Sebastian Elbaum

Professor
Computer Science Department
University of Virginia
Charlottesville, VA 22903

Email: selbaum@virginia.edu
Web: cs.virginia.edu/~se4ja
Phone: 434-243-5213

Professional Preparation

Ph.D. in Computer Science, University of Idaho, 1999.

M.S. in Computer Science, University of Idaho, 1997.

Systems Engineer, Universidad Catolica de Cordoba, Argentina, 1995.

Appointments

2018 - Present: Professor, Computer Science, University of Virginia.

2018 - 2023: Anita Jones Faculty Fellow, Computer Science, University of Virginia.

2015: Co-founder of Drone Amplified, Inc.

2015 - 2018: Charles Bessey Professor, Department of CSE, University of Nebraska - Lincoln.

2010 - 2018: Professor, Department of CSE, University of Nebraska - Lincoln.

2013: Research Scientist, Google, Mountain View, California, USA. (Sabbatical from UNL).

2005 - 2010: Associate Professor, Department of CSE, University of Nebraska - Lincoln.

2007: Visiting Researcher, Italian National Research Council, Pisa, Italy (sabbatical from UNL).

2006: Academic Fellow, University College London, London, UK. (Sabbatical from UNL).

1999 - 2005: Assistant Professor, Department of CSE, University of Nebraska - Lincoln.

1996 - 1999: Research and Teaching Assistant, Department of CS, University of Idaho.

1993 - 1995: Programmer at Mercado de Valores de Cordoba, Coca Cola, and Estancias del Sur.

Honors and Awards

1. ACM Fellow, class of 2023.

2. IEEE Fellow, class of 2020.

3. Anita Jones Professorship at the University of Virginia, 2018-2023.

4. Distinguished Artifact Award, International Symposium of Software Testing and Analysis, 2020.

5. Distinguished Reviewer, International Conference in Software Engineering, 2020.

6. Test of Time Award, Internation Symposium of the Foundations of Software Engineering, 2018.

7. Best Paper Award, International Conference on Intelligent Robots and Systems, 2018.

8. Best Demo Award, International Symposium of Software Testing and Analysis, 2017.

9. Distinguished Paper Award, International Conference in Software Engineering, 2016.

10. ACM Distinguished Scientist, 2016.

11. Charles Bessey Endowed Professorship, University of Nebraska, 2015.

12. Second Prize, Blue Sky Ideas Visions Track, Foundations of Software Engineering, 2014.

13. Distinguished Paper Award, International Symposium in Software Testing and Analysis, 2013.

14. Distinguished Paper Award, International Conference in Software Engineering, 2012.

15. Google Faculty Research Award, 2012.

16. Best Paper Award, Empirical Software Engineering and Measurement Symposium, 2011.

17. Dean's Award for Excellence in Graduate Education, UNL Graduate Studies, 2009.

18. Distinguished Paper Award, International Conference in Software Engineering, 2008.

19. CSE Department Recognition Award for overall commitment and dedication to Department, 2009.

20. Student Choice Outstanding Teaching Award, CSE Department at UNL, 2004-05, 2005-06, and 2007-08.

21. Outstanding Educator Award, UNL Beta Theta PI, 2009.

22. Distinguished Visitor, Universidad Catolica de Cordoba, 2007.

23. Academic Fellowship, University College London, 2007.

24. Distinguished Paper Award, International Symposium on Foundations of Software Engineering, 2006.

25. IBM Eclipse Innovation Award, 2006.

26. National Science Foundation CAREER Award, 2004 - 2009.

27. Harold and Esther Edgerton Research and Teaching Award for Junior Faculty at UN, 2002 - 2004.

28. J. D. Edwards Honors Program Professorship, UNL, 1999 - 2006.

29. Layman Award, Junior Faculty Research Award at UNL, 2000.

30. Best Student Paper Award, USENIX Workshop on Intrusion Detection and Monitoring, 1999.

FUNDING AS PRINCIPAL OR CO-PRINCIPAL INVESTIGATOR

1. National Science Foundation, SHF: Medium: More Reliable Image Networks through Scene-based Specification, Neuro-symbolic Training, and Systematic Specification-driven Testing, $1,174,741, 2023-2027, PI.

2. National Science Foundation, Workshop on Software Engineering for Robotics, $62,000, 2023-2024, PI, co-chaired with Claire Le Guoues.

3. Air Force Office of Scientific Research, Automatically Inferring Human Machine Interaction Properties and Predicting and Adapting to their Violation, $1,125,000, 2021-2024, PI.

4. National Science Foundation , FMitF: Track I: FMitF: Track I: Focusing Incremental Abstraction-based Verification on Neural Networks Input Distributions, $510,000, 2020-2023, Co-PI.

5. DARPA Lockeed Martin - subcontractor, CertGATE: Certification from Generation of Automated Test Evidence UVA-portion $500,000, Co-PI.

6. National Science Foundation, Award: NRI: 1924777 INT: COLLAB: Raining Drones: Mid-Air Release & Recovery of Atmospheric Sensing Systems, UVA portion $403,543, 2019-2022, PI.

7. National Science Foundation, CCF-1900676, Rearchitecting Neural Networks for Verification, $1,250,000, 2019 - 2023, Co-PI.

8. National Science Foundation, Award: SHF-1909414 Small: Explicating and Exploiting the Physical Semantics of Code, $515,022, 2019-2022, Co-PI.

9. National Science Foundation, Award: CCF-1718040, Holistic Analysis: Integrating the Semantics of the World and the Code, 2017-2020, $484,694, PI.

10. National Science Foundation, Award: NRT-1735362, Training in Theory and Application of Cross-scale Resilience in Agriculturally Dominated Social Ecological Systems, 2017-2021, $2,998,886, Co-PI.

11. National Strategic Research Institute, Detection of Nuclear Threats using Deployable Sensors, 2017-2018, $484,266, Co-PI.

12. National Science Foundation, Award: NRI-1638099 , Enabling Unmanned Aerial Systems (UAS) Fire Ignitions in Complex Firefighting Contexts, 2016-2019, $1,003,270, PI.

13. National Science Foundation, Award: CCF-1526652, Testing in the Presence of Continuous Change, 2015-2018, $425,000, PI.

14. National Science Foundation, Award: 1526253, Systematically and Scalably Testing Network Programs through Symbolic Exploration of Packet Dynamics, 2015-2018, $499,800, Co-PI.

15. National Robotic Initiative, National Science Foundation and USDA, Co-Aerial-Ecologist: Robotic Water Sampling and Sensing in the Wild, 2013-2016, $956,210, Co-PI.

16. National Science Foundation, Award: 1218265, Searching for Code in Large Repositories with Lightweight Specifications, 2012-2015, $449,033, PI.

17. (Internal) UNL Office of Research and Economic Development, 2012-2013, $108,000. PI with Dr. Detweiler.

18. Air Force Office for Scientific Research, Award #FA9550-10-1-0406, Safeguarding End-User Military Software, 2010-2014, $3,955,000, Co-PI.

19. Air Force Office for Scientific Research, Award #FA9550-09-1-0687, Enhancing the Dependability of Complex Missions through Automated Analysis, 2009-2013, $600,000, PI.

20. National Science Foundation, Award: 0915526 , T2T: A Framework for Amplifying Testing Resources, 2009-2012, $492,000. PI.

21. National Aeronautics and Space Administration, Award: NNX08AV20A, Differential Symbolic Execution: Supporting Evolution of High-Assurance Software, 2008-2011, $750,000. Co-PI.

22. National Science Foundation, Award: 0720654, Predictable Adaptive Residual Monitoring for Real-time Embedded Systems, 2007-2011, $500,000. Co-PI.

23. Lockheed Martin, Integrated Software Quality, 2007, $60,000. Co-PI.

24. EPSRC, UK, Testing Techniques for Context-Aware Ubiquitous Systems, 2006, $87,270. Co-PI.

25. IBM, Eclipse Innovation Award, Carving and Replaying Differential Unit Test Cases, 2006, $22,000. PI.

26. National Science Foundation, Award: 0347518, CAREER: Leveraging Field Data to Test Highly-Configurable and Rapidly-Evolving Pervasive Systems, 2004 - 2009, $425,000. PI.

27. National Science Foundation, Award: 0454203, Computer and Network Systems and CRI Program, Collaborative Research : A Community Resource to Support Controlled Experimentation with Program Analysis and Software Testing Techniques, 2005-2009, $1,200,000. Co-PI.

28. National Science Foundation, Collaborative Research: Program Analysis Techniques to Support Dependable RTSJ Applications, 2004-2007, $210,000. Co-PI.

29. National Science Foundation, Award: 0411043, Building Scalable and Adaptive Garbage Collector for Server Systems, 2004-2007, $275,000. Co-PI.

30. National Science Foundation, Award: 0324861, ITR: Collaborative Research: Dependable End-User Software, 2003 - 2009, UNL Portion: $280,000. PI.

31. (Internal) Research Council Faculty Seed Grant, Dependable End-User Web Applications, 2003, $10,000. PI.

32. (Internal) University of Nebraska, Undergraduate Creative Activity and Research Experience (UCARE), 2001 - 2004, $6000. PI.

33. National Science Foundation, Award: 0080898, ITR: Collaborative Research: a New Generation of Scalable, Cost-Effective Regression Testing Techniques, 2000 - 2003, UNL portion: $240,000. PI.

34. NASA-EPSCoR, Extending the Software Black Box Recorder to a Distributed Environment, 2000 - 2001, $15,000. PI.

RESEARCH AND CREATIVE ACTIVITIES

Citations = 12443, h-index = 50; i10-index = 129 (Google Scholar, January 2024).

Refereed Journal Papers

J-1. Meriel von Stein, David Shriver and Sebastian Elbaum, DeepManeuver: Adversarial Test Generation for Trajectory Manipulation of Autonomous Vehicles, in IEEE Transactions on Software Engineering, doi: 10.1109/TSE.2023.3301443.

J-2. Minh Vu, Lisong Xu, Sebastian Elbaum, Wei Sun, and Kevin Qiao. Efficient Protocol Testing Under Temporal Uncertain Event Using Discrete-event Network Simulations. ACM Trans. Model. Comput. Simul. 32, 2, Article 13, 2022. https://doi.org/10.1145/3490028

J-3. John-Paul Ore, Carrick Detweiler, and Sebastian Elbaum, An Empirical Study on Physical Type Annotations: Accuracy, Speed, and Suggestion-Effectiveness, ACM Transactions in Software Engineering and Methodology, 30(2), 1-29, 2021.

J-4. Wei Sun, Lisong Xu, Sebastian Elbaum, D Zhao, Model-Agnostic and Efficient Exploration of Numerical Congestion Control State Space of Real-World TCP Implementations IEEE/ACM Transactions on Networking, 29(5), 1990-2004, 2021.

J-5. A. Shankar, S. Elbaum and C.Detweiler, Towards In-Flight Transfer of Payloads Between Multirotors, IEEE Robotics and Automation Letters, 6201-6208, 2020.

J-6. Siya Kunde, Sebastian Elbaum, Brittany A Duncan, Characterizing User Responses to Failures in Aerial Autonomous Systems, IEEE Robotics and Automation Letters, 1587-1594, 2020.

J-7. H. Jiang, S. Elbaum, and C. Detweiler, Inferring and monitoring invariants in robotic systems. Autonomous Robots 41(4): 1027-1046, 2017.

J-8. D. Twidwell, C. Allen, C. Detweiler, J. Higgins, C. Laney, and S. Elbaum, Smokey Comes of Age: Unmanned Aerial Systems for Fire Management, Frontiers in Ecology and the Environment, 14(6): 333-339, 2016.

J-9. K. Stolee, S. Elbaum, and M. Dwyer, Code search with input/output queries: Generalizing, ranking, and assessment. Journal of Systems and Software, Elsevier, 16():35-48, 2016.

J-10. J.P. Ore, S. Elbaum, A. Burgin, and C. Detweiler, Autonomous Aerial Water Sampling. Journal of Field Robotics 32(8): 1095-1113, 2015.

J-11. C. Detweiler, J.P. Ore, D. Anthony, S. Elbaum, A. Burgin, and A. Lorenz, ENVIRONMENTAL REVIEWS AND CASE STUDIES: Bringing Unmanned Aerial Systems Closer to the Environment. Journal Environmental Practice 17(3): 188-200, 2015.

J-12. P. Zhang and S. Elbaum, Amplifying Tests to Validate Exception Handling Code: an Extended Study. ACM Transactions Software Engineering Methodology, 23(4): 1-28, 2014.

J-13. K. Stolee, S. Elbaum, and D. Dobos, Solving the Search for Source Code. ACM Transactions Software Engineering Methodology 23(3): 26, 2014.

J-14. K. Stolee and S.Elbaum, Identification, Impact, and Refactoring of Smells in Pipe-like Web Mashups. IEEE Transactions Software Engineering 39(12): 1654-1679, 2013.

J-15. K. Stolee, S. Elbaum, and A. Sarma, Discovering How End-User Programmers and their Communities use Public Repositories. Information Software Technology Journal, 55(7): 1289-1303, 2013.

J-16. M. Fisher, S. Elbaum, and G. Rothermel, An Automated Analysis Methodology to Detect Inconsistencies in Web Services with WSDL Interfaces. Journal of Software Verification, Testing, and Reliability, 23(1): 27-51 2013.

J-17. C. Bartolini, A. Bertolino, S. Elbaum, and E. Marchetti, Bringing White-Box Testing to Service Oriented Architectures through a Service Oriented Approach. Journal of Systems and Software, 84(4): 655-668, 2011.

J-18. M. Diep, M. Dwyer, and S. Elbaum, Lattice-based Sampling for Path Property Monitoring. ACM Transactions of Software Engineering Methodologies, 21(1), May 2011.

J-19. M. Sama, S. Elbaum, F. Raimondi, D. Rosenblum and Z. Wang, Context-Aware Adaptive Applications: Fault Patterns and Their Automated Identification. IEEE Transactions on Software Engineering, 36(5):644-661, September/October 2010.

J-20. M. Sama, D. Rosenblum, Z. Wang, and S. Elbaum, Multi-Layer Faults in the Architectures of Mobile, Context-Aware Adaptive Applications. Journal of Systems and Software, 83(6):906-914, June 2010.

J-21. J. Ruthruff, S. Elbaum, and G.Rothermel, Experimental Program Analysis. Information Software Technology Journal, 52(4): 359-379, April 2010.

J-22. S. Elbaum, H. Chin, M. Dwyer, and M. Jorde, Carving and Replaying Differential Unit Test Cases from System Test Cases, IEEE Transactions on Software Engineering. 35(1):29-45, January 2009.

J-23. C. Scaffidi, A. Cypher, S. Elbaum, A. Koesnandar and B. Myers, Using Scenario-Based Requirements to Direct Research on Web Macro Tools. Journal of Visual Languages and Computing, Elsevier, 19(4):485-498, August 2008.

J-24. S. Elbaum, S. Kanduri, and A. Andrews, On the Potential of Anomalies as Precursors of Field Failures: An Empirical Study. Empirical Software Engineering Journal, 12(5):447-469, 2007.

J-25. K. Chilakamarri and S. Elbaum, Leveraging Disposable Instrumentation to Reduce Coverage Collection Overhead. Journal of Software Testing, Reliability, and Verification, 16(4):267-288, April 2006.

J-26. S. Elbaum and M. Diep, Profiling Deployed Software: Assessing Strategies and Testing Opportunities. IEEE Transactions on Software Engineering, 31(4):312-327, April 2005.

J-27. H. Do, S. Elbaum, and G. Rothermel, Controlled Experimentation with Software Testing Techniques: Infrastructure Support and its Potential Impact. Empirical Software Engineering Journal, 10(4):405-435, 2005.

J-28. S. Elbaum, G. Rothermel, S. Karre and M. Fisher, Leveraging User Session Data to Support Web Application Testing. IEEE Transactions of Software Engineering, 31(3):187-202, March 2005.

J-29. G. Rothermel, S. Elbaum, A. Malishevsky, and P. Kallakuri, On Test Suite Composition and Cost-Effective Regression Testing. ACM Transactions of Software Engineering and Methodologies, 13(3):277-331, July 2004.

J-30. S. Elbaum, G. Rothermel, S. Kanduri, and A. Malishevsky, Selecting a Cost-Effective Test Case Prioritization Technique. Software Quality Journal, 12(3):185-210, September 2004.

J-31. S. Elbaum, P. Kallakuri, A. Malishevsky, G. Rothermel, and S.Kanduri, Understanding the Effects of Changes on the Cost-Effectiveness of Regression Testing Techniques. Journal of Software Testing, Verification, and Reliability, 13(2):65-83, June 2003.

J-32. L. Zhao and S. Elbaum, Quality Assurance under the Open Source Development Model. Journal of Systems and Software, 66(1):65-75, April 2003.

J-33. W. Chen, R. Untch, G. Rothermel, S. Elbaum, and J. von Ronne, Can Fault-Exposure-Potential Estimates Improve the Fault Detection Abilities of Test Suites?. Journal of Software Testing, Verification, and Reliability, 4(2):197-218, December 2002.

J-34. S. Elbaum, A. Malishevsky, and G. Rothermel, Test Case Prioritization: A Family of Empirical Studies. IEEE Transactions on Software Engineering, 28(2):159-182, February 2002.

J-35. S. Elbaum and J. Munson, Evaluating Regression Test Suites Based on Their Fault Exposure Capability. Journal of Software Maintenance - Research and Practice, 12(3):171-184, 2000.

J-36. S. Elbaum and J. Munson, Software Evolution and the Code Fault Introduction Process. Empirical Software Engineering Journal, 4(3):241-262, 1999.

Rigorously Refereed Conference Papers

C-1. Soneya Hossain, Antonio Filieri, Matthew Dwyer, Sebastian Elbaum, Willem Visser. Neural-Based Test Oracle Generation: A Large-scale Evaluation and Lessons Learned. FSE. 120–132. 2023.

C-2. Sira Vegas and Sebastian Elbaum. Pitfalls in Experiments with DNN4SE: An Analysis of the State of the Practice. FSE. 528–540. 2023.

C-3. Felipe Toledo, David Shriver, Sebastian Elbaum, Matthew Dwyer. Deeper Notions of Correctness in Image-Based DNNs: Lifting Properties from Pixel to Entities. FSE-NIER. 2122-2126. 2023

C-4. Carl Hildebrandt, Meriel von Stein, Sebastian Elbaum. PhysCov: Physical Test Coverage for Autonomous Vehicles. ISSTA. 449-461. 2023.

C-5. Garrett Christian, Trey Woodlief, Sebastian Elbaum. Generating Realistic and Diverse Tests for LiDAR-Based Perception Systems. ICSE. 2604-2616. 2023.

C-6. Soneya Binta Hossain, Matthew Dwyer, Sebastian Elbaum, Anh Nguyen-Tuong. Measuring and mitigating gaps in structural testing. ICSE. 1712-1723. 2023.

C-7. Christopher Morse, Lu Feng, Matthew Dwyer, Sebastian Elbaum. A Framework for the Unsupervised Inference of Relations Between Sensed Object Spatial Distributions and Robot Behaviors. ICRA. 901-908. 2023.

C-8. Carl Hildebrandt, Wen Ying, Seongkook Heo, Sebastian Elbaum. Mimicking Real Forces on a Drone Through a Haptic Suit to Enable Cost-Effective Validation. ICRA. 10518-10524. 2023.

C-9. Meriel von Stein and Sebastian Elbaum. Finding Property Violations through Network Falsification: Challenges, Adaptations and Lessons Learned from OpenPilot. ASE. Industry Track. 1-5. 2022.

C-10. Trey Woodlief, Sebastian Elbaum, and Kevin Sullivan. Semantic image fuzzing of AI perception systems. ICSE, 1958–1969, 2022. https://doi.org/10.1145/3510003.3510212

C-11. Carl Hildebrandt, Meriel v. Stein, Trey Woodlief and Sebastian Elbaum, Preparing Software Engineers to Develop Robot Systems, ICSE-SEET, 205-216, 2022. doi: 10.1109/ICSE-SEET55299.2022.9794165.

C-12. Felipe Toledo, David Shriver, Sebastian Elbaum and Matthew Dwyer, Distribution Models for Falsification and Verification of DNNs, ASE, 317-329, 2021. doi: 10.1109/ASE51524.2021.9678590.

C-13. Chijung Jung, Ali Ahad, Jinho Jung, Sebastian Elbaum, and Yonghwi Kwon. Swarmbug: debugging configuration bugs in swarm robotics, ESEC/FSE, 868–880, 2021. https://doi.org/10.1145/3468264.3468601

C-14. Sayali Kate, Michael Chinn, Hongjun Choi, Xiangyu Zhang, and Sebastian Elbaum, PHYSFRAME: type checking physical frames of reference for robotic systems, ESEC/FSE, 45–56, 2021. https://doi.org/10.1145/34682

C-15. David Shriver, Sebastian Elbaum, Matthew B. Dwyer, DNNV: A Framework for Deep Neural Network Verification. CAV, 137-150, 2021.

C-16. Ajay Shankar, Sebastian Elbaum, Carrick Detweiler, Freyja: A Full Multirotor System for Agile & Precise Outdoor Flights, ICRA, 217-223, 2021.

C-17. Meriel von Stein, Sebastian Elbaum, Automated Environment Reduction for Debugging Robotic Systems. ICRA , 3985-3991, 2021.

C-18. Trey Woodlief, Sebastian Elbaum, Kevin Sullivan, Fuzzing Mobile Robot Environments for Fast Automated Crash Detection, ICRA, 5417-5423, 2021.

C-19. Carl Hildebrandt, Sebastian Elbaum, World-in-the-Loop Simulation for Autonomous Systems Validation, ICRA, 10912-10919, 2021.

C-20. David Shriver, Sebastian Elbaum, Matthew B. Dwyer, Reducing DNN Properties to Enable Falsification with Adversarial Attacks. ICSE, 275-287, 2021.

C-21. Yan Xiao, Ivan Beschastnikh, David S. Rosenblum, Changsheng Sun, Sebastian Elbaum, Yun Lin, Jin Song Dong, Self-Checking Deep Neural Networks in Deployment, ICSE, 372-384, 2021.

C-22. Felipe Toledo, David Shriver, Sebastian Elbaum, Matthew B. Dwyer, Distribution Models for Falsification and Verification of DNNs. ASE, 317-329, 2021.

C-23. Sayali Kate, Michael Chinn, Hongjun Choi, Xiangyu Zhang, Sebastian Elbaum, PHYSFRAME: type checking physical frames of reference for robotic systems, ESEC/SIGSOFT FSE, 45-56, 2021.

C-24. Chijung Jung, Ali Ahad, Jinho Jung, Sebastian Elbaum, Yonghwi Kwon, Swarmbug: debugging configuration bugs in swarm robotics, ESEC/SIGSOFT FSE, 868-880, 2021,

C-25. D. Xu, D. Shriver, M. Dwyer and S. Elbaum, Systematic Generation of Diverse Benchmarks for DNN Verification,International Conference on Computer Aided Verification, 97-121, 2020.

C-26. C. Hildebrandt, S. Elbaum, N. Bezzo and M. Dwyer,Feasible and stressful trajectory generation for mobile robots, ACM International Symposium of Software Testing and Analysis, 349-362, 2020. **Distinguished artifact award.**

C-27. A. Shankar, S. Elbaum and C.Detweiler, Dynamic Path Generation for Multirotor Aerial Docking in Forward Flight, IEEE Conference on Decision and Control, 1564-1571, 2020.

C-28. C. Hildebrandt, S. Elbaum and N. Bezzo, Blending kinematic and software models for tighter reachability analysis, ACM/IEEE International Conference on Software Engineering: New Ideas and Emerging Results, 33-36, 2020.

C-29. B. Balasubramaniam, H. Bagheri, S. Elbaum, and J. Bradley, Investigating Controller Evolution and Divergence through Mining and Mutation, ACM/IEEE International Conference on Cyber-Physical Systems, 151-161, 2020.

C-30. D. Shriver, S. Elbaum, M. Dwyer, and D. Rosenblum, Evaluating Recommender System Stability with Influence-Guided Fuzzing, AAAI Conference on Artificial Intelligence, 4934-4942, 2019.

C-31. M. Vu, L. Xu, S. Elbaum, W. Sun, and K. Qia, Efficient systematic testing of network protocols with temporal uncertain events, IEEE Conference on Computer Communications, 604-612, 2019.

C-32. W. Sun and L. Xu and S. Elbaum and D. Zhao, Model-Agnostic and Efficient Exploration of Numerical State Space of Real-World TCP Congestion Control Implementations, USENIX Symposium on Networked Systems Design and Implementation, 719-734, 2019.

C-33. S. Kate, J. Ore, X. Zhang, S. Elbaum, Z. Xu, Phys: probabilistic physical unit assignment and inconsistency detection, Foundations of Software Engineering, 563-573, 2018.

C-34. J. Ore, S. Elbaum, C. Detweiler, L. Karkazis, Assessing the type annotation burden, Automated Software Engineering, 190-201, 2018.

C-35. A. Shankar, S. Elbaum, and C. Detweiler, In-air Exchange of Small Payloads Between Multirotor Aerial Systems, International Symposium on Experimental Robotics, 2018

C-36. E. Beachly, C. Detweiler, S. Elbaum, B. Duncan, C. Hilderbrandt, D. Twidwell, and C. Allen, Fire-Aware Planning of Aerial Trajectories and Ignitions, IEEE/RSJ International Conference on Intelligent Robotics and Systems, 2018. **Best paper award.**

C-37. B. Duncan, E. Beachly, A. Bevins, S. Elbaum, and C. Detweiler, Investigation of Communicative Flight Paths for small Unmanned Aerial Systems, IEEE International Conference on Robotics and Automation (ICRA), 2018.

C-38. A. Shankar, S. Elbaum, and C. Detweiler, Towards Aerial Recovery of Parachute-Deployed Payloads, IEEE/RSJ International Conference on Intelligent Robotics and Systems, 2018.

C-39. W. Sun, L. Xu, and S. Elbaum, Limitations of Emulating Realistic Network Environments for Correctness Testing of Internet Applications, ICC, 1-6, 2018.

C-40. W. Sun, L. Xu, and S. Elbaum, Scalably Testing Congestion Control Algorithms of Real-World TCP Implementations, ICC, 1-7, 2018.

C-41. J. Liang, S. Elbaum, and G. Rothermel, Redefining Prioritization: Continuous Prioritization for Continuous Integration, International Conference in Software Engineering, 688-698, May 2018.

C-42. J. Ore, C. Detweiler, and S. Elbaum, Dimensional inconsistencies in code and ROS messages: A study of 5.9M lines of code, International Symposium on Experimental Robotics, 712-718, September 2017.

C-43. J. Ore, C. Detweiler, and S. Elbaum, Lightweight detection of physical unit inconsistencies without program annotations, International Symposium on Software Testing and Analysis, 341-351, July 2017.

C-44. N. Sharma, S. Elbaum, and C. Detweiler, Rate impact analysis in robotic systems, International Conference on Robotics and Automation, 2089-2096, June 2017.

C-45. W. Sun, L. Xu, and S. Elbaum, Improving the cost-effectiveness of symbolic testing techniques for transport protocol implementations under packet dynamics, International Symposium on Software Testing and Analysis, 79-89, July 2017.

C-46. D. Shriver, S. Elbaum, and K. Stolee, At the End of Synthesis: Narrowing Program Candidates, International Conference in Software Engineering, New Ideas and Emerging Technologies Results Track, 19-22, May 2017.

C-47. A. Taylor, S. Elbaum, and C. Detweiler, Co-Diagnosing Configuration Failures in Co-Robotic Systems, International Conference on Intelligent Robots and Systems, 2934-2939, September 2016.

C-48. E. Rizzi, S. Elbaum, and M. Dwyer, On the techniques we create, the tools we build, and their misalignments: a study of KLEE, International Conference in Software Engineering, 132-143, May 2016. **Distinguished paper award.**

C-49. E. Beachley, J. Higgins, C. Laney, S. Elbaum, C. Detweiler, C. Allen, and D. Twidwell, A micro-UAS to Start Prescribed Fires. ISER, 1-12, 2016.

C-50. W. Sun, L. Xu, S. Elbaum, SPD: Automatically Test Unmodified Network Programs with Symbolic Packet Dynamics, Globecom, 1-6, December 2015.

C-51. C. Sadowski, K. Stolee, and S. Elbaum, How developers search for code: a case study, Foundations of Software Engineering, 191-201, September 2015.

C-52. Matias Waterloo, Suzette Person, Sebastian G. Elbaum. Test Analysis: Searching for Faults in Tests, Automated Software Engineering Conference, New Ideas and Emerging Technologies Results Track, 149-154, November 2015.

C-53. S. Elbaum, G. Rothermel, and J. Penix. Techniques for improving regression testing in continuous integration development environments, Foundations of Software Engineering, 235-245, November 2014.

C-54. S. Elbaum and D. Rosenblum: Known unknowns: testing in the presence of uncertainty. Foundations of Software Engineering, Vision Track, 833-836, November 2014. **Second Prize.**

C-55. D. Anthony, S. Elbaum, A. Lorenz, and C. Detweiler: On crop height estimation with UAVs. International Conference on Intelligent Robots and Systems, 4805-4812, September 2014.

C-56. H. Seo, C. Sadowski, S. Elbaum, E. Aftandilian, and R. Bowdidge, Programmers' build errors: a case study (at google), International Conference on Software Engineering, 724-734, May 2014.

C-57. Y. Wang, S.Person, S. Elbaum, M. Dwyer: A framework to advise tests using tests. International Conference on Software Engineering, New Ideas and Emerging Technologies Results Track, 440-443, May 2014.

C-58. J. Ore, S. Elbaum, A. Burgin, B. Zhao, and C. Detweiler, Autonomous Aerial Water Sampling. International Conference of Field and Service Robotics, 137-151, December 2013.

C-59. H. Jiang, S. Elbaum, and C. Detweiler, Reducing failure rates of robotic systems though inferred invariants monitoring. International Conference on Intelligent Robots and Systems, 1899-1906, September 2013.

C-60. R. Purandare, M. Dwyer, and S. Elbaum, Optimizing monitoring of finite state properties through monitor compaction. International Symposium on Software Testing and Analysis, 280-290, July 2013. **Distinguished paper award.**

C-61. F. Zervoudakis, D. Rosenblum, S. Elbaum, and A. Finkelstein, Cascading verification: an integrated method for domain-specific model checking. Symposium on the Foundations of Software Engineering, 400-410, August 2013.

C-62. K. Stolee and S. Elbaum, Toward semantic search via SMT solver, Symposium on the Foundations of Software Engineering, New Ideas and Emerging Results Track, November 2012.

C-63. S. Anthony, W. Bennett, M. Vuran, M. Dwyer, S. Elbaum, A. Lacy, M. Engels, and W. Wehtje, Sensing through the continent: towards monitoring migratory birds using cellular sensor networks, International Conference on Information Processing in Sensor Networks, 329-340, April 2012.

C-64. P. Zhang, S. Elbaum and M. Dwyer, Compositional load test generation for software pipelines, International Symposium on Software Testing and Analysis, 89-99, July 2012.

C-65. C. Lucas, S. Elbaum, and D.Rosenblum, Detecting problematic message sequences and frequencies in distributed systems, Object Oriented Programming Systems, Languages, and Applications, 915-926, October 2012.

C-66. R. Purandare, J. Darsie, S. Elbaum, and M. Dwyer: Extracting conditional component dependence for distributed robotic systems, International Conference on Robotics and Systems, 1533-1540, October 2012.

C-67. P. Zhang and S. Elbaum, Amplifying tests to validate exception handling code, International Conference in Software Engineering, 595-605, May 2012. **Distinguished paper award.**

C-68. P. Zhang, S. Elbaum, and M. Dwyer, Automatic generation of load tests, Automated Software Engineering Conference, 43-52, November 2011.

C-69. K. Stolee, S. Elbaum, and A. Sarma, End-User Programmers and their Communities: An Artifact-based Analysis, Symposium of Empirical Software Engineering and Measurement, 147-156, September 2011. **Distinguished paper award.**

C-70. R. Purandare, M. Dwyer, and S. Elbaum, Monitoring Finite State Properties: Algorithmic Approaches and Their Relative Strengths, Run-time Verification Conference, 381-395, September 2011.

C-71. K. Stolee and S. Elbaum, Refactoring Pipe-like Mashups for End-User Programmers, International Conference on Software Engineering, 81-90, May 2011.

C-72. R. Purandare, M. Dwyer, and S. Elbaum, Monitor optimization via stutter-equivalent loop transformation, Conference on Object-Oriented Programming, Systems, Languages, and Applications, 270-285, October 2010.

C-73. K. Stolee, S. Elbaum, and G.Rothermel, Revealing the Copy and Paste Habits of End Users, Visual Languages and Human-Centric Computing, September 2009.

C-74. E. Sherman, M. Dwyer, and S. Elbaum, Saturation-based Testing of Concurrent Programs, European Software Engineering Conference and Symposium on the Foundations of Software Engineering, 53-62, August 2009.

C-75. C. Bartolini, A. Bertolino, S. Elbaum, and E. Marchetti, Whitening SOA Testing, European Software Engineering Conference and Symposium on the Foundations of Software Engineering, 161-170, August 2009.

C-76. M. Diep, S. Elbaum, and M. Dwyer, Trace Normalization, International Symposium of Software Reliability Engineering, 67-76, November 2008.

C-77. S. Person, M. Dwyer, S. Elbaum, and C. Pasareanu, Differential Symbolic Execution, International Symposium on Foundations of Software Engineering, 226-237, November 2008. **Test of Time award.**

C-78. M. Sama, D. Rosenblum, Z. Wang, and S. Elbaum, Model-Based Fault Detection in Context-Aware Adaptive Applications, 261-271, International Symposium on Foundations of Software Engineering, November 2008.

C-79. A. Koesnandar, S. Elbaum, G. Rothermel, L. Hochstein, K. Stolee, and C. Scaffidi, Using Assertions to Help End-User Programmers Create Dependable Web Macros, International Symposium on Foundations of Software Engineering, 124-134, November 2008.

C-80. M. Jorde, S. Elbaum, and M. Dwyer, Increasing Test Granularity by Aggregating Unit Tests, International Conference on Automated Software Engineering, 9-18, September 2008.

C-81. M. Dwyer, M. Diep, and S. Elbaum, Reducing the Cost of Path Property Monitoring by Sampling the Lattice of sub-Alphabet Properties, International Conference on Automated Software Engineering, 228-237, September 2008.

C-82. J. Ruthruff, J.Penix, J. Morgenthaler, S. Elbaum, and G. Rothermel, Predicting Accurate and Actionable Static Analysis Warnings: An Experimental Approach, International Conference on Software Engineering, 341-350, May 2008. **Distinguished paper award.**

C-83. M. Diep, S. Elbaum and M.B. Dwyer, Reducing Irrelevant Trace Variations, International Conference on Automated Software Engineering, 477-480, November 2007.

C-84. C. Scaffidi, A. Cypher, S. Elbaum, A. Koesnandar and B. Myers, Scenario-Based Requirements for Web Macro Tools, Symposium on Visual Languages and Human Centric Computing, 197-204, September 2007.

C-85. S. Lingham and S. Elbaum, Supporting End-Users in the Creation of Dependable Web Clips, International World Wide Web Conference, 953-962, May 2007.

C-86. M. Dwyer, A. Kinneer, and S. Elbaum, Adaptive Online Program Analysis, International Conference on Software Engineering, 220-229, May 2007.

C-87. M. Dwyer, S. Elbaum, S. Person, and R. Purandare, Parallel Randomized State-Space Search, International Conference on Software Engineering, 3-12, May 2007.

C-88. S. Elbaum, S. Person, J. Dokulil, and M. Jorde, Bug Hunt: Making Early Software Testing Lessons Engaging and Affordable, International Conference on Software Engineering, Educational Track, 688-697, May 2007.

C-89. Z. Wang, S. Elbaum and D. Rosenblum, Automated Generation of Context-Aware Tests, International Conference on Software Engineering, 406-415, May 2007.

C-90. M. Fisher, S. Elbaum and G. Rothermel Dynamic Characterization of Web Application Interfaces, Fundamental Approaches to Software Engineering, 260-275, January 2007.

C-91. M. Dwyer, S. Person, and S. Elbaum, Controlling Factors in Evaluating Path-sensitive Error Detection Techniques, International Symposium of Foundations of Software Engineering, 92-104, November 2006. **Distinguished paper award.**

C-92. S. Elbaum, H. Chin, M. Dwyer and J. Dokulil, Carving Differential Unit Test Cases from System Test Cases, International Symposium of Foundations of Software Engineering, 253-264, November 2006.

C-93. M. Diep, M. Cohen, and S. Elbaum, Probe Distribution Techniques to Profile Events in Deployed Software, International Symposium of Software Reliability Engineering, 395-406, November 2006.

C-94. J. Ruthruff, S. Elbaum, and G. Rothermel, Experimental Program Analysis: A New Program Analysis Paradigm, International Symposium of Software Testing and Analysis, Big-idea Track, June 2006.

C-95. S. Elbaum, R. Chilakamarri, M. Fisher, and G. Rothermel Web Application Characterization through Directed Requests, Workshop on Dynamic Analysis, 49-56, May 2006.

C-96. S. Elbaum, R. Chilakamarri, B. Gopal, and G. Rothermel, Helping end-users engineer dependable web application, International Symposium of Software Reliability Engineering, 22-31, November 2005.

C-97. W. Srisa-an, M. Oey, and S. Elbaum, Garbage Collection in the Presence of Remote Objects: A Case Study, International Symposium on Distributed Objects and Applications, October 2005.

C-98. K. Chilakamarri and S. Elbaum, Reducing Coverage Collection Overhead with Disposable Instrumentation, International Symposium of Software Reliability Engineering, 233-244, November 2004.

C-99. H. Do, S. Elbaum, and G. Rothermel, Infrastructure Support for Controlled Experimentation with Software Testing and Regression Testing Techniques, International Symposium on Empirical Software Engineering, 60-70, September 2004.

C-100. S. Elbaum and M. Hardojo, An Empirical Study of Profiling Strategies for Released Software and Their Impact on Testing Activities, International Symposium on Software Testing and Analysis, 65-75, July 2004.

C-101. S. Elbaum, S. Kanduri and A. Andrews, Anomalies as Precursors of Field Failures, International Symposium of Software Reliability Engineering, 108-118, November 2003.

C-102. S. Elbaum, S. Karre, and G. Rothermel, Improving Web Application Testing with User Session Data, International Conference on Software Engineering, 49-59, May 2003.

C-103. S. Kanduri and S. Elbaum, An Empirical Study of Tracing Techniques from a Failure Analysis Perspective, International Symposium of Software Reliability Engineering, 280-291, November 2002.

C-104. A. Malishevsky, G. Rothermel, and S. Elbaum, Modeling the Cost-Benefits Tradeoffs for Regression Testing Techniques, International Conference on Software Maintenance, 204 - 213, October 2002,

C-105. G. Rothermel, S. Elbaum, A. Malishevsky, P. Kallakuri, B. Davia, The Impact of Test Suite Granularity on the Cost-Effectiveness of Regression Testing, International Conference on Software Engineering, 130-140, May 2002.

C-106. S. Elbaum, D. Gable, and G. Rothermel, The Impact of Evolution on Code Coverage Information, International Conference on Software Maintenance, 170-179, November 2001.

C-107. S. Elbaum, A. Malishevsky, and G. Rothermel, Incorporating varying test costs and fault severities into test case prioritization, International Conference on Software Engineering, 329-338, May 2001.

C-108. S. Elbaum and J. Munson, Software Black Box: An Alternative Mechanism for Failure Analysis, International Symposium on Software Reliability Engineering, 365-376, October 2000.

C-109. S. Elbaum, D. Gable, and G. Rothermel, Understanding and Measuring Source of Variation in the Prioritization of Regression Test Suites, International Software Metrics Symposium, 169-179, April 2001.

C-110. S. Elbaum, A. Malichevsky and G. Rothermel, Prioritizing Test Cases for Regression Testing, International Symposium of Software Testing and Analysis, 102-112, August 2000.

C-111. J.Munson and S. Elbaum, Code Churn: A Measure for Estimating the Impact of Code Change, International Conference Software Maintenance, 24-31, November 1998.

C-112. S. Elbaum and J. Munson. Getting a handle on the fault injection process: Validation of Measurement Tools, International Symposium of Software Metrics, 133-143, November 1998. *(Not available)*

Other Conference Papers, Articles, and Workshop Papers

O-1. M. Stein, S. Elbaum, L. Feng and S. Sheng, Probabilistic Conditional System Invariant Generation with Bayesian Inference, arXiv preprint arXiv:2012.06615, 2020.

O-2. Deep Learning & Software Engineering: State of Research and Future Directions, P. Devanbu, M. Dwyer, S. Elbaum, M. Lowry, K. Moran, D. Poshyvanyk, B. Ray, R. Singh and X. Zhang, arXivpreprint arXiv:2009.08525, 2020.

O-3. D. Shriver, D. Xu, S. Elbaum and M. Dwyer, Refactoring neural networks for verification, arXiv preprint arXiv:1908.08026, 2019.

O-4. E. Beachly, C. Detweiler, S. Elbaum, D. Twidwell, and B. Duncan. UAS-Rx interface for mission planning, fire tracking, fire ignition, and real-time updating. International Symposium on Safety, Security, and Rescue Robotics, 67-74, October 2017.

O-5. S. Elbaum: The State of ICSE. ACM SIGSOFT Software Engineering Notes 42(2): 4-5, June 2017.

O-6. J. Ore, C. Detweiler, and S. Elbaum, Phriky-units: a lightweight, annotation-free physical unit inconsistency detection tool. International Symposium of Software Testing and Analysis, Demo Track, 352-355, July 2017. **Best tool demo award.**

O-7. S. Elbaum: The State of ICSE. ACM SIGSOFT Software Engineering Notes 41(5): 9-10, November 2016.

O-8. Eric F. Rizzi, Matthew B. Dwyer, Sebastian G. Elbaum: Safely reducing the cost of unit level symbolic execution through read/write analysis. ACM SIGSOFT Software Engineering Notes 39(1): 1-5, 2014.

O-9. K. Stolee and S. Elbaum. On the Use of Input/Output Queries for Code Search. ESEM Short Paper, 251-254, October 2013.

O-10. K. Stolee and S. Elbaum, Exploring the use of crowdsourcing to support empirical studies in software engineering, Short paper at the Empirical Software Engineering and Metrics Symposium, September 2010.

O-11. M. Sama, D. Rosenblum, Z. Wang, and S. Elbaum, Multi-Layer Faults in the Architectures of Mobile Context-Aware Adaptive Applications International Workshop on Software Architectures and Mobility, May 2008.

O-12. C. Scaffidi, A. Cypher, S. Elbaum, A. Koesnandar, J. Lin, B. Myers, and M. Shaw. Using Topes to Validate and Reformat Data in End-User Programming Tools, Workshop on End-User Software Engineering, 2008.

O-13. A. Bertolino, G. De Angelis, S. Elbaum, A. Sabetta, Scaling up SLA Monitoring in Pervasive Environments, International Workshop on the Engineering of Software Services for Pervasive Environment, 65-68, 2007.

O-14. S. Elbaum, M. Fisher II, and G. Rothermel, Dependability in Web Software, End-User Software Engineering, Dagstuhl, 2007.

O-15. Z. Wang and S. Elbaum, Localizing Faults that Caused Field Failures, Fast Abstract at the International Symposium of Software Reliability Engineering, 2005.

O-16. M. Cohen, M. Dwyer, S. Elbaum and J. Hatcliff and G. Rothermel, Behavior Coverage for High-Confidence Medical Software, High Confidence Medical Device Software and Systems Workshop, 2005.

O-17. F. Nkwocha and S. Elbaum, Fault Patterns in Matlab, Workshop on End-User Software Engineering, 17-20, 2005.

O-18. M. Oey, W. Srisa-an, and S. Elbaum, Remote Objects: The Next Garbage Collection Challenge, Workshop on Managed Runtime Environments, 2005.

O-19. H. Do, S. Elbaum, G. Rothermel, Building an Infrastructure to Support Experimentation with Software Testing Techniques, Workshop on Empirical Research in Software Testing, July 2004.

O-20. M. Hardojo, S. Elbaum, and Z. Wang, The Effect of Field Data Integrity on the Potential of Failure Reproduction and Fault Isolation, Workshop on Remote Analysis and Monitoring of Software Systems, 41-44, 2004.

O-21. G. Rothermel and S. Elbaum, Putting Your Best Tests Forward, IEEE Software - Quality Time, 74-77, August/September 2003.

O-22. S. Elbaum and M. Hardojo, Deploying Instrumented Software to Assist the Testing Activity, Workshop on Remote Analysis and Monitoring of Software Systems, 13-15, 2003.

O-23. X. Liu and S. Elbaum, On the Use of Empirical Studies to Compare Failure Analysis Techniques, IEEE Workshop of Empirical Studies of Software Maintenance, 2002.

O-24. S. Karre and S. Elbaum, An Empirical Assessment of XML Parsers, Sixth Workshop on Web Engineering, 39-46, May 2002.

O-25. S. Elbaum, An Experimental Infrastructure for Evaluating Failure Analysis Techniques for Released Software, IEEE Workshop of Empirical Studies of Software Maintenance, 2-6, 2001.

O-26. S. Dunbar, S. Goddard, S. Henninger, and S. Elbaum, Bootstrapping the Software Design Studio, Creativity and Innovation in Higher Education, NCIIA, 179-188, 2001.

O-27. S. Elbaum and S. Narla, A Methodology for Operational Profile Refinement, IEEE Annual Reliability and Maintainability Symposium, 142-147, 2001.

O-28. S. Elbaum and J. Munson, Investigating Software Failures with a Software Black Box, IEEE Aerospace Conference, March 2000.

O-29. S. Elbaum and J. Munson, Intrusion Detection through Dynamic Software Measurement, USENIX Workshop on Intrusion Detection and Network Monitoring, 41-50, 1999. **Best Student Paper Award.**

O-30. J. Munson and S. Elbaum, Software Reliability as a Function of the Execution Patterns, Hawaiian International Conference on System Sciences, 1999.

O-31. J. Munson, S. Elbaum, R. Karcich, J. Wilcox, Software Risk Assessment through Software Measuring and Modeling, IEEE Aerospace Conference, 1998.

O-32. S. Elbaum, Object Oriented Traceability, Annual Oregon Workshop on Software Metrics, 1997.

O-33. S. Elbaum, A Conceptual Framework for a Software Black Box, Dissertation, Computer Science Department, University of Idaho, 1999.

Patents

Pa-1. UAV based fire ignition. Higgins, J., Laney, C., Allen, C., Detweiler, C. and Elbaum, S. UNL. U.S. Pat. Application No: 62/242,485. September 1, 2021. [Granted]

Pa-2. Crop canopy measurements with a low flying unmanned aerial vehicle. Detweiler, C. and Anthony, D. A. UNL. U.S. Pat. Application No: 62/214,881. September 1, 2015. [Granted]

Pa-3. Aerial Water Sampler. Detweiler, C, Ore, J, Zhao, B and Elbaum, S. Inventors and UNL. U.S. Pat. No: 20150268136. September 24, 2015. [Granted]

Pa-4. Searching for code by specifying its behavior. Elbaum, S. and Stolee, K. . Sebastian Elbaum, Kathryn Stolee, and UNL. U.S. Pat. No: PCT/US2013/036967. April 17, 2013. [Granted]

Invited Presentations

Ip-1. Testing the Long Tail Distribution of Autonomous Mobile Systems. Keynote. Workshop on Autonomous Software Testing. October 2022.

Ip-2. Emerging Testing Techniques for Validating and Verifying Robot Systems, Invited Speaker at the RSS Workhop on Envisioning an Infrastructure for Multi-Robot and Collaborative Autonomy Testing and Evaluation, July 2022.

Ip-3. Bridging Program Analysis and Autonomous Robots, JAIIO 50th Plenary Session - virtual, Argentina, October 2021.

Ip-4. Program Analysis Meets Autonomous Robots, ICSE Technical Briefing - virtual, July 2020.

Ip-5. Time management and work-life management, New Software Engineering Faculty Symposium, ICSE - virtual, July 2020.

Ip-6. | Techniques - Tools | = Unknown, Tutorial, School of Experimental Software Engineering, Madrid, Spain, 2019.

Ip-7. Student recruiting, advising, and mentoring, New Software Engineering Faculty Symposium, ICSE, Montreal, Canada, 2019.

Ip-8. Holistic Analysis: Integrating the Semantics of the Code and the World, Distinguished Speaker Series, University of Virginia, 2017.

Ip-9. Building Useful Repositories: A Success Story from the Testing and Analysis Community, REINFORCE Workshop, University of Southern California, 2017.

Ip-10. UAS-Rx for Fire Management, National Volunteer Fire Council, Kearney, Nebraska, 2017.

Ip-11. From idea to paper and everything in between, Ph.D. and Young Researchers Warm-up Symposium, Buenos Aires, Argentina, 2016.

Ip-12. Think like an immigrant, Graduate Commencement Speech, University of Nebraska - Lincoln, 2016.

Ip-13. Sunday with a Scientist (co-host with Carrick Detweiler, over 400 attendees), University of Nebraska State Museum, 2015.

Ip-14. Crowdsourcing Software Engineering Empirical Studies: Opportunities and Perils, First International Workshop on CrowdSourcing in Software Engineering, Invited Talk, International Conference in Software Engineering, 2014.

Ip-15. Searching for programs with inputs/outputs, Invited Tech-Talk, Google, 2013.

Ip-16. On the search for programs and faults, Department of Computer Science Colloquium, University of Alabama, 2013.

Ip-17. Seminar at the Software Engineering Educators Symposium (co-located with FSE 2010), Making Software Testing Engaging and Affordable in Early Programming Classes, 2010.

Ip-18. A New Breed of Dynamic Program Analysis Techniques, University of Costa Rica, 2010.

Ip-19. Test Transformation, University of Stellenbosch, South Africa, 2010.

Ip-20. Group lead of Empirical Research and Program Analysis at Dagstuhl Perspectives Workshop: New Frontiers for Empirical Software Engineering, 2010.

Ip-21. Carving and Replaying Differential Unit Test Cases from System Test Cases, Invited paper presentation to the TSE/TOSEM Journal Session at International Conference in Software Engineering, Vancouver, Canada, May 2009.

Ip-22. T2T: A Test Case Transformation Framework, Accenture, Chicago, November 2008.

Ip-23. Carving: Supporting Testing Efforts at LM, Lockheed Martin - Progress Report and Future Collaborations, 2007.

Ip-24. Emerging Breed of Dynamic Analysis Techniques, CNR, Pisa, Italy, 2007.

Ip-25. Continuous Analysis and Testing of Evolving Systems, Kings College, London, UK, 2006.

Ip-26. Continuous Analysis and Testing of Evolving Systems, Imperial, London, UK, 2006.

Ip-27. Continuous Analysis and Testing of Evolving Systems, Brunel University, London, UK, 2006.

Ip-28. Testing of Evolving Systems, Intel Testing Seminar Series, Folsom, 2006.

Ip-29. Better Empirical Science for Software Engineering, International Conference on Software Engineering, Invited Plenary Talk with Vic Basili, Shanghai, 2006.

Ip-30. Leveraging Deployed Software Instances for QA, Workshop on High-Confidence Embedded Systems, Lincoln, Nebraska, 2005.

Ip-31. Advanced Testing Techniques, Seminar Series at the Escuela de Ciencias Informáticas, Departamento de Computacion, Universidad de Buenos Aires, Argentina, 2004.

Ip-32. Techniques for Profiling Released Software, Seminar on Understanding Program Dynamics, Dagstuhl, Germany, 2003.

Infrastructure Made Available to Community

- DNNF: a tool for reducing a DNN and an associated safety property – a correctness problem – into an equivalid set of correctness problems formulated with robustness properties which can be processed by existing adversarial attack techniques.
  `https://github.com/dlshriver/DNNF`

- Phrikyunits: a lightweight static analysis tool to detect inconsistent physical units manipulation in C++ code using ROS libraries that requires NO developer annotations.
  `https://github.com/unl-nimbus-lab/phriky-units`

- The Google Dataset of Testing Results. This data repository was prepared during my sabbatical at Google, and it provides the software testing and analysis community with a sample of 3.5 Million test suite execution results from a fast and large scale continuous testing infrastructure.
  `https://code.google.com/p/google-shared-dataset-of-test-suite-results/`

- SIR - Infrastructure to Support Controlled Experimentation with Testing Techniques. This repository provides Java and C programs for use in experimentation with testing and analysis techniques, and materials facilitating that use. The repository was co-created with Dr. Rothermel starting in 2005.
  `http://sir.unl.edu`

- Educational Testing Tutorial: "Bug Hunt". This web-based tutorial provides hand-on lessons to engage students in the application of techniques that assist in the development of dependable software. Retired in 2014.

- Carving and Replay Unit Tests from System Tests. This tool enables the automated transformation from system tests to unit tests that are focused efficient but encode some of the power of system tests. Retired in 2012.

- Robofox, a web browser extension that enables the automation of repetitive browsing tasks such as extracting information from a site, integrating data across sites and application, and formatting the collected information. Robofox provides support for the generation and execution of more dependable web macros. Retired in 2010.

SERVICE AND SYNERGISTIC ACTIVITIES

Editorial Boards and Conference Organization

- Co-Chair for the NSF-sponsored Workshop on Software Engineering for Robotics – SE4Robotics (co-located with IROS, 2023)
- Co-Chair for the First Workshop on Dependability and Trustworthiness of Safety-Critical Systems with Machine Learned Components – SE4SafeML (co-located with FSE 2023)
- Steering Committee Chair for ICSE (2015-2017, 2017-2019)
- Program Co-Chair of the Technical Track at ICSE (2015)
- Associate Editor of the ACM Transactions of Software Engineering and Methodologies (2010-2015)
- Program Co-Chair of the New and Emerging Results Track at ICSE (2013)
- Steering Committee Member of the International Symposium of Software Testing and Analysis (2007-2012)

- Steering Committee Member of the Empirical Software Engineering and Measurement Symposium (2008-2010)
- Program Co-Chair of the Empirical Software Engineering and Measurement Symposium (2008)
- Founder and Executive Committee Member of the End-User Shaping Effective Software Consortium (2004-2010)
- Invited Editor to the TSE Special Issue of the Best Papers of ISSTA 2007 (2008)
- Program Chair of the International Symposium of Software Testing and Analysis (2007)
- Co-Editor in Chief of the Information and Software Technology Journal (2005 - 2007)
- Editorial Board Member of the Information and Software Technology Journal (2008 - present)
- Editorial Board, Software Quality Journal (2004 - 2006)
- Program Co-Chair of the Workshop on End User Software Engineering (2005)
- Proceedings Chair, International Symposium on Empirical Software Engineering (2004)
- Student Papers Chair, International Symposium on Software Reliability Engineering (2004)

Program Committees

- International Symposium on Foundations of Software Engineering and the European Conference in Software Engineering (2006, 2007, 2009, 2010, 2012, 2018, 2019, 2022)
- International Conference of Software Engineering (2004, 2009, 2011, 2014, 2015, 2016, 2020, 2023)
- International Symposium on Software Testing and Analysis (2004, 2007, 2008, 2011, 2021, 2022)
- International Conference on Robotics and Automation (2020-2022), Associate Editor (2022-2024)
- International Symposium on Software Reliability Engineering (2000, 2003-2005, 2008, 2009)
- International Conference on Fundamental Approaches to Software Engineering (2010)
- International Conference on Software Testing (2008)
- International Conference on Software Maintenance (2004, 2005)
- International Symposium on Empirical Software Engineering / / Symposium on Empirical Software Engineering and Measurement (2003, 2007, 2009, 2011, 2013)

University and Department Service

- UVA Futures Initiative (2023-Present)
- UVA CS Graduate Student Ombudperson (2020-Present)
- UVA CS Search Committee Chair (2021-2022)
- UVA SEAS Engineering Research Advisory Council (2020-2021)
- UVA CS Search Committee Chair (2019-2020)
- UVA CS Search Committee Chair (2018-2019)
- UVA CS Graduate Committee (2018-2019)

Affiliations

- Co-Founder of the Lab for Engineering Safe Software (LESS) at the University of Virginia, 2020.

- Co-Founder and Former Co-director of the NIMBUS (Nebraska Intelligent MoBile Unmanned Systems) Lab at UNL

- Co-founded of Drone Amplified, Inc., 2016.

- Co-founder of the E2: Software Engineering Laboratory at UNL

- Co-founder and Former Executed Board Member of EUSES (End Users Shaping Effective Software) Research Group

- Association for Computer Machinery (ACM) and ACM Sigsoft

- Institute for Electrical and Electronic Engineering (IEEE)

TEACHING
___

Courses Taught
- UVA: Advanced Software Development Techniques
- UVA: Analysis of Software Artifacts
- UVA: Program Analysis and its Applications
- UVA: Robotics for Software Engineers
- UNL: Introduction to Data Structures
- UNL: Software Development Essentials
- UNL: Programming Languages Concepts
- UNL: Software Engineering
- UNL: Senior Design
- UNL: Special Topics: Software Engineering for Robotics
- UNL: Special Topics: Empirical Software Engineering
- UNL: Software Testing, Verification, and Analysis
- UNL: Advanced Software Engineering

Innovations
- 2021-2022: Re-Design and re-implementation of undergraduate course on Robotics for software engineers for virtual delivery and lower adoption bar.
- 2019-2020: Design and implementation of new undergraduate course on Robotics for software engineers.
- 2018-2019: Design and implementation of new graduate course mostly directed for M.S. students on Program Analysis and Applications.
- 2017: Re-design of *Testing, Verification, and Analysis* course.
- 2017: Re-design of *Testing, Verification, and Analysis* course.
- 2017: Design and implementation of new course on *Software Engineering for Robotics*.

- 2015: Curriculum and course development for new Software Engineering Major.
- 2012-2015: Integration of Senior Design and Design Studio courses.
- 2008: Design and implementation of new course on *Analysis of Software Artifacts*.
- 2007: Incorporation of programming languages comparative assessment assignments into the *Programming Languages Concepts* course.
- 2007: Incorporation of design patterns and advanced development environments into the *Software Engineering* course.
- 2004-2010: *Bug Hunt*: Web Tutorial to Assist the Learning of Software Testing in CS1 and CS2. *Bug Hunt* was used vy thousands of students worldwide.
- 2003-2004: Design of first graduate-only course on *Software Quality, Testing, and Analysis*.
- 2002-2003: Design of *Software Development Essentials* for the JDE Honors Program (now Raikes School).
- 2001-2002: Incorporation of maintenance experience into *Software Engineering* course.
- 2001-2002: Design and implementation of new course on *Empirical Software Engineering*.
- 2000-2003: Review and enhancement of JDE Honors Program (now Raikes School) undergraduate curriculum.
- 1999-2000: Design and implementation of new course on *Software Quality*.

MENTORING AND ADVISING

Ph.D. Graduate Advisor or Co-Advisor

1. Felipe Toledo, Topic: Verification and Validation of DNNs (Ph.D., in progress)
2. Trey Woodlief, Topic: Generation of Tests for Complex Inputs in Autotonomous Systems (Ph.D., in progress)
3. Meriel Stein, Topic: Adversarial Analysis of Autonomous Vehicles (Ph.D., in progress)
4. Carl Hildebrandt, Topic: Hybrid-Analysis of Autonomous Systems (Ph.D., in progress)
5. David Shriver, Topic: Verification of DNNs (Ph.D., 2022, ACM Sigsoft Distinguished Dissertation Award)
6. Ajay Shankar (co-advised with Dr. Detweiler), Topic: Enabling In-AirInteractions of Aerial Vehicles (PhD, 2021)
7. John Paul Ore (co-advised with Dr. Detweiler), Topic: Testing and Analysis of Robotic Systems (PhD, 2019)
8. Wei Sun (co-advised with Dr. Xu), Topic: Automatic Testing of Networking Protocols (PhD, 2017)
9. Rahul Purandare (co-advised with Dr. Dwyer), Topic: Run-time Verification (Post-doc, 2013)
10. Katie Stolee, Topic: Seaching for Semantics with Solvers (PhD, 2013)
11. Pingyu Yang, Topic: Automatic Test Transformation (PhD, 2013)
12. Madeline Hardojo, Topic: Profiling and Analyzing Deployed Software (PhD, 2009)
13. Mark Fisher (co-advised with Dr. Rothermel), Topic: Analysis and Validation of Web Applications and Services (Ph.D, co-advised with G. Rothermel, 2008)
14. Zhimin Wang, Topic: Validating Context Aware and Mobile Applications (Ph.D., 2008)

15. Joe Ruthruff (co-advised with Dr. Rothermel), Topic: Experimental Program Analysis (Ph.D - co-advised with G. Rothermel, 2008)

M.S. Graduate Advisor or Co-Advisor

1. Christopher Morse, Topic: Infering Spatial Properties (MS-Thesis, 2023)

2. Garret Christian, Topic: Test Generation of LiDAR Inputs (MS-Project, 2022)

3. Andrew Elsey (co-advised with Kevin Sullivan), Topic: Program Analysis with Physical Semantics (MS-Project, 2021)

4. Nate Olsen , Topic: Drone Swarm Deployment (MS-Project, 2019)

5. David Shriver, Topic: Properties of Systems that Learn (MS-Thesis, 2018)

6. Balaji Balasubrmanian (co-advised with Dr. Bradley), Topic: Evolution and Analysis of Controllers (MS-Thesis, 2018)

7. Evan Beachly (co-advised with Dr. Detweiler), Topic: UAS-for fire management (MS-Thesis, 2017)

8. Nishant Sharma (co-advised with Dr. Detweiler), Topic: Impact Analysis of Robotic Systems (MS-Thesis, 2017)

9. Matias Waterloo, Topic: Test Analysis (MS-Thesis, 2016)

10. Adam Taylor, Topic: Configuration Support for Co-Robotic Systems (MS-Thesis, 2015)

11. Eric Rizzi (co-advised with Dr. Dwyer), Topic: Discovery Over Application: A Case Study of Misaligned Incentives in Software Engineering (MS-Thesis, 2015)

12. Hengle Jiang, Topic: Invariants for Robotic Systems, (MS-Thesis, 2014)

13. Andrew Mittleider (co-advised with Dr. Detweiler), Topic: UAV's efficiency (MS-Thesis, 2013)

14. Heath Roehr (co-advised with Dr. Cohen), Topic: Program behavioral differences (MS-Thesis, 2013)

15. Yurong Wang (co-advised with Dr. Dwyer), Topic: Test Advices (MS-Thesis, 2012)

16. Javier Darsie, Topic: Statistical Properties (MS-Thesis, 2012)

17. Katie Stolee, Topic: Refactoring Pipe Mashups (MS-Thesis, 2010)

18. Matthew Jorde, Topic: Analysis of Program States (MS-Thesis, 2008)

19. Padmapriya Ashokkumar (co-advised with L. Hochstein), Topic: Design by Contract (MS-Project, 2007)

20. Andhy Koesnandar, Topic: End-User Engineering of Web Applications (MS-Thesis, 2007)

21. Hui Nee Chin, Topic: Test Carving (MS-Project, 2007)

22. Sandeep Lingham, Topic: End-User Engineering of Web Applications (MS-Project, 2006)

23. Bhuvana Gopal, Topic: End-User Engineering of Web Applications (Ms-Thesis, 2005)

24. Sameera Reddy, Topic: Regression Testing (MS-Thesis, 2004)

25. Fidel Knowcha, Topic: End-User Software Engineering with Matlab (MS-Thesis, 2004)

26. Ram Chilakamarri, Topic: Software Instrumentation and Profiling (MS-Thesis, 2004)

27. Madeline Hardojo, Topic: Profiling Deployed Software (MS-Thesis, 2004)

28. Satya Kanduri, Topic: Failures Reproduction and Anomaly Detection (MS-Thesis, 2003)

29. Srikanth Karre, Topic: Web Testing (MS-Thesis, 2003)

30. Xin Liu, Topic: Failure Reproduction (MS-Thesis, 2002)

31. Praveen Kallakuri, Topic: Regression Testing (MS-Thesis, 2002)

32. Smita Narla, Topic: Operational Profiles (MS-Project, 2001)

33. David Gable, Topic: Regression Testing (MS-Thesis, 2001)

Undergraduate Research: Eric Gruber; Tuan Duc Dao (undergraduate Thesis and UCARE recipient); Ted Whaler; Khoa Lee (supported through REU); Shane Geiger ; Jared Bakewell; David Friberg (supported through REU); Coddy Ebberson; Jonathan Dokulil (UCARE recipient and supported through REU); Nick Steinbaugh (supported through REU); Matthew Jorde (supported through REU), Bumsoo Hong (supported through grant); Steve Trout (supported through REU); Bumsoo Hong (supported through REU), Josh Reed (supported through NASA grant), Charles Lucas (supported through REU), Xin Guo (supported through NSF grant), Megan Jensen (AFOSR support), Daniel Dobos (NSF support), Adam Taylor (AFOSR support), David Shriver (supported through REU), Mark Nail (supported through REU), Joanna Zhao, Michael Chinn (NSF-support), Jack Mc-Dowell, Avaneen Pinninti (NSF-support), Zharif Cabrera (Leadership Alliance support), Samuel Ghezae(Leadership Alliance support), Mira Khan.

Other Personnel Supervised: Andrew Rasmussen§ (Nimbus Lab Manager, 2016-present), Christian Amelinckx (Nimbus Lab Applications Engineer, 2014-2015), Seth McNeill, (Nimbus Lab Applications Engineer, 2013-2014).