

Curriculum Vitae: Karthik Pattabiraman

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Research Interests

Error Resilient Systems, Compilers and Programming Languages, IoT Reliability & Security.

Education

PhD in Computer Science	University of Illinois (Urbana Champaign)	May 2009
	<i>Advisor: Ravishankar K. Iyer</i>	
MS in Computer Science	University of Illinois (Urbana Champaign)	Dec 2004
	<i>Advisor: Daniel A. Reed</i>	
B.Tech in Information Technology	University of Madras (Chennai, India)	Jul 2001

Awards and Honors

- **External awards**

- Recipient of the *Inaugural* Rising Star in Dependability award (RSD), 2020, awarded jointly by the IEEE Technical Committee on Fault Tolerant Computing (TC-FTC) and IFIP Working Group on Dependable Computing and Fault-tolerance, to “*recognize a junior researcher, from academia or industry, who demonstrates outstanding potential for creative ideas and innovative research in the field of dependable and resilient computer systems and networks.*”
- Member of the IFIP WG 10.4 on Dependable Computing and Fault Tolerance (January 2015 onwards). The WG 10.4 consists of over 60 eminent experts in the field of fault-tolerant and dependable computing from academia and industry, and membership is by election. I was also elected as the vice-chair in 2019 – one of two vice-chairs of the committee.
- University of Illinois’s (UIUC) Computer Science Department Distinguished Alumni Award – Early Career Educator Category, 2018. This award “*honors computer science alumni or faculty members who have attained early career milestones and show great promise toward continued contributions to computer science education and research.*”
- NSERC Discovery Accelerator Grant Supplement (DAS) Award for 2015-2018. “*The DAS Program provides substantial and timely resources to researchers who have a superior research program that is highly rated in terms of originality and innovation, and who show strong potential to become international leaders within their field.*” One of 125 awarded across all fields of science and engineering out of more than 3000 applications in 2015 across Canada.
- Winner of the 2008 *William C. Carter* award sponsored by the IEEE Technical Committee on Fault-Tolerant Computing (TC-FTC) and the IFIP Working Group on Dependable Computing and Fault Tolerance (WG 10.4). The William C. Carter Award is presented annually since 1997 “*to recognize an individual who has made a significant contribution to the field of dependable computing through his or her graduate dissertation research*”. The award is given to one student a year at the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN).

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- o Listed in the DSN conference hall of fame (top 15) - only Canadian researcher listed in the hall of fame. DSN is the top conference in the area of dependable computing, and the hall of fame reflects the number of publications in the conference since 1988. (<https://engineering.purdue.edu/~sbagchi/dsn-hof.html>)
- **Internal awards won at UBC**
 - o UBC Killam award in 2020 for excellence in mentoring, to “*recognize faculty members’ outstanding ability to foster the intellectual, professional, and personal development of graduate students.*” I won the award in the mid-career category (less than 12 years in the first faculty position) - one award was given across all of UBC.
 - o UBC Killam Faculty Research Prize, 2018 in the Sciences and Engineering category “*in recognition of outstanding research and scholarly contributions*” - I was the only winner in the “Junior” category (less than 12 years since PhD) across all of UBC.
 - o Killam Research Fellowship at UBC for 2016. This fellowship is awarded on a competitive basis to 10 researchers each year across all of UBC and all ranks (for salary and research supplement during a study leave, i.e., sabbatical).
- **Awards won by my students**
 - o My student Bo Fang (co-supervised with Matei Ripeanu) won the William C. Carter dissertation award in Dependability for 2020. This award is aimed at “*recognizing an individual who has made a significant contribution to the field of dependable and secure computing throughout his or her PhD dissertation.*” One award is given each year. His thesis also received an *honorable mention* at the SIGHPC dissertation award, 2020, and was nominated by UBC for the ACM doctoral dissertation award (1 of 2 nominees).
 - o My student Guanpeng Li received Standard Performance Evaluation Corporation (SPEC) Kaivalya Dixit Distinguished Dissertation award in 2019. This award “*aims to recognize outstanding doctoral dissertations in the field of computer benchmarking, performance evaluation, and experimental system analysis in general*”. One award is given each year.
- **Paper awards**
 - o Best Paper at the ACM Transactions on Embedded Computing Systems (TECS) in 2020 - this was awarded to one paper published in the journal in the years 2018-2020.
 - o Paper at International Conference for High-Performance Computing, Storage and Networking (SC), 2019 was a finalist for the SC reproducibility challenge (1 of 3 papers chosen among more than 300 papers submitted to the conference).
 - o Best paper award nominee at the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2018. One of three papers that were nominated out of nearly 250 submissions.
 - o Paper at ISSRE’14 was chosen as the “Highlights of ISSRE” in ISSRE 2019 – one of 26 papers among 1074 published in 30 years of the IEEE International Symposium on Software Reliability Engineering (ISSRE). These are papers that have had “*great influence and impact in the community*”.
 - o Distinguished paper awards at the European Dependable Computing Conference (EDCC), 2015 and 2016. One of three papers from more than 50 submissions in each year.
 - o ACM SIGSOFT Distinguished paper award at the IEEE/ACM International Conference on Software Engineering (ICSE) 2014, one of nine papers that received the award (out of nearly 500 submissions).
 - o Best paper award runner up at the IEEE International Conference on Software Testing, Verification and Validation (ICST) 2013. (one of 2 papers among more than 150 submissions).
 - o Best paper award nominee at the IEEE International Conference on Software Testing, Verification and Validation (ICST) 2012 (one of 6 papers among more than 150 submissions).

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Work Experience (post PhD)

- Professor, Dept. of Electrical and Computer Engineer, Univ. of British Columbia, July 2020 - present.
- Associate Professor, Dept. of Electrical and Computer Engineering, Univ. of British Columbia, July 2015 - Jun 2020.
- Assistant Professor, Dept. of Electrical and Computer Engineering, Univ. of British Columbia, Jan 2010- Jun 2015.
- Post-Doctoral Researcher, Microsoft Research, Research in Software Engineering (RiSE) Group, Jan-Dec 2009.

Current Graduate Students (PhD/MASc)

1. Mohammad Rafiuzzaman, PhD, from 2017. (co-advised with Sathish Gopalakrishnan). International Doctoral Fellowship (IDF) awardee.
2. Asem Ghaleb, PhD, from 2018. (co-advised with Julia Rubin). Four Year Fellowship (FYF) awardee.
3. Pritam Dash, PhD, from 2020. Four Year Fellowship (FYF) awardee.
4. Abraham Chan, PhD, from 2020. NSERC PGS(D) and Four Year Fellowship (FYF) awardee.
5. Kumseok Jung, PhD, from 2021. Interned at Microsoft Research.
6. Niranjhana Narayanan, MASc, from 2019.
7. Xi Rui, MASc, from 2020.
8. Ali Asgari, MASc, from 2021.

Former Graduate Students and Post-docs

Post-doc:

1. Julien Gascon-Samson. NSERC Postdoctoral Fellow, 2016-2018. Currently assistant professor of Computer Science at the Ecole Technologie Supérieure (ETS), Montreal.

PhDs:

1. Mehdi Karimibuiki, PhD, 2020 (co-advised with Andre Ivanov). Four Year Fellowship (FYF) awardee. First position: Senior Security Engineer, Sierra Wireless, Vancouver.
2. Bo Fang, PhD, PhD 2020, MASc from 2011-2014 (co-advised with Matei Ripeanu). Interned at Los Alamos National Labs (LANL), Pacific Northwest National Labs (PNNL). J.K. Zee Fellowship. (received the NSERC Postdoctoral Fellowship in 2020 - ranked #2 in CS). First Position: Postdoctoral researcher at Pacific Northwestern National Labs. Winner of **William C Carter Dissertation award, 2020** and **honorable mention for the ACM SIGHPC dissertation award, 2020**. **Nominated by UBC for the ACM Doctoral Dissertation award, 2020**.
3. Guanpeng Li, PhD, 2019. Four Year Fellowship (FYF) awardee. Interned at Nvidia Research. Distinguished paper runner up at DSN 2018 (received the NSERC Postdoctoral Fellowship in 2019). Current Position: Assistant Professor, University of Iowa (U Iowa), Computer Science department. First Position: Post-doctoral researcher, University of Illinois (UIUC). Winner of the **SPEC Kaivalya Dixit Distinguished Dissertation Award, 2019**.

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4. Farid Molazem Tabrizi, PhD, 2017. Interned at Fortinet, Vancouver, and Google, Mountain View. Distinguished paper award at EDCC 2015. Best paper award at TECS 2020. First Position: Google, US.
5. Saba Alimadadi, PhD, 2017 (co-advised with Ali Mesbah), Distinguished paper award at ICSE 2014. Interned at SAP Vancouver. Current Position: Assistant professor, Simon Fraser University (SFU), Computer Science department. First Position: Post-doctoral researcher at Northeastern University, US (received the NSERC Postdoctoral Fellowship in 2018 – **ranked #1 in CS division**).
6. Frolin Ocariza, PhD, 2016 (co-advised with Ali Mesbah), MSc, 2012: NSERC CGS(D) and FYF awardee. Interned at Microsoft Research, Redmond, and Fujitsu Labs, America. First position: SAP, Vancouver.
7. Shabnam Mirshokraie, PhD, 2015 (co-advised with Ali Mesbah), Best paper runner up at ICST 2013. First Position: Co-founder of a Startup in Stealth mode.
8. Layali Rashid, PhD, 2013 (co-advised with Sathish Gopalakrishnan), NSERC CGS(D) and FYF awardee. Interned at Microsoft Research, Redmond. First position: Qualcomm, US.

Masters (thesis):

1. Jiasheng Wei, MSc, 2012. First position: Microsoft, Canada.
2. Anna Thomas, MSc, 2013. First position: IBM Canada.
3. Majid Dadashi, MSc, 2014. First position: 1-QBit, Canada.
4. Xin Chen, MSc, 2014. Impact paper award at ISSRE'14. First position: CCB Fintech, China.
5. Sheldon Sequira, MSc, 2014 (co-advised with Ali Mesbah), Distinguished paper award at ICSE'14. First Position: SAP, Vancouver.
6. Kartik Bajaj, MSc, 2014 (co-advised with Ali Mesbah), FYF awardee, MITACS Globalink Fellowship and FYF awardee. Vancouver. First Position: Hootsuite, Vancouver.
7. Qining Lu, MSc, 2015. First position: Google, Canada.
8. Nithya Narayanamurthy, MSc, 2015. Distinguished paper award at EDCC 2016. First Position: Oracle Labs, Vancouver.
9. Abraham Chan, MSc, 2017. First Position: Huawei, Canada.
10. Maryam Raiyat Aliabadi, MSc, 2018. First Position: PhD student, Sharif Univ.
11. Ekta Aggarwal, MSc, 2019 (co-advised with Andre Ivanov). First position: Clio
12. Lucas Palazzi, MSc, 2019. First Position: Data Realm Inc.
13. Zitao Chen, MSc, 2020. First Position: Research Programmer, UBC.
14. Abdul Rehman Anwer, MSc, 2020. First Position: Huawei, Canada.
15. Aarti Kashyap, MSc, 2020. Invited to attend Heidelberg Laureate Forum. First Position: PhD student, UBC CS.
16. Pritam Dash, MSc, 2020. First Position: PhD student, UBC.
17. Kumseok Jung, MSc, 2021. First Position: PhD student, UBC.

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M.Eng (non-thesis):

1. Jose Thomas, first position: Lotlinx Canada.
2. Ahmed Effat, first position: Abebooks, Canada.

Visiting PhD students:

1. Behrooz Sangchoolie, Chalmers University of Technology, Gothenburg, Sweden (May-Aug 2016).
Co-authored paper at DSN'17. Current Position: Researcher, Research Institutes of Sweden (RiSE).
2. Yong Yang, Co-authored paper at ISSRE'20. PhD student at Peking University, China. (Feb – Aug 2019).
3. Arpan Gujarati, PhD student, MPI-SWS, Germany (joint with Sathish Gopalakrishnan, Feb-March 2020).

Undergraduate students: I have mentored a total of 32 undergraduate students as summer interns or undergraduate project advisees at UBCs. Six of these students were NSERC USRA interns (equivalent of NSF REUs in Canada).

Selected Activities

- Steering Committee Member for the IEEE Pacific Rim International Symposium on Dependable Computing (PRDC), 2015-2020. One of ten members of the Steering Committee.
- Steering Committee Member for the Workshop on Dependable and Secure Machine Learning (DSML), 2021, co-held with the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2021. (One of the seven members of the SC).
- Senior Member of the IEEE (since 2015), Senior member of the ACM (since 2019), and a member of the Usenix Association (since 2010).
- Co-organizer of a Dagstuhl workshop on "Characterizing and Modeling Residual Software Bugs" (August 2020), one of five co-organizers from different universities. (Unfortunately, this was cancelled due to the COVID-19 situation). Dagstuhl workshops are chosen competitively from submitted proposals.
- Guest co-editor of a special issue of
 - IEEE Transactions on Dependable and Secure Computing (TDSC), 2018 (one of three co-editors).
 - IEEE Transactions on Reliability (TR), TBD on Software Reliability Engineering (one of two co-editors).
- Conference Organization
 - Track co-chair for IEEE/ACM Conference on Design Automation and Test in Europe (DATE), 2021 - Dependability and System-Level Test Track (one of two co-chairs). First time track in DATE.
 - Program co-chair of the International Workshop on Dependable and Secure Machine Learning (DSML), co-held with the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2020. (one of seven co-chairs) – DSML had the largest attendance among all DSN workshops.
 - Program coordinator for IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2020.
 - New Faculty Symposium Co-Chair for IEEE International Conference on Software Reliability Engineering (ISSRE), 2020. (First time for ISSRE)
 - Member of expert panel to choose the best paper for the ACM International Conference on High-Performance Parallel and Distributed Computing (HPDC), 2020.
 - Program co-chair for the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2019. (one of two co-chairs)

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- o Program co-chair of the second International Workshop on Dependable and Secure Machine Learning (DSML), co-held with the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2019. (one of five co-chairs) – DSML had the largest attendance among all DSN workshops.
- o Program co-chair of the first International Workshop on Dependable and Secure Machine Learning (DSML), co-held with the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2018. (one of three co-chairs)
- o Publications co-chair for the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2018. (one of two co-chairs)
- o Program co-chair of the IEEE Workshop on Silicon Errors in Logic, System Effects (SELSE), 2018. (one of two co-chairs)
- o Program co-chair for the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2017. (one of two co-chairs)
- o Program chair for the 16th IEEE International Workshop on Assurance in Distributed Systems and Networks (ADSN), 2017. Held in conjunction with the IEEE International Conference on Distributed Computing Systems (ICDCS), 2017.
- o Member of expert panel for the Special Issue on Software Reliability in Journal of Systems and Software, Journal of Software and Systems (JSS), 2017, based on the best papers from ISSRE 2016.
- o Industry track co-chair for the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2017. (one of two co-chairs)
- o Program co-coordinator: IEEE International Symposium on Software Reliability Engineering (ISSRE), 2016.
- o Workshops co-chair of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2016. (one of two co-chairs)
- o Finance chair of the 14th ACM/IFIP/Usenix International Conference on Middleware, 2015.
- o Local Chair of 1st IEEE International Conference on Software Quality, Reliability and Security (QRS), 2015.
- o Publicity co-chair of the 11th European Dependable Computing Conference (EDCC), 2015.
- o Publications chair of the 8th IEEE/ACM International Symposium of Network On Chips (NOCS), 2015
- o Fast abstracts chair, IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2014.
- o Student Track chair, IEEE International Symposium on Software Reliability Engineering (ISSRE), 2014.
- o General chair of the IEEE Pacific Rim International Symposium on Dependable Computing (PRDC), 2013.
- o Program co-chair of the first and second workshops on *Compiler and Architectural Techniques for Application Reliability and Security* (CATARS), held in conjunction with the IEEE International Conference on Dependable Systems and Networks (DSN), 2008 and 2009. (one of two co-chairs)
- Delivered tutorial on “LLFI and the art of Fault Injection”
 - IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2017.
 - IEEE International Symposium on Software Reliability Engineering (ISSRE), 2019.
- Delivered tutorial on “Modern Web Applications’ Reliability Engineering”
 - IEEE International Symposium on Software Reliability Engineering (ISSRE), 2014, and 2016.
 - IEEE International Conference on Quality, Reliability and Security (QRS), 2015.
- Selected Technical Program Committee member (excluding PC chair roles)
 - IEEE International Conference on Dependable Systems and Networks (DSN), 2010-2012, 2015-2021.
 - IEEE International Symposium on Software Reliability Engineering (ISSRE), 2012, 2016-2019. 2020 (Program Board member)
 - IEEE International Symposium on Parallel and Distributed Systems (IPDPS), 2021.
 - IEEE International Conference on Rebooting Computing (ICRC), 2020.
 - IEEE International Conference on Distributed Computing Systems (ICDCS), 2020, 2021.
 - IEEE International Conference on Parallel Processing (ICPP), 2020, 2021.

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- ACM International Conference on High-Performance and Distributed Computing (HPDC), 2019-2021.
- IEEE/ACM International Conference on Automated Software Engineering (ASE), 2019 (Reliable, Rapid Response Reviewer).
- IEEE/ACM International Conference on Design Automation (DAC), 2018.
- International Conference on Computer Safety, Reliability and Security (SafeComp), 2016.
- IEEE International Conference on Cloud Computing (Cloud), 2015, 2016.
- IEEE International Online Testing Symposium (IOLTS), 2014, 2015.
- IEEE International High Assurance Systems Symposium (HASE), 2010-2017.
- IEEE Workshop on Silicon Errors in Logic, System Effects (SELSE), 2011-2014.
- European Dependable Computing Conference (EDCC), 2017-2021.
- IEEE Pacific Rim International Symposium on Dependable Computing (PRDC), 2012, 2015-2017.
- Panel for selection of best papers for the ACM International Conference on High-Performance and Distributed Computing (HPDC), 2020.
- Expert Panel of Special issue of Journal of Software Systems (JSS), to select the best papers from ISSRE 2016.
- Reviewer for the following journals:
 - IEEE Transactions on Dependable and Secure Computing (TDSC)
 - ACM Journal on Emerging Technologies in Computing (JETC)
 - IEEE Transactions on Computers
 - IEEE Transactions on CAD (TCAD)
 - IEEE Transactions on Cloud Computing
 - IEEE Transactions on Software Engineering (TSE)
 - Journal on Software Testing and Verification (STVR).
- External examiner:
 - Bushara Aloraini, PhD, University of Waterloo, September 2020.
 - Bin Nie, PhD, College of William and Mary, April 2019.
 - Oliver Schwan, PhD, TU Darmstadt, March 2019.
 - Mohammad Shahrear Iqbal, PhD, Queens University, November 2017.
 - K. R. Sekar, PhD, Sastra University, India. May 2016.
 - Jonah Kaplan, MAsc, McGill University, Canada. December 2015.
- Consulting activities (only selected activities are listed)
 - Los Alamos National Labs (LANL), January 2018 to February 2018.
 - Futurewei, a wholly owned subsidiary of Huawei, June 2016 to August 2016.
- Internal Service (UBC/ECE department): Space Committee (2011), Scholarship Committee (2012, 2013, 2014 – chair, 2019), Graduate Experience Committee (2013), Merit/PSA Committee (2013), Curriculum Committee (2015, 2016), Research Facilities Support Grant Committee (2017), External awards committee (2018, 2020), Faculty recruiting Committee (2018, 2019): Software Engineering and Systems position, Peer evaluation of teaching committee (2020).
- Professional Engineer (P.Eng.) registered with the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC), Canada, since 2011.

Teaching Accomplishments

I have taught 10 courses at UBC, four of which I created from scratch (CPEN400A, EECE571K, EECE571R, and EECE571P). CPEN400A is one of the most popular electives in the department, and has the highest registration among all ECE electives with over 120 students (based on enrolment numbers as of September 2020). I have also won 2

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Teaching and Learning Enhancement Grants (2011, 2012) from UBC as co-PI for improving the undergraduate curriculum. The first one was for incorporating concurrency, and the second one was for incorporating cloud computing. Teaching evaluation scores from the last time I taught each course are provided out of 5.0, based on the answer to the question “Overall, the instructor was an effective teacher” (mean value).”

1. Undergraduate courses (total of 5 courses taught over 6 years)
 - a. Software Engineering (EECE 310) – Taught three times (Score: 4.0)
 - b. Software Design (EECE 309/210) – Taught twice (Score: 4.0)
 - c. Software Architecture (EECE 417) – Taught twice (Score: 3.8)
 - d. Operating Systems (EECE 315) – Taught once (Score 4.4)
 - e. Building Modern Web Applications (CPEN 400A) – Created, and Taught four times (Score: 4.2)
2. Graduate Courses (total of 4 courses)
 - a. Design of Fault-tolerant Systems (EECE 513) – Taught three times (Score: 4.2)
 - b. Program Analysis and Optimization (EECE 571P) – Created and Taught three times (Score: 4.4)
 - c. Error Resilient Computing Systems (EECE 513) – Created and Taught twice (Score: 4.5)
 - d. Security and Reliability of Internet of Things (EECE 571K/R) – Created and Taught thrice (Score: 4.5)
 - e. Dependable and Secure Autonomous Systems (EECE 571P) - Created and taught once (Score: 4.9)
3. Other: Taught in the Vancouver Summer Programme (VSP), a UBC-affiliated institute for 1 month intensive course on “Principles of the Modern Internet”, along with a colleague. July-August, 2017, 2018, and 2019.

Research Accomplishments

1. **Good Enough Dependability:** This has been the mainstay of my research programme at UBC since I joined in 2010. Together with my students, I proposed the idea of trading off protection overhead for fault coverage in applications by systematically modeling error propagation, and reasoning about which errors are the most impactful. Prior to this approach, the default approach was “all-or-nothing” protection, which was used only in a few highly critical systems such as banking and healthcare, due to its high cost. In contrast, the good enough approach can be customized based on the application’s needs. Our main contribution has been to identify the important portions of an application for protection using both analytical modeling and empirical techniques, without requiring any support from the programmer. The good enough approach has since become the mainstream approach for dependability, and has been adopted by many companies as well. This line of work has received a best-paper nomination at DSN’18, and a distinguished paper award at EDCC’16.
2. **Empirical Studies of Reliability:** Along with my graduate students and colleagues at MSR and UBC, I pioneered the area of empirical studies of JavaScript-based web applications’ reliability. Our papers in this area showed that even mature, production websites exhibit significant numbers of JavaScript errors, and that the majority of these errors are caused by the interaction of the JavaScript code with the Document Object Model (DOM). The latter result flies in the face of conventional wisdom which rules that JavaScript errors occur due to the loosely typed nature of the language. This work has shaped many of the web application engineering tools we have since developed and released. We also performed empirical studies of cloud application reliability, which received an impact paper award at ISSRE’14.
3. **Fault Injectors:** My group at UBC has developed many fault injectors to evaluate the error resilience of programs. One of our main products in this space is LLFI, a fault injector based on the LLVM compiler that is highly configurable and allows easy mapping of the fault propagation results to the program’s code. LLFI supports a wide variety of failure modes in hardware and software, and is used by both researchers and

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industry. For example, Cisco Systems funded a project to adopt LLFI in their internal quality assurance process. It has also been used by IBM Research and Nvidia. Another fault injector developed by our group, GPU-Qin, to evaluate the error resilience of GPGPU applications, has been used by academic research groups, national labs, and industry research labs such as Nvidia and AMD.

4. **Tools for web application engineering:** We have developed a number of tools and techniques for web applications' engineering based on the insights from our empirical studies. These have been published in top-tier international venues, and are being used by other researchers in the area. One such tool, Clematis, developed in collaboration with the SALT Lab at UBC, has won the SIGSOFT distinguished paper award at ICSE'14. We have also won best paper nominations/runner-up awards at ICST'12, and ICST'13.
5. **Internet of Things (IoT) Security:** In this line of work, we have developed a systematic framework for reasoning about the security of IoT devices such as smart meters, insulin pumps, drones etc. We have built a formal model for capturing the key behavioral properties of an IoT device, and then use the model to drive automated attack generation against the device. We have also built intrusion detection systems (IDSes) to efficiently detect attacks against IoT devices. This work has received a distinguished paper award at EDCC'15, and has received significant media coverage (see Press).
6. **Dependability of Machine Learning:** This is also a recent area I have been exploring with my students and colleagues at Nvidia and Los Alamos National Labs. We investigate the resilience of Machine Learning (ML) algorithms deployed on special purpose hardware platforms to soft errors. Our paper on the reliability of deep neural network (DNN) accelerators has been adopted by Nvidia research in their product. We have also built a fault injection tool for ML programs written using the TensorFlow framework, called TensorFI, in collaboration with Los Alamos National Labs. Recently, we built BinFI, a tool for optimizing fault injections into ML programs deployed in safety-critical systems such as self-driving cars.

A more detailed research statement can be found on my homepage (<http://blogs.ubc.ca/karthik/>)

Selected Recent Talks (2010 to current)

- *Stopping the Barbarians at the Gate: Protecting End User Devices from Security Attacks,*
 - IFIP WG 10.4 workshop on Cyber-Physical Systems Security and Reliability, Italy. January 2020.
 - International Workshop on Governing Adaptive & Unplanned Systems of Systems (GauSS), 2020.
- *Error Resilient Machine Learning for Safety-critical Applications*
 - IOLTS 2020. Special session on Dependable Machine Learning (remote).
 - MLPerf working Group Meeting, March 2020 (remote).
 - IFIP WG 10.4 meeting on Machine learning dependability, June 2019.
 - Chinese University of Hong Kong, July 2019.
 - AMD Research, October 2019.
 - Workshop on Robust and Trustworthy Machine Learning, November 2019 (invited).
- *Resilience and Security in Cyber-Physical Systems: Self-Driving Cars and Smart Devices,*
 - Johns Hopkins University, March 2019.
 - University of Virginia, March 2019.
- *Error Resilience of Deep Neural Network Accelerators and Applications,* Trends in HPC Workshop, co-held with the HPDC PC meeting, Arlington, Virginia, March 2019.
- *Building Reliable Software for the Web, IoT and Beyond,*
 - Zhejiang University, China. May 2018.
 - Technische Universitat, Darmstadt, Germany, June 2018.

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- *Modeling Hardware Error Propagation In Programs for Low Cost Dependability*, Northeastern University, 2018.
- *Resilience & Security of Cyber-Physical Systems: Self-Driving Cars and Smart Devices*, Microsoft Research, 2017.
- *Tolerating Hardware Faults in Commodity Software: Problems, Solutions and a Roadmap*, Workshop on Silicon Errors in Logic, System Effects (SELSE), 2017, Boston, US. *Opening Keynote Talk*.
- *Why do Modern Web Applications Fail and What Can we Do About it?*
 - CS department, Univ of Utah, 2016.
 - CS department, Univ of Massachusetts, Amherst, 2018.
- *Security and Reliability of the Internet of Things: A Smart Meter Case Study*, Microsoft Research, 2016.
- *Does Error Resilience matter in the age of Approximate Computing?* Invited Panelist at Workshop on Silicon Errors in Logic, Systems Effects (SELSE), 2016 on “Resilience and Probabilistic Computing”.
- *Error Resilient Systems and Approximate Computing: Conjoined Twins Separated at Birth?* Dagstuhl workshop on Approximate and Probabilistic Computing, November 2015 (invited).
- *Good Enough Dependability: A new paradigm for Dependable Systems Design*,
 - Purdue University, West Lafayette, Indiana, November 2017.
 - University of Illinois at Urbana-Champaign, October 2017.
 - Indian Institute of Technology (IIT), Madras, August 2017.
 - Universitat De Polytechnica, Valencia (UPV), Jan 2017.
 - University of Virginia (U. Va.), March 2016.
 - University of Illinois at Chicago (UIC), Feb 2016.
 - Rutgers, State University of New Jersey, October 2016. ECE Colloquium.
 - Microsoft Research, August 2015.
 - University of Maryland (College Park), February 2015.
 - Technische Universität Darmstadt, November 2014.
- *Application-level Error Resilience: Tolerating Hardware Faults through Software Techniques*, Nvidia, 2015.
- *Good Enough Dependability: Providing Security and Reliability at Low Cost for Embedded Devices*, Qualcomm Research Silicon Valley, May 2015.
- *Helping Developers Understand, Analyze and Synthesize JavaScript Code in Web Applications*, Intel, May 2015.
- *Tolerating Silent Data Corruption (SDC) causing Hardware Faults through Software Techniques*,
 - Electrical and Computer Engineering, Georgia Tech, Computer Engineering Seminar, June 2014.
 - IBM T.J. Watson Research, New York, August 2014.
 - AMD Research, Boston, August 2014.
- *Invited Panelist: “Towards 21st Century High Assurance Engineering”*, 15th IEEE High Assurance System Engineering (HASE), 2014, Miami, Florida. (one of four panelists)
- *How I learned to Stop Worrying and Love the DOM*,
 - IFIP WG 2.4 Meeting, Victoria (April 2016)
 - Microsoft Research, Redmond (August, 2014)
 - Intel, Santa Clara (May 2013)
 - Microsoft Research, India (August 2013)
 - IBM Research, India (August 2013)
- *Why do Web Applications Fail and What can we do about it?*,
 - Intel, Santa Clara, September 2012.
 - CS department Colloquium, Queens University, August 2012.
 - ECE department, University of Illinois at Urbana-Champaign (UIUC), May 2012.
 - Microsoft Research, Redmond, June, 2011.

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- *Good Enough Software Systems: Tolerating (most) Hardware Errors in Software*,
 - o CS department Colloquium, University of Pittsburgh, Feb 2012.
 - o CS department Colloquium, McGill University, Montreal, Quebec, March 2011.
 - o IEEE Vancouver Computer Society Seminar, May 2010.

Press Coverage of Research

1. Drones and Rovers Security (December 2019)

- a. EurekAlert (https://www.eurekalert.org/pub_releases/2019-11/uobc-urh112719.php)
- b. TechXplore (<https://techxplore.com/news/2019-11-highlights-safeguard-drones-robotic-cars.html>)
- c. GlobalNews BC (<https://globalnews.ca/news/6235460/ubc-drone-hacking-research/>)
- d. Market Associates
(<https://themarketassociates.com/2019/12/03/the-need-to-secure-drones-and-automated-vehicles-against-cyber-attacks/>)
- e. HelpNet (<https://www.helpnetsecurity.com/2019/12/02/hacking-robotic-vehicles/>)
- f. SERENE RISC digest (September 2020)
https://www.serene-risc.ca/public/media/files/prod/page_files/11/14_SERENE-RISC-Vol3-Iss1.pdf

2. Smart meter security (June 2019)

- a. UBC (<https://news.ubc.ca/2019/06/06/ubc-researchers-find-ways-to-hackproof-smart-meters/>)
- b. TheStraight
(<https://www.straight.com/tech/1250511/smart-meters-your-home-are-target-hackers-says-ubc-researcher>)
- c. EurekAlert (https://www.eurekalert.org/pub_releases/2019-06/uobc-urf060519.php)
- d. E&T
(<https://eandt.theiet.org/content/articles/2019/06/system-developed-to-boost-smart-meter-resilience-to-cyber-attacks/>)
- e. ScienceDaily (<https://www.sciencedaily.com/releases/2019/06/190606101822.htm>)
- f. TechXplore (<https://techxplore.com/news/2019-06-ways-hackproof-smart-meters.html>)

Research Funding (Includes grants currently held and held in the past – amounts are specified in CAD¹)

1. Building Error-Resilient Applications on Many-Core Platforms, NSERC Discovery Grant, 2010-2015, \$120,000
2. Microsoft Research, Unrestricted Gift, 2010, \$17,000.
3. Teaching and Learning Enhancement Fund, University of British Columbia, 2011 (co-PI with 2 others), \$39,000.
NOTE: these grants are awarded on a competitive basis by UBC to enhance the undergraduate curriculum.
4. WATERS: A computational Infrastructure for Web Application Testing, Energy-Efficiency, Reliability and Security, Leaders Opportunity Funds (LOF), Canada Foundation for Innovation (CFI), 2011 (PI, 1 co-PI), \$280,000
5. Shared-memory Multiprocessor for Parallel Algorithms and Architectures, NSERC Research Tools and Infrastructure Grant (RTI), 2011. (Co-PI with six others). \$80,000.
6. Leveraging Dynamic Co-Processor Platforms for High-Performance Computing Applications, NSERC Engage Grant, 2011 (Sole PI). \$22,750. (Industry partner: Secodix, Vancouver).
7. Assessing the Error Reporting Capabilities of the Freescale QoRIQ Platform, NSERC Engage Grant, 2011 (Sole PI), 24,675. (Industry partner: Freescale).
8. Nokia Research, Unrestricted Gift, 2012. \$15,000.
9. Teaching and Learning Enhancement Fund, University of British Columbia, 2012 (co-PI, 1 PI) \$31,000.

¹ Unlike most US Government agencies, grant amounts from most Canadian Government agencies (e.g., NSERC) do not include overheads (i.e., indirect costs of research). Also, student fees are typically not included in the grant amounts, so grant sizes tend to be smaller as well.

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10. Automatic Code Partitioning for XPU Acceleration, MITACS Accelerate Grant, 2012 (Sole PI), \$30,000.
11. Hardening Software to Detect Hardware Faults, NSERC Engage Grant, 2012 (Sole PI). \$25,000. (Industry partner: Cisco).
12. Systematic Software Analysis and Maintenance Techniques for Web 2.0 Applications, NSERC Strategic Project Grant, 2012-2015 (Co-PI with three others), \$480,000. My share: \$120,000
13. Unifying Static and Dynamic Analysis Techniques for Checking Non-Functional Properties, Lockheed Martin Research Grant, 2012-2013 (Co-PI with four others), \$180,000.
14. Secure and Trusted Network Terminals for Smart vehicular Networks, DIVA Strategic Network Grant, 2010-2015 (Multiple PIs, my portion is \$20,000 a year).
15. Software Robustness Assessment through Fault Injection, Research Grant, Cisco Systems, 2013-2015 (Sole PI). \$120,000.
16. Hardware Fault Injection for GPGPU Applications, NSERC Engage Grant, 2013 (Sole PI). \$25,000. (Industry partner: AMD).
17. Nvidia Equipment Donation, 2013. \$3000 market value.
18. Programming Techniques for QUBO compatible processors II, MITACS Accelerate Grant (Sole PI), 2013. \$30,000. (Industry partner: 1-Qbit, Vancouver).
19. Intel, Unrestricted Gift, 2012-2016 (PI, one co-PI), \$270,000. My share: \$135,000. NOTE: The funding was awarded each year on a competitive basis for four years in a row.
20. AMD, Unrestricted gift, 2014. \$8000.
21. Building Error-Resilient Applications on Next Generation Computing Platforms, NSERC Discovery Grant, 2015-2020, \$250,000 (Awarded an additional Discovery Accelerator (DAS) Supplement of \$120,000 for 2015-2018).
22. Low-cost Security for Internet of Things (IoT) Security, NSERC Engage Grant, 2015 (Sole PI), \$25,000. (Industry partner: Sierra Wireless).
23. Error Propagation Analysis for GPGPU Applications, NSERC Engage Grant, 2015 (Sole PI), \$23,000. (Industry partner: Nvidia).
24. Automatic Secure Code Migration for the Web of Things, Intel Research, 2016-2019 (PI, 1 Co-PI). \$210,000. My share: \$105,000.
25. Error-Resilient Machine Learning Systems, NSERC Strategic Grant, 2017-2020 (Co-PI, 4 other co-PIs). \$720,000. My share: \$180,000
26. Designing Efficient and Resilient Deep Learning Accelerators using an AI Supercomputer, NSERC RTI Grant, 2018 (Co-PI, 4 other co-PIs). \$150,000. (Equipment grant)
27. Invariant-Driven Intrusion Detection System for Cyber-Physical Systems, NSERC Engage Grant, 2018. (Industry Partner: General Dynamics, Canada). \$25,000 (sole PI).
28. Automatic, Secure, Code Migration in the Heterogeneous world of the Internet of Things (IoT), NSERC CRD Grant, 2019-2022. (PI, Co-PI: 2 Others) \$254,400. My share: \$90,000.
29. Huawei-UBC AI System-On-Chip (SoC) Program, 2019. \$71,400 (sole PI).
30. Huawei-UBC Software Engineering Research Program, 2019. \$72,800 (sole PI).
31. Resilient, Secure, and Programmable Next-Generation Internet of Things (IoT), NSERC Discovery Grant, 2020-2025, \$240,000 (sole PI).
32. Unrestricted Gift, Intel Research, 2020. \$64,000 (sole PI).
33. Huawei-UBC Software Engineering Research Program, 2020. \$89,000 (PI, 1 co-PI).
34. NSERC Discovery Grants Department of National Defense (DND) Research Supplement. \$120,000 (sole PI). 2020-2023.

Publications (by type, in chronological order): Names of students and post-docs I have (co-)advised are bolded.

According to Google Scholar, my h-index=36 (https://scholar.google.ca/citations?user=p_V9YWgAAAAJ&hl=en)

Curriculum Vitae: Karthik Pattabiraman

(a) *Journals: In my area, conference papers are often more prestigious and rigorous than journal papers. Also, many journal papers are expanded versions of the conference papers – these are indicated below.*

- [1] *ThingsMigrate: Platform Independent Migration of Stateful JavaScript Applications*, **Kumseok Jung, Julien Gascon-Samson, Shivanshu Goyal, Armin Rezalean-Asel**, Karthik Pattabiraman, Wiley Journal of Software Practice and Experience (SPE). Acceptance Date: October 2020.
- [2] *An Empirical Study of the Impact of Single and Multiple Bit-Flip Errors in Programs*, **Behrooz Sangchoolie**, Karthik Pattabiraman and Johan Karlsson, IEEE Transactions on Dependable and Secure Computing (TDSC). Accept date: October 2020.
- [3] *Stealthy Attacks Against Robotic Vehicles Protected by Control-based Intrusion Detection Techniques*, **Pritam Dash, Mehdi Karimibuiki**, and Karthik Pattabiraman, To appear in the ACM Journal on Digital Threats: Research and Practice (DTRAP), 2020 .
- [4] *Improving the accuracy of IR-level Fault Injection*, **Lucas Palazzi, Guanpeng Li, Bo Fang**, and Karthik Pattabiraman, IEEE Transactions on Dependable and Secure Computing (TDSC). Accept date: February 2020.
- [5] *Design-Level and Code-Level Security Analysis of IoT Devices*, **Farid Molazem Tabrizi** and Karthik Pattabiraman, ACM Transactions on Embedded Computing Systems (TECS). Accept date: January 2019. **Won Best Paper Award.**
- [6] *Configurable Detection of SDC-causing Errors in Programs*, **Qining Lu, Guanpeng Li**, Karthik Pattabiraman, Meeta Gupta and Jude Rivers, ACM Transactions on Embedded Computing Systems (TECS), 2017.
- [7] *A Study of Causes and Consequences of Client-Side JavaScript Bugs*, **Frolin Ocariza, Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, IEEE Transactions on Software Engineering (TSE), 2016.
- [8] *A Systematic Methodology for Evaluating the Error Resilience of GPGPU Applications*, **Bo Fang**, Karthik Pattabiraman, Matei Ripeanu, and Sudhanva Gurumurthi, IEEE Transactions on Parallel and Distributed Systems (TPDS). Accept date: December 2015.
- [9] *Understanding JavaScript Event-Based Interactions with Clematis*, **Saba Alimadadi**, Ali Mesbah and Karthik Pattabiraman, ACM Transactions on Software Engineering and Methodology (TOSEM), 2016.
- [10] *Error Detector Placement for Soft-Computing Applications*, **Anna Thomas** and Karthik Pattabiraman, ACM Transactions on Embedded Computing Systems (TECS), 2016.
- [11] *Automatic Fault Localization for Client-Side JavaScript*, **Frolin Ocariza, Guanpeng Li**, Karthik Pattabiraman and Ali Mesbah, Journal of Software Testing, Verification and Reliability (STVR), 2015.
- [12] *Guided Mutation Testing for JavaScript Web Applications*, **Shabnam Mirshokraie**, Ali Mesbah and Karthik Pattabiraman, IEEE Transactions on Software Engineering (TSE), 41(5), 429-444 (2015).
- [13] *Characterizing the Impact of Intermittent Hardware Faults on Programs*, **Layali Rashid**, Karthik Pattabiraman and Sathish Gopalakrishnan, IEEE Transactions on Reliability (TR), [64\(1\)](#): 297-310, 2015.
- [14] *Modular Protections against Non-control Data Attacks*, Cole Schlesinger, Karthik Pattabiraman, Nikhil Swamy, David Walker, and Benjamin Zorn, Journal of Computer Security (JCS), [22\(5\)](#): 699-742, 2014. **Invited as one of the best papers from CSF'11.**
- [15] *SymPLFIED: Symbolic Program Level Fault Injection and Error Detection*, Karthik Pattabiraman, Nitin Nakka, Zbigniew Kalbarczyk and Ravishankar K Iyer, IEEE Transactions on Computers (TC). 62(11), 2013.

Curriculum Vitae: Karthik Pattabiraman

- [16] *Efficient Runtime Detection and Toleration of Asymmetric Races*, Paruj Ratanaworabhan, Martin Burtscher, Darko Kirovski, Benjamin Zorn, Rahul Nagpal, Karthik Pattabiraman, IEEE Transactions on Computers (TC), 61(4), 2012.
- [17] *Automated Derivation of Application-specific Error Detectors using Dynamic Analysis*, Karthik Pattabiraman, Giacinto Paolo Saggese, Daniel Chen, Zbigniew Kalbarczyk and Ravishankar Iyer, IEEE Transactions on Dependable and Secure Computing (TDSC), 8(5), 2011.
- [18] *Automated Derivation of Application-aware Error Detectors using Static Analysis*, Karthik Pattabiraman, Zbigniew Kalbarczyk and Ravishankar Iyer, IEEE Transactions on Dependable and Secure Computing (TDSC), 8(1), 2011.
- (b) *Conference Proceedings (Acceptance rates provided where known: see note above): Publications in tier-1 conferences are indicated with a '*'. These are highly competitive venues with low acceptance rates.*
- [19] *TensorFI: A Flexible Fault Injection Framework for TensorFlow Applications*, **Zitao Chen, Niranjhana Narayanan, Bo Fang, Guanpeng Li**, Karthik Pattabiraman, and Nathan DeBardeleben, Proceedings of the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2020. (Acceptance Rate: 25.6%).
- [20] *How Far Have We Come in Detecting Anomalies in Distributed Systems? An Empirical Study with a Statement-level Fault Injection Method*, **Yong Yang**, Yifan Wu, Karthik Pattabiraman, Long Wang, and Ying Li, Proceedings of the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2020. (Acceptance Rate: 25.6%).
- [21] **GPU-TRIDENT: Efficient Modeling of Error Propagation in GPU Programs*, **Abdul Rehman Anwer, Guanpeng Li**, Karthik Pattabiraman, Michael Sullivan, Timothy Tsai and Siva Hari. Proceedings of the IEEE/ACM International Conference for High-Performance Computing, Storage and Networking (SC), 2020. (Acceptance Rate: 25.1%).
- [22] **How Effective are Smart Contract Analysis Tools? Evaluating Smart Contract Static Analysis Tools Using Bug Injection*, **Asem Ghaleb** and Karthik Pattabiraman, Proceedings of the ACM International Conference on Software Testing and Analysis (ISSTA), 2020. (Acceptance Rate: 26%). **Artifacts Functional Badge from ACM.**
- [23] **Trace Sanitizer: Eliminating the Effects of Non-Determinism on Error Propagation Analysis*, Habib Saissi, Stefan Winter, Oliver Schwan, **Karthik Pattabiraman**, and Neeraj Suri, Proceedings of IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2020. (Acceptance Rate: 16.5%).
- [24] *Out of Control: Stealthy Attacks on Robotic Vehicles Protected by Control-Based Techniques*, **Pritam Dash, Mehdi Karimibuiki**, and Karthik Pattabiraman, Proceedings of the Annual Computer Security Applications Conference (ACSAC), 2019. (Acceptance Rate: 22.6%). **Artifacts Reusable Badge from ACM.**
- [25] *A tale of two injectors: An end-to-end comparison of IR-level and Assembly-level Fault Injection*, **Lucas Palazzi, Guanpeng Li, Bo Fang**, and Karthik Pattabiraman, Proceedings of the IEEE International Conference on Software Reliability Engineering (ISSRE), 2019. (Acceptance Rate: 31.5%).
- [26] **BinFI: An Efficient Fault Injector for Safety-Critical Machine Learning Systems*, **Zitao Chen, Guanpeng Li**, Karthik Pattabiraman, and Nathan DeBardeleben, Proceedings of the IEEE/ACM International Conference for High-Performance Computing, Storage and Networking (SC), 2019. (Acceptance Rate: 21%). **Finalist for SC 20 reproducibility challenge (one of three papers).**
- [27] *BonVoision: Leveraging Spatial Data Smoothness for Recovery from Memory Soft Errors*, **Bo Fang**, Karthik Pattabiraman, Matei Ripeanu and Sriram Krishnamoorthy, Proceedings of the ACM International Conference on Supercomputing (ICS), 2019. (Acceptance Rate: 23.2%).
- [28] *Failure Prediction in the Internet of Things due to Memory Exhaustion*, **Mohammad Rafiuzzaman, Julien Gascon-Samson**, Karthik Pattabiraman, and Sathish Gopalakrishnan, Proceedings of the ACM/SIGAPP Symposium

Curriculum Vitae: Karthik Pattabiraman

on Applied Computing (SAC), 2019. Dependable, Adaptive and Secure Distributed Systems Track. (Acceptance rate: 27.5%).

- [29] *DynPolAC: Dynamic Policy-based Access Control for IoT Systems*, **Mehdi Karimibuiki, Ekta Aggarwal**, Karthik Pattabiraman, and Andre Ivanov, Proceedings of the IEEE International Conference on Pacific Rim Dependable Computing (PRDC), 2018. (Acceptance Rate: 45%).
- [30] *ThingsMigrate: Platform-Independent Migration of Stateful JavaScript IoT Applications*, Julien Gascon-Samson, Kumseok Jung, Shivanshu Goyal, Armin Rezalean-Asel, Karthik Pattabiraman, Proceedings of the European Conference on Object Oriented Programming (ECOOP), 2018. (Acceptance Rate: 39%).
- [31] **Modeling Soft Error Propagation in Programs*, **Guanpeng Li**, Karthik Pattabiraman, Siva Hari, Michael Sullivan and Timothy Tsai, Proceedings of the IFIP/IEEE International Conference on Dependable Systems and Networks (DSN), 2018 (Acceptance rate for regular papers: 25%). **Best Paper Award Nominee (1 of 3)**.
- [32] **Modeling Input-Dependent Error Propagation in Programs*, **Guanpeng Li, and** Karthik Pattabiraman, Proceedings of the IFIP/IEEE International Conference on Dependable Systems and Networks (DSN), 2018 (Acceptance rate for regular papers: 25%).
- [33] **Inferring Hierarchical Motifs from Execution Traces*, **Saba Alimadadi**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the ACM/IEEE International Conference on Software Engineering (ICSE), 2018 (Acceptance Rate: 21%).
- [34] **Detecting Unknown Inconsistencies in Web Applications*, **Frolin Ocariza**, Karthik Pattabiraman, and Ali Mesbah, Proceedings of the ACM/IEEE International Conference on Automated Software Engineering (ASE), 2017. (Acceptance Rate: 21%).
- [35] **Understanding Error Propagation in Deep Learning Neural Network (DNN) Accelerators and Applications*, **Guanpeng Li**, Siva Hari, Michael Sullivan, Timothy Tsai, Karthik Pattabiraman, Steve Keckler, and Joel Emer, Proceedings of the International Conference for High-Performance Computing, Storage and Networking (SC), 2017. (Acceptance Rate: 19%).
- [36] **ARTINALI: Dynamic Invariant Detection for Cyber-Physical System Security*, **Maryam Raiyat Aliabadi, Amita Kamath, Julien Gascon-Samson**, and Karthik Pattabiraman, Proceedings of the ACM SIGSOFT Symposium on Foundations of Software Engineering (FSE), 2017. (Acceptance Rate: 24.5%).
- [37] **LetGo: A Lightweight Continuous Framework for HPC Applications Under Failures*, **Bo Fang**, Qiang Guan, Nathan Debardeleben, Karthik Pattabiraman, and Matei Ripeanu, Proceedings of the ACM International Symposium on High-Performance Parallel and Distributed Computing (HPDC), 2017. (Acceptance Rate: 19%).
- [38] **One Bit is (Not) Enough: An Empirical Study of the Impact of Single and Multiple Bit Flip Errors*, **Behrooz Sangchoolie**, Karthik Pattabiraman and Johan Karlsson, Proceedings of the IEEE International Conference on Dependable Systems and Networks (DSN), 2017. (Acceptance Rate: 23%).
- [39] *IPA: Error Propagation Analysis of Multi-Threaded Programs Using Likely Invariants*, **Abraham Chan**, Stefan Winter, Habib Saissi, Karthik Pattabiraman and Neeraj Suri, Proceedings of the IEEE International Conference on Software Testing, Verification and Validation (ICST), 2017. (Acceptance Rate: 27%).
- [40] *Formal Security Analysis of Smart Embedded Systems*, **Farid Molazem Tabrizi** and Karthik Pattabiraman, Proceedings of the Annual Computer Security Applications Conference (ACSAC), 2016. (Acceptance Rate: 23%).
- [41] **Understanding Error Propagation in GPGPU Applications*, **Guanpeng Li**, Karthik Pattabiraman, Chen-Yong Cher and Pradip Bose, Proceedings of the International Conference for High-Performance Computing, Storage and Networking (SC), 2016. (Acceptance Rate: 18%).

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- [42] *Finding Resilience-Friendly Compiler Optimizations Using Meta-Heuristic Search Techniques*, **Nithya Narayanamurthy**, Karthik Pattabiraman and Matei Ripeanu, Proceedings of the European Dependable Computing Conference (EDCC), 2016. (Acceptance Rate: 41%). **Best Paper Award (1 of 3)**.
- [43] *FIDL: A Fault Injection Description Language for Compiler-Based Tools*, **Maryam Raiyat Ailabadi** and Karthik Pattabiraman, Proceedings of the 35th International Conference on Computer Safety, Reliability and Security (SafeComp), 2016. (Acceptance Rate: 35%)
- [44] **ePVF: An Enhanced Program Vulnerability Factor Methodology for Cross-Layer Resilience Analysis*, **Bo Fang, Qining Lu**, Karthik Pattabiraman, Matei Ripeanu and Sudhanva Gurumurthi, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2016. (Acceptance Rate: 21%).
- [45] *Atrina: Inferring Unit Oracles from GUI Test Cases*, **Shabnam Mirshokraie**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the IEEE International Conference on Software Testing, Verification and Validation (ICST), 2016. (Acceptance Rate: 27%)
- [46] **Understanding Asynchronous Interactions in Full-Stack JavaScript*, **Saba Alimadadi**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the IEEE/ACM International Conference on Software Engineering (ICSE), 2016. (Acceptance Rate: 19%)
- [47] *Experience Report: An Application-Specific Checkpointing Technique for Minimizing Checkpoint Corruption*, **Guanpeng Li**, Karthik Pattabiraman, Chen-Yong Cher and Pradip Bose, Proceedings of the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2015. (Acceptance Rate: 32%)
- [48] **Synthesizing Web Element Locators*, **Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the IEEE/ACM International Conference on Automated Software Engineering (ASE), 2015. (Acceptance Rate: 20.6%)
- [49] *Flexible Intrusion Detection Systems for Memory-Constrained Embedded Systems*, **Farid Tabrizi** and Karthik Pattabiraman, Proceedings of the 11th European Conference on Dependable Computing (EDCC), 2015. (Acceptance Rate: 46%). **Distinguished paper award – one of three from 54 submissions**.
- [50] **Hybrid Change-Impact Analysis for JavaScript Applications*, **Saba Alimadadi**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the European Conference on Object Oriented Programming (ECOOP), 2015. (Acceptance rate: 22.8%)
- [51] **Fine Grained Characterization of Faults Causing Long Latency Crashes in Programs*, **Guanpeng Li, Qining Lu**, and Karthik Pattabiraman, Proceedings of the IEEE/IFIP International Conference on Dependable Systems (DSN), 2015. (Acceptance Rate: 22.5%)
- [52] *JSEFT: Automated JavaScript Unit Test Generation*, **Shabnam Mirshokraie**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the IEEE International Conference on Software Testing, Verification and Validation (ICST), 2015. (Acceptance Rate: 25%). **Invited as one of the best papers in the conference to the Journal on Software Testing and Verification (STVR)**.
- [53] **Finding Inconsistencies in JavaScript MVC Applications*, **Frolin Ocariza**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the IEEE/ACM International Conference on Software Engineering (ICSE), 2015. (Acceptance Rate: 18.5%)
- [54] *Failure Analysis of Jobs in Compute Clouds: A Google Cluster Case Study*, **Xin Chen**, Charng-da Lu and Karthik Pattabiraman, Proceedings of the 25th IEEE International Symposium on Software Reliability Engineering (ISSRE), 2014. (Acceptance rate: 25%). **Chosen as one of the “highlights of ISSRE” – one of 26 papers chosen from over 1000 papers in the 30 year history of the ISSRE conference (in 2019)**.

Curriculum Vitae: Karthik Pattabiraman

- [55] **DOMpletion: DOM-Aware JavaScript Code Completion*, **Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the ACM International Conference on Automated Software Engineering (ASE), 2014. (Acceptance Rate: 20%)
- [56] **SDCTune: A Model for Predicting the SDC Proneness of an Application for Configurable Protection*, **Qining Lu**, Karthik Pattabiraman, Meeta S. Gupta and Jude A. Rivers, International Conference on Compilers, Architecture and Synthesis for Embedded Systems (CASES), 2014. (Acceptance Rate: 30%)
- [57] **Integrated Hardware-Software Diagnosis for Intermittent Hardware Faults*, **Majid Dadashi**, **Layali Rashid**, Karthik Pattabiraman and Sathish Gopalakrishnan, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2014. (Acceptance Rate: 30%)
- [58] **Quantifying the Accuracy of High-Level Fault Injection Techniques for Hardware Faults*, **Jiesheng Wei**, **Anna Thomas**, **Guanpeng Li**, and Karthik Pattabiraman, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2014. (Acceptance Rate: 30%)
- [59] **Vejovis: Suggesting Fixes for JavaScript Faults*, **Frolin Ocariza**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the IEEE/ACM International Conference on Software Engineering (ICSE), 2014, Hyderabad, India (Acceptance Rate: 20%).
- [60] **Understanding JavaScript Event-Based Interactions*, **Saba Alimadadi**, **Sheldon Sequira**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the IEEE/ACM International Conference on Software Engineering (ICSE), 2014, Hyderabad, India (Acceptance Rate: 20%). **ACM SIGSOFT Distinguished Paper Award (9 of nearly 500 submissions)**.
- [61] *Mining Questions Asked by Web Developers*, **Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the 11th Working Conference on Mining Software Repositories (MSR), 2014. (Acceptance Rate: 34%)
- [62] *GPU-Qin: A Methodology for Evaluating the Error Resilience of GPGPU Applications*, **Bo Fang**, Karthik Pattabiraman, Matei Ripeanu and Sudhanva Gurusurthi, Proceedings of the IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS), 2014. (Acceptance Rate: 30%).
- [63] *Model-based Intrusion Detection for Smart Meters*, **Farid M. Tabrizi** and Karthik Pattabiraman, Proceedings of the IEEE International Symposium on High Assurance Systems Engineering (HASE), 2014. Miami, USA (Acceptance rate: 30%).
- [64] **Pythia: Generating Test Cases with Oracles for JavaScript Applications*, **Shabnam Mirshokraie**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the ACM/IEEE International Conference on Automated Software Engineering (ASE), New Ideas Track, 2013. October 2013 (Acceptance rate: 23%).
- [65] *An Empirical Study of Client-Side JavaScript Bugs*, **Frolin Ocariza**, **Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, Proceedings of the IEEE International Symposium on Empirical Software Engineering and Measurement (ESEM), 2013 (Acceptance rate: 28 %).
- [66] **Error Detector Placement for Soft Computation*, **Anna Thomas** and Karthik Pattabiraman, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2013. (Acceptance Rate: 20%).
- [67] *Efficient JavaScript Mutation Testing*, **Shabnam Mirshokraie**, Ali Mesbah and Karthik Pattabiraman, Proceedings of the IEEE International Conference on Software Testing, Verification and Validation (ICST), 2013. (Acceptance Rate: 25 %). **Ranked as the second best paper (i.e., first runner up) at the conference of over 150 submissions.**
- [68] *Intermittent Hardware Errors Recovery: Modeling and Evaluation*, **Layali Rashid**, Karthik Pattabiraman and Sathish Gopalakrishnan, Proceedings of the International Conference on Quantitative Evaluation of Systems (QEST), 2012. (Acceptance rate: Unknown).

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- [69] **BlockWatch: Leveraging Similarity in Parallel Programs for Error Detection*, **Jiesheng Wei** and Karthik Pattabiraman, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2012 (Acceptance rate: 17%).
- [70] *AutoFlox: An Automatic Fault Localizer For JavaScript*, **Frolin Ocariza**, Karthik Pattabiraman and Ali Mesbah, IEEE International Conference on Software Testing, Verification and Validation (ICST), 2012. (Acceptance rate: 27%). **Nominated for best paper award (one of six), among more than 150 submissions.**
- [71] *JavaScript Errors in the Wild: An Empirical Study*, **Frolin Ocariza**, Karthik Pattabiraman and Benjamin Zorn, Proceedings of IEEE International Symposium on Software Reliability Engineering (ISSRE), 2011 (Acceptance Rate: 25%).
- [72] *Modular Protections against Non-control Data Attacks*, **Cole Schlesinger**, Karthik Pattabiraman, Nikhil Swamy, David Walker and Benjamin Zorn, Proceedings of the IEEE Computer Security Foundations (CSF) Symposium, 2011 (Acceptance Rate: 26%). **Invited for a special issue by Journal of Computer Security (JCS).**
- [73] **Flikker: Saving DRAM Refresh-power through Critical Data Partitioning*, **Song Liu**, Karthik Pattabiraman, Thomas Moscibroda and Benjamin Zorn, Proceedings of the ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), 2011. (Acceptance Rate: 20%).
- [74] *Modeling the Propagation of Intermittent Hardware Faults in Programs*, **Layali Rashid**, Karthik Pattabiraman and Sathish Gopalakrishnan, Proceedings of the IEEE Pacific Rim International Symposium on Dependable Computing (PRDC), 2010. (Acceptance rate: 41.5%).
- [75] *DoDOM: Leveraging DOM Invariants for Robustness Testing of Web 2.0 Applications*, **Karthik Pattabiraman** and Benjamin Zorn, Proceedings of the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2010. (Acceptance rate: 32 %).
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- [77] *Discovering Application-level Insider attacks using Symbolic Execution*, Karthik Pattabiraman, Nithin Nakka, Zbigniew Kalbarczyk and **Ravishankar Iyer**, Proceedings of the IFIP International Information Security Conference (SEC), 2009. (Acceptance Rate: 22%).
- [78] *ToleRace: Detecting and Tolerating Asymmetric Races*, **Paruj Ratanaworabhan**, Martin Burtscher, Darko Kirovski, Benjamin Zorn, Karthik Pattabiraman and Rahul Nagpal, Proceedings of the ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP), 2009. (Acceptance Rate: 24%).
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- [82] **Processor-level Selective Replication*, **Nithin Nakka**, Karthik Pattabiraman and Ravishankar Iyer, Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2007. (Acceptance Rate: 25%).

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- [84] *Application-Based Metrics for Strategic Placement of Detectors*, Karthik Pattabiraman, Zbigniew Kalbarczyk and Ravishankar Iyer, Proceedings of the IEEE Symposium on Pacific Rim Dependable Computing (PRDC), 2005. (Acceptance Rate: 36.5%).
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(c) *Selected Workshop Papers (Number of pages given, where applicable)*

- [87] *New Wine in an Old Bottle: N-Version Programming for Machine Learning Components*, **Arpan Gujarati**, Sathish Gopalakrishnan and Karthik Pattabiraman, To appear in the Proceedings of the International Workshop on Software Certification (WoSoCER), co-held with the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2020. (4 pages)
- [88] *Towards Predicting the Impact of Roll-Forward Failure Recovery for HPC Applications*, **Bo Fang**, Jieyang Chen, Karthik Pattabiraman, Matei Ripeanu, Sriram Krishnamoorthy, Fast abstract at the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2019. (2 pages).
- [89] *OneOS: IoT Platform based on POSIX and Actors*, **Kumseok Jung, Julien Gascon-Samson**, and Karthik Pattabiraman, 2nd Usenix workshop on Hot Topics in Edge Computing (HotEdge), 2019. (7 pages).
- [90] *Towards analytically evaluating the error resilience of GPU Programs*, **Abdul Rehman Anwer, Guanpeng Li, Karthik Pattabiraman, Siva Kumar Sastry Hari, Michael Sullivan and Timothy Tsai**, *IEEE Workshop on Silicon Errors in Logic, System Effects (SELSE)*, 2019. (6 pages).
- [91] *ThingsJS: Towards a Distributed and Self-Adaptable Cloud Edge Middleware*, **Julien Gascon-Samson, Kumseok Jung**, and Karthik Pattabiraman, Poster presentation at the ACM/IEEE Symposium on Edge Computing (SEC), 2018. (2 pages)
- [92] *ThingsMigrate - Platform-Independent Live-Migration of JavaScript Processes*, **Kumseok Jung, Julien Gascon-Samson**, and Karthik Pattabiraman, Demo presentation at the ACM/IEEE Symposium on Edge Computing (SEC), 2018. (2 pages)
- [93] *CORGIDS: A Correlation-based Generic Intrusion Detection System*, Ekta Aggarwal, Mehdi Karimbuiki, Karthik Pattabiraman and Andre Ivanov, 5th ACM International Workshop on Cyber-Physical System Security (CPS-SPC), co-located with the ACM International Conference on Computer and Communications Security (CCS), 2018. (11 pages)
- [94] *TensorFI: A Configurable Fault Injector for TensorFlow Applications*, Guanpeng Li, Karthik Pattabiraman, and Nathan DeBardeleben, 8th IEEE International Workshop on Software Certification (WoSoCER), 2018, co-located with the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2018.

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- [95] *SmartJS: Dynamic and Self-Adaptable Runtime Middleware for Next-Generation IoT Systems*, **Julien Gascon-Samson, Mohammad Rafiuzzaman** and Karthik Pattabiraman, Poster Paper, ACM SIGPLAN Conference on Systems, Programming, Languages and Applications: Software for Humanity (SPLASH) (2 pages).
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- [98] *Intrusion Detection Systems for Embedded Systems*, **Farid Molazem Tabrizi** and Karthik Pattabiraman, Doctoral student Symposium Track of the ACM Middleware Conference (Middleware), 2015. (6 pages).
- [99] *A Fault Injection Description Language (FIDL) for Compiler-based Tools*, **Maryam Raiyat**, Karthik Pattabiraman and Nematollah Bidokhti, Industry Track of the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2015. (1 page – refereed based on abstract)
- [100] *LED: Tool for Synthesizing Web Element Locators*, **Kartik Bajaj**, Karthik Pattabiraman and Ali Mesbah, Tools Track of the IEEE/ACM International Conference on Automated Software Engineering (ASE), 2015. (3 pages)
- [101] *LLFI: An Intermediate Code Level Fault Injector for Hardware Faults*, **Qining Lu, Mostafa Farahani, Jiesheng Wei, Anna Thomas** and **Karthik Pattabiraman**, Proceedings of IEEE International Conference on Quality, Reliability and Security (QRS), August 2015. Short paper. (6 pages)
- [102] *Failure Prediction of Jobs in Compute Clouds: A Google Cluster Case Study*, **Xin Chen**, Charng-da Lu and Karthik Pattabiraman, International Workshop on Reliability and Security Data Analysis (RSDA), 2014 (6 pages). Held in conjunction with the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2014. (6 pages)
- [103] *Soft-LLFI: A Comprehensive Framework for Software Fault Injection*, **Maryam Raiyat**, Karthik Pattabiraman and Nematollah Bidokhti, Industry Track of the IEEE International Symposium on Software Reliability Engineering (ISSRE), 2014.
- [104] *Evaluating the Error Resilience of Parallel Programs*, **Bo Fang**, Karthik Pattabiraman, Matei Ripeanu and Sudhanva Gurumurthi, Workshop on Fault Tolerance for High-Performance at Extreme Scale (FTXS), 2014 (6 pages). In conjunction with DSN 2014.
- [105] *Effect of Compiler Optimizations on the Error Resilience of Soft Computing Applications*, **Anna Thomas** and **Karthik Pattabiraman**, First Workshop on Algorithm and Application Error Resilience (AER), 2013, in conjunction with ICS 2013 (8 pages).
- [106] *Predicting Job Completion Times Using System Logs in Supercomputers*, **Xin Chen**, Charng-da Lu and Karthik Pattabiraman, IEEE Workshop on Reliable and Security Data Analysis (RSDA), 2013, in conjunction with DSN 2013 (6 pages).
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- [109] *Towards Building Error Resilient GPGPU Applications*, **Bo Fang, Jiesheng Wei**, Karthik Pattabiraman, Matei Ripeanu, 3rd IEEE Workshop on Resilient Architecture (WRA) in conjunction with MICRO 2012. (6 pages).
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- [112] *BlockWatch: Leveraging Similarity in Parallel Programs for Error Detection*, **Jiesheng Wei** and **Karthik Pattabiraman**, Workshop on Silicon Errors in Logic, System Effects (SELSE), 2012. (6 pages).
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- [118] *FPGA Hardware Implementation of Statically Derived Application-aware Error Detectors*, **Peter Klemperer**, Shelley Chen, Karthik Pattabiraman, Zbigniew Kalbarczyk and Ravishankar Iyer, Workshop on Dependable and Secure Nano-computing (WDSN), In conjunction with DSN 2007. (6 pages).
- [119] *Tolerance: Tolerating and Detecting Asymmetric Races (Position Paper)*, Rahul Nagpal, Karthik Pattabiraman, Darko Kirovski, Benjamin Zorn, Workshop on Software Tools for Multi-core Systems (STMCS), 2007 (4 pages), in conjunction with PPOPP 2007.
- [120] *Processor-level Selective Replication*, **Nithin Nakka**, Karthik Pattabiraman, Zbigniew Kalbarczyk, Ravishankar Iyer, Workshop on Silicon Errors in Logic, System Effects (SELSE), 2006. (6 pages).
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- (d) *Invited contributions (non-refereed or lightly refereed)*
- [122] *Error Resilient Machine Learning for Safety Critical Systems: Position Paper*, Karthik Pattabiraman, **Guanpeng Li**, and **Zitao Chen**, Special Session on Dependable Machine Learning, IEE International Online Testing Symposium (IOLTS), 2020.
- [123] *Fault Injection at the Instruction Set Architecture (ISA) Level*, Karthik Pattabiraman and **Guanpeng Li**, To appear as a chapter in the “*Cross Layer Reliability of Computer Systems*”, Editors: Giorgio De Natale, Dimitros Gizopoulos,

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- [124] *GPUS: Combining high-performance with high-reliability*, L. Bautista Gomez, F. Cappello, L. Carro, N. DeBardeleben, **B. Fang**, S. Gurumurthi, K. Pattabiraman, P. Rech, M. Sonza Reorda, Embedded tutorial paper Proceedings of the International Symposium on Design Automation and Test in Europe (DATE), 2014.
- [125] *Towards Application-aware Security and Reliability*, Ravishankar Iyer, Zbigniew Kalbarczyk, Karthik Pattabiraman, Wen-Mei Hwu, William Healey, Peter Klemperer and Reza Farivar, IEEE Security and Privacy (S&P) Magazine, Jan 2007. pages: 57- 62.

(e) Patents

- [126] *Critical Memory*, with Benjamin Zorn and Vinod Grover, Microsoft Corporation, 2011.
- [127] *Critical Memory using Replication*, with Benjamin Zorn, Vinod Grover, Microsoft Corporation, 2011.
- [128] *Providing Hardware Resources having Different Reliabilities for Use by an Application*, with Benjamin Zorn, Thomas Moscibroda and Song Liu, Microsoft Corporation, 2016.
- [129] *Leveraging On-Chip Variability*, Benjamin Zorn, Darko Kirovski, Ray Bittner, and Karthik Pattabiraman, Microsoft Corporation, 2016.

(f) Software Artifacts Released (Most of these are released under a BSD/MIT/Illinois open source license)

- [130] *LLFI*: A fault injector based on the LLVM compiler. Available:
<https://github.com/DependableSystemsLab/LLFI>
- [131] *GPU-Qin*: A fault injector for injecting faults into GPGPUs. Available:
<https://github.com/DependableSystemsLab/GPU-Injector>
- [132] *PINFI*: A fault-injector based on Intel's PIN tool for injecting faults into program binaries. Available:
<https://github.com/DependableSystemsLab/PINFI>
- [133] *AutoFlox*: Localize faults in JavaScript-based Web Applications. Available:
<http://ece.ubc.ca/~frolino/projects/autoflox/>
- [134] *VejoVis*: Suggest fixes for faults in JavaScript-based Web Applications. Available:
<http://ece.ubc.ca/~frolino/projects/vejoVis/>
- [135] *Clematis*: Enable understanding of JavaScript-based Web Applications. Available:
<http://salt.ece.ubc.ca/software/clematis/>
- [136] *Mutandis*: Perform mutation testing in JavaScript Web Applications. Available:
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- [137] *Pythia*: Generate Oracles for test cases in JavaScript Web Applications. Available:
<https://github.com/saltlab/Pythia>
- [138] *DOMpletion*: Enable automatic code completion in JavaScript Web Applications. Available:
<https://github.com/saltlab/dompletion>
- [139] *CrashFinder*: Find long-latency causing crash locations in Programs through Static Analysis. Available:
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- [140] *Aurebesh*: Find inconsistencies in MVC frameworks used in web applications. Available:
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- [141] *LED*: Synthesize JavaScript code for DOM interactions in web applications. Available:
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- [145] *LLFI-GPU*: Fault injection tool for GPUs at the LLVM IR level. Available:
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- [146] *ARTINALI*: Invariant detection for cyber-physical systems. Available:
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- [147] *Trident/vTrident*: Analytical model for SDC rate prediction of CPU programs. Available:
<https://github.com/DependableSystemsLab/Trident>
- [148] *DNNFI*: Fault injector for deep learning neural network Accelerator platforms. Available:
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- [149] *LLFI-IPA*: Invariant-based Error Propagation Analysis Framework. Available:
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- [150] *Sahand*: Understanding JavaScript Client-Server Asynchronous Interactions. Available:
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- [151] *Holocron*: Inconsistency Detection Tool for JavaScript MVC applications. Available:

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<https://github.com/DependableSystemsLab/Holocron>

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<https://github.com/saltlab/sabalan>

[153] LetGo: Roll-forward error recovery for parallel programs' crashes. Available:

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<https://github.com/DependableSystemsLab/DynPolAC>

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[158] BinFI: Binary Fault Injector TensorFlow Applications

<https://github.com/DependableSystemsLab/TensorFI-BinaryFI>

[159] ACSAC'19: Stealthy attacks against Robotic Vehicles found in our ACSAC'19 paper

<https://github.com/DependableSystemsLab/stealthy-attacks>

[160] TriInjectors: Results from our ISSRE'19 paper on fault injectors' comparison

<https://github.com/DependableSystemsLab/ISSRE19>

[161] SolidiFI: Solidity fault Injector from our ISSTA'20 paper

<https://github.com/DependableSystemsLab/SolidiFI>

[162] GPU-Trident: Analytical model for predicting the SDC rate of GPU programs

<https://github.com/DependableSystemsLab/GPU-Trident>

[163] SSFI: Statement level fault injector for Java Programs (used in our ISSRE'20 paper)

<https://github.com/alexvanc/ssfi/tree/multi-mode>

[164] PC Meeting Web Dashboard: For running physical PC meetings - used for DSN'19 , DSN'20 and HPDC'19.

<https://github.com/DependableSystemsLab/PCMeetingDashboard>