

RESEARCH INTERESTS

GPU architecture, reliability estimation and fortification, performance analysis, workload characterization of large-scale systems, reliability of HPC and large scale systems, simulation.

EDUCATION

Ph.D. in Computer Science

June 2022

Department of Computer Science
William & Mary, Williamsburg, VA
• Advisor: Prof. Evgenia Smirni

B.E. in Computer Science

June 2016

School of Computer Science and Technology
University of Science and Technology of China (USTC), Hefei, China
• Advisor: Prof. Bei Hua

PUBLICATIONS

X. Zhou, A. Schmedding, H. Ren, **L. Yang**, P. Schowitz, E. Smirni, H. Alemzadeh, “Strategic Safety-Critical Attacks Against an Advanced Driver Assistance System”, 52th IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), Practice Experience Report, to appear in 2022.

R. Pincioli, **L. Yang**, J. Alter, E. Smirni, “Lifespan and Failures of SSDs and HDDs: Similarities, Differences, and Prediction Models”, IEEE Transactions on Dependable and Secure Computing (TDSC), to appear in 2022

L. Yang, B. Nie, A. Jog, E. Smirni, “SUGAR: Speeding Up GPGPU Application Resilience Estimation with Input Sizing”, Proceedings of the ACM on Measurement and Analysis of Computing Systems (Sigmetrics) 2021, no. 1: 1-29. (Acceptance Rate: 12%) [PDF] [Video] [Slides]

L. Yang, B. Nie, A. Jog, E. Smirni, “Enabling Software Resilience in GPGPU Applications via Partial Thread Protection”, IEEE/ACM 43rd International Conference on Software Engineering (ICSE) 2021: pp. 1248-1259. (Acceptance Rate: 22%) [PDF] [Video] [Slides]

L. Yang, B. Nie, A. Jog, E. Smirni, “Practical Resilience Analysis of GPGPU Applications in the Presence of Single- and Multi-bit Faults”, IEEE Transactions on Computers, vol. 70, no. 1, pp. 30-44, 1 Jan. 2021. [PDF]

B. Nie, **L. Yang**, A. Jog, E. Smirni, “Fault Site Pruning for Practical Reliability Analysis of GPGPU Applications”, 51st Annual IEEE/ACM International Symposium on Microarchitecture (MICRO) 2018: pp. 749-761. (Acceptance Rate: 21%) [PDF] [Slides]

K. Zhang, B. He, J. Hu, Z. Wang, B. Hua, J. Meng, **L. Yang**, “G-NET: Effective GPU Sharing in NFV Systems”, 15th USENIX Symposium on Networked Systems Design and Implementation (NSDI) 2018: pp. 187-200. (Acceptance Rate: 16%) [PDF]

L. Yang, L. Cherkasova, R. Badgular, J. Blancaflor, R. Konde, J. Mills, E. Smirni, “Evaluating Scalability and Performance of a Security Management Solution in Large Virtualized Environments”,

Proceedings of the 2018 ACM/SPEC International Conference on Performance Engineering (ICPE): pp. 168-175. [PDF] [Slides]

Papers Under Submission

A. Schmedding, **L. Yang**, R. Pincioli, E. Smirni, “Epidemic Spread Modeling for COVID-19 Using Mobility Data”, Submitted to VLDB.

Refereed Posters

L. Yang, “Typhoon: Enabling GPGPU Application Resilience Estimation with Different Input Types”, ACM Sigmetrics Student Research Competition (SRC) 2021

L. Yang, A. Schmedding, R. Pincioli, E. Smirni, “Simulating COVID-19 Containment Measures Using the South Korean Patient Data”, Sensys 2020, COVID-19 Pandemic Research Poster Session.

PROFESSIONAL EXPERIENCE

Research Assistant

August 2017 - June 2022

Department of Computer Science, College of William & Mary, Williamsburg, VA

- *Accelerating GPGPU Application Resilience Estimation.*

Analyzed GPU applications by injecting faults across the application execution. Proposed single- and multi-bit fault site pruning to speed up GPGPU application resilience estimation with a tremendous reduction of fault sites by up to seven orders of magnitude.

- *Input-Aware GPGPU Application Error Resilience Estimation.*

- Conducted intensive and deep resilience characterization on GPGPU applications considering different input sizes. Proposed SUGAR (Speeding Up GPGPU Application Resilience Estimation with input sizing), a fast and accurate resilience estimation methodology for GPGPU applications with significant speedups (up to 1336 times) and 97.0 on the average.
- (Ongoing work) Examine the effect of input types on GPGPU application error resilience and explore methods to accelerate error estimation for different input types. Discovered a monotonic trend between resilience and the norm of the input matrix which can be used to estimate the resilience of different inputs.

- *Reliability-Aware GPGPU Application Fortification.*

Proposed a methodology that aimed to re-map threads with the same resilience characteristics to the same thread group and selectively protect unreliable thread groups with a significant reduction of $> 20\%$ execution cycles.

- *Comparison of Resilience Estimation Using Hardware- and Software-Level Fault Injection Tools.*

(Ongoing work) Conduct fault injection experiments using a hardware-level fault injector implemented in GPGPU-Sim 4.0 and the software-level fault injector NVBitFI. Compare application resilience obtained from these two fault injectors and identify vulnerable components in GPUs.

- *Domain-Specific Application Error Resilience Estimation and Fortification.*
 - (Ongoing work) Conduct reliability characterization of deep neural network models to understand the vulnerability of layers and neurons and explore low-overhead fortification mechanisms to protect DNN applications.
 - (Ongoing work) Perform fault injection campaign on autonomous vehicle systems to pinpoint the vulnerable components and safety-critical errors.
- *Reliability-Related Trace Analysis.*
Presented a comparative study of hard disk drives (HDDs) and solid state drives (SSDs) that constitute the typical storage in data centers and compared their similarities and differences. Developed several machine learning failure prediction models that are shown to be surprisingly accurate, achieving high recall and low false positive rates.
- *Epidemic Spread Modeling of Covid-19.*
Developed an individual-centric model and a flexible tool, GeoSpread, for COVID-19 spread in an urban setting. Validated the simulation predictions from GeoSpread with ground truth and evaluated different what-if counter-measure scenarios.

Teaching Assistant

August 2016 - May 2018

Department of Computer Science, William & Mary, Williamsburg, VA

- Computer Organization
- Network Systems and Design
- Simulation
- Introduction to Cryptography

Software Engineering Intern

May 2021 - August 2021

Facebook Inc, Menlo Park, CA

- Enhanced PyTorch distributed training benchmark.
- Enhanced PyTorch distributed communication library (c10d).

Reliability Intern

June 2019 - October 2019

IBM Corporation, Austin, TX

- Integrated benchmark testing into reliability platform to understand customer experience and reliability of IBM cloud.

Attendee in ACACES Summer School

July 2018

Fiuggi, Italy

- International Summer School on Advanced Computer Architecture and Compilation for High-Performance and Embedded Systems.
- Attended the poster session with poster “Error Site Pruning for Practical Reliability Analysis of GPGPU Applications”.

Software Engineering Intern

May 2017 - August 2017

Hytrust Inc, Mountain View, CA

- Design and implementation of a benchmark to measure the performance of VM operations.
- Found some design issues in the cloud environment from performance assessment.
- Built a large-scale virtualized environment supporting 50,000 VMs on 4 physical machines using VMware nested virtualization.

AWARDS

- W&M CS Graduate Park Award, 2022
- Student Travel Grant for DSN, 2022
- W&M International Student Opportunity Scholarship , 2021
- vGHC Students and Faculty Scholarship, 2021
- Student Travel Grant for MICRO, ICPE, and NSDI, 2018
- W&M OGSR Research Grant, 2018
- W&M Student Leadership Grant, 2018
- W&M CS Student Travel Grant, 2018
- Active Member in Social Practice, USTC, 2015
- Excellent Student Cadre, USTC, 2014
- Outstanding League Member, USTC, 2013
- Tenth Yang Ya Scholarship, USTC, 2013
- Second Prize in Essay Competition, USTC, 2013

SERVICE

- Program Committees, IPDPS 2023
- Organizing Committees, Sigmetrics 2023 (Publicity Chair)
- Session Chair & Poster Judge, ACM Capital Region Celebration of Women in Computing (CAPWIC) 2021 and 2022
- Sub-reviewer of Sigmetrics 2022, DSN 2022, DSN 2021, Sigmetrics 2021, Sigmetrics 2020, Performance 2020, ICPE 2020, Sigmetrics 2019, DSN 2019
- Member of WHPC-Virginia (Women in High Performance Computing in Virginia) and SWC-WM (Society of Women in Computing in William & Mary)
- Volunteer, HPDC 2019 Program Committee Meeting
- Mentor, HackViolet 2022

REFERENCES

- **Evgenia Smirni**, Sidney P. Chockley Professor, William & Mary. esmirni@cs.wm.edu
- **Adwait Jog**, Adina Allen Associate Professor, William & Mary. ajog@wm.edu
- **Dimitris Gizopoulos**, Professor, University of Athens. dgizop@di.uoa.gr
- **Yifan Sun**, Assistant Professor, William & Mary. ysun25@wm.edu