado, USA, April 1-4, 2009, Workshops Proceedings*. IEEE Computer Society, 2009, pp. 152–153. ISBN: 978-0-7695-3671-2. DOI: 10.1109/ICSTW.2009.35.

Invited Tutorials

[T1] Stephanie Forrest and Claire Le Goues. "Evolutionary software repair". In: *Genetic and Evolutionary Computation Conference, GECCO '12, Philadelphia, PA, USA, July 7-11, 2012, Companion Material Proceedings*. Ed. by Terence Soule and Jason H. Moore. ACM, 2012, pp. 1345–1348. ISBN: 978-1-4503-1178-6. DOI: 10.1145/2330784.2330943.

Invited Panels and Presentations

Panel: 30 years of ASE
–30th IEEE/ACM International Conference on Automated Software Engineering (ASE)
Moderated by Lars Grunske

Automatic Program Repair Using Genetic Programming
–University of Massachusetts, Amherst, *Amherst, MA*, Jan 2014
–Virginia Polytechnic Institute and State University (Virginia Tech), *Blacksburgh, VA*, Sep 2012

Bloat vs. overfitting in test-driven GP for program repair
–28th Crest Open Workshop, Genetic Programming for Software Engineering
University College London, *London, UK*, Oct 2013

Question your assumptions: the bleeding edge of search-based program repair
–Lille 1 University/INRIA Lille Norde-Europe, *Lille, France*, Oct 2013

Specification Mining with few false positives
–King's College London, Nov 2009

Student Supervision

PhD Advisor
All PhD students advised at Carnegie Mellon University.

current Deborah Katz, Ph.D. in Computer Science, entered 2012
Zack Coker, Ph.D. in Computer Science, entered 2013
Mauricio Soto, Ph.D. in Software Engineering, entered 2014
Afsoon Afzal, Ph.D. in Software Engineering, entered 2015

Teaching Activities

Instructor of Record	*Carnegie Mellon University*	
15-313	Foundations of Software Engineering (undergraduate)	Fall 2016
17-808	Software Engeering Research (Ph.D.)	Fall 2016
15-819O	Special Topics in Programming Languages: Program Analysis (Ph.D)	Spring 2016
15-313	Foundations of Software Engineering (undergraduate)	Fall 2015
17-808	Software Engeering Research (Ph.D.)	Fall 2015
17-654	Analysis of Software Engineering (Masters)	Spring 2015
15-313	Foundations of Software Engineering (undergraduate)	Fall 2014
17-808	Software Engeering Research (Ph.D.)	Fall 2014
17-654	Analysis of Software Engineering (Masters)	Spring 2014
17-808	Software Engeering Research (Ph.D.)	Fall 2013
	University of Virginia	
CS444/6444	High Performance and Parallel Computation (undergraduate/graduate)	Spring 2013
Principle Teaching Assistant	*University of Virginia*	
CS210	Software Development Methods (undergraduate)	Spring 2008
CS410	Programming Languages (undergraduate)	Spring 2008
CS210	Software Development Methods	Fall 2007

Software and Software Artifacts

Linked project pages list project collaborators.

SearchRepair: A semantic-search-based automated program repair technique.
`https://github.com/ProgramRepair/SearchRepair`
ManyBugs and IntroClass: benchmarks for research in automated repair of C programs.
`http://repairbenchmarks.cs.umass.edu`

GenProg: framework for search-and evolutionary-computation-based repair of C programs.
`http://genprog.cs.virginia.edu`
Boogie Verification Debugger (BVD): tool to assist in debugging failed program verification activities.
`http://boogie.codeplex.com/`

Professional Associations

ACM	Association for Computing Machinery
ACM SIGSOFT	ACM Special Interest Group on Software Engineering
IEEE	The Institute of Electrical and Electronics Engineers
IEEE Women	IEEE Women in Engineering