

### North Carolina State University

Ph.D. in Computer Science; Advisors: Dr. Xipeng Shen and Dr. Yan Solihin

Raleigh, North Carolina, USA

Aug. 2018 - Present

### Tsinghua University

M.E. in Computer Science; Advisor: Dr. Wei Xue

Beijing, China

Aug. 2015 - Jul. 2018

### Jilin University

B.E. in Software Engineering; Ranking: 3/332

Changchun, Jilin, China

Aug. 2011 - Jul. 2015

## Research Experience

### Computer Science Department, North Carolina State University

Raleigh, NC, USA

Research Assistant; Advisors: Dr. Xipeng Shen and Dr. Yan Solihin

Aug. 2018 - Present

#### • **Memory Exposure Reduction and Randomization for Persistent Memory Objects (ASPLOS 2020)**

- Proposed a new approach to reduce memory disclosure/corruption vulnerabilities by reducing memory exposure time using attachment and detachment of a persistent memory object (PMO).
- Designed a novel hardware support to efficiently attach/detach by embedding a page table subtree into a PMO.

#### • **Hardware Domain Virtualization for Intra-process Isolation of Persistent Memory Objects (ISCA 2020)**

- Proposed to use intra-process isolation to improve security of using PMOs.
- Designed an architecture support for efficient memory protection key (MPK) virtualization and domain virtualization, achieving 10X and 52X speedups over the state-of-art MPK virtualization.

#### • **Temporal Exposure Reduction-Based Protection for Persistent Memory (HPCA 2022)**

- Explored and formalizing semantics of temporal exposure reduction protection (TERP).
- Designed compiler and runtime system support to solve TERP adoption challenges

#### • **User-transparent Legacy Code Support for Persistent Memory (ISCA 2021)**

- Designed the sound persistent reference analysis, providing accurate analysis on various pointer manipulations.
- Designed simple and efficient architecture support to assist pointer distinguishing and manipulation.

#### • **Hardware-Based Address-Centric Acceleration of Key-Value Store (HPCA 2021)**

- Designed an address-centric accelerator with hardware and software support to reduce address translation overhead in key-value store systems.
- Leveraged the opportunities on the new tradeoffs between hashing complexities and overhead.

### Google

Research Intern & Student Researcher; Mentors: Dr. David E. Culler and Dr. Ravi Rajwar

Sunnyvale, CA, USA

May. 2021 - Present

#### • **Persistent Memory Enabling Transformative System Design Simplification**

- Designed efficient execution environment to fully utilize low latency durability from persistent memory.
- Abstracted interfaces from various application durable models to simply port applications by using our execution environment.

### Future Technologies Group, Oak Ridge National Laboratory

Research Assistant; Mentor: Dr. Mehmet E. Belviranli

Oak Ridge, TN, USA

May. 2019 - Aug. 2019

#### • **Hardware-Centric co-location Performance Modeling on Heterogeneous System-on-chip (MICRO 2021)**

- Built the fundamental understanding of memory contention on SoCs.
- Designed a novel processor-centric performance modeling methodology and a new three region interference-conscious performance model to capture memory contention effects.
- Predicted accurate memory contention effects, improving 70% accuracy over the state-of-the-art work.

### Computer Science Department, North Carolina State University

Research Assistant; Advisors: Dr. Xipeng Shen and Dr. Işıl Dillig

Raleigh, NC, USA

April. 2020 - April. 2021

#### • **Translating UDFs to SQL through Lazy Inductive Synthesis (OOPSLA 2021)**

- Achieved a good trade-off between expressiveness and scalability using a technique that we dub *lazy inductive synthesis*
- Implemented our method in a tool and evaluated it on real-world SQL queries with UDFs targeting the Spark system, showing synthesised programs significantly improves performance.

## Department of Computer Science, Tsinghua University

Research Assistant; Dr. Wei Xue

Beijing, China

Aug. 2015 - Jul. 2018

- **Performance Modeling and Optimization on the Heterogeneous Many-core Processor (IPDPS 2018, SC 16)**

- Built a purely static performance model of SW26010, the heterogeneous many-core processor that powers Sunway TaihuLight. This model achieves an average accuracy as high as 95% on 17 benchmarks from Rodinia.
- Designed a compiler auto-tuning tool from the model, reducing 97% tuning time with nearly optimal results.

## Computer Science Department, ETH Zurich

Research Assistant; Mentors: Prof. Torsten Hoefler and Dr. Tobias Grosser

Zurich, Switzerland

Apr. 2017 - Sep. 2017

- **Performance Model Generator**

- Developed a Domain-specific Language based on polyhedral model to generate performance models

## Publication

<b>HPCA 2022</b>	<b>Yuanchao Xu</b> , Chencheng Ye, Xipeng Shen, and Yan Solihin; “Temporal Exposure Reduction Protection for Persistent Memory”; The 28th IEEE International Symposium on High-Performance Computer Architecture, February 2022. <a href="#">Accepted, to appear</a>
<b>MICRO 2021</b>	<b>Yuanchao Xu</b> , Mehmet Esat Belviranili, Xipeng Shen and Jeffrey Vetter; “PCCS: Processor-Centric Contention Slowdown Model for Heterogeneous System-on-chips”; The 54th IEEE/ACM International Symposium on Microarchitecture, Online, October 2021. <a href="#">[Paper]</a> <a href="#">[Slides]</a>
<b>ICDM 2021</b>	Hui Guan, Umang Chaudhary, <b>Yuanchao Xu</b> , Lin Ning, Lijun Zhang, and Xipeng Shen; “Recurrent Neural Networks Meet Context-Free Grammar: Two Birds with One Stone”; The IEEE International Conference on Data Mining, Online, December 2021. <a href="#">[Paper]</a>
<b>OOPSLA 2021</b>	Guoqiang Zhang, <b>Yuanchao Xu</b> , Xipeng Shen, and Işıl Dillig; “UDF to SQL Translation through Compositional Lazy Inductive Synthesis”; The ACM SIGPLAN Object Oriented Programming Languages, Systems and Applications, Chicago, Illinois, October 2021. <a href="#">[Paper]</a>
<b>ISCA 2021</b>	ChenCheng Ye, <b>Yuanchao Xu</b> , Xipeng Shen, Xiaofei Liao, Hai Jin and Yan Solihin; “Supporting Legacy Libraries on Non-Volatile Memory: A User-Transparent Approach”; The 48th ACM/IEEE International Symposium on Computer Architecture, Online, June 2021. <a href="#">[Paper]</a>
<b>HPCA 2021</b>	ChenCheng Ye, <b>Yuanchao Xu</b> , Xipeng Shen, Xiaofei Liao, Hai Jin and Yan Solihin; “Hardware-Based Address-Centric Acceleration of Key-Value Store”; The 27th IEEE International Symposium on High-Performance Computer Architecture, Seoul, South Korea, February 2021. <a href="#">[Paper]</a>
<b>ISCA 2020</b>	<b>Yuanchao Xu</b> , ChenCheng Ye, Yan Solihin, Xipeng Shen; “Hardware-Based Domain Virtualization for Intra-Process Isolation of Persistent Memory Objects”; The 47th ACM/IEEE International Symposium on Computer Architecture, Valencia, Spain, June 2020. <a href="#">[Paper]</a> <a href="#">[Slides]</a>
<b>ASPLOS 2020</b>	<b>Yuanchao Xu</b> , Yan Solihin, Xipeng Shen; “MERR: Improving Security of Persistent Memory Objects via Efficient Memory Exposure Reduction and Randomization”; The 25th ACM International Conference on Architectural Support for Programming Languages and Operating Systems, Lausanne, Switzerland, March 2020. <a href="#">[Paper]</a> <a href="#">[Slides]</a>
<b>IPDPS 2018</b>	Shizhen Xu, <b>Yuanchao Xu</b> , Wei Xue, Xipeng Shen, Xiaomeng Huang, Guangwen Yang; “Taming the “Monster”: Overcoming Program Optimization Challenges on SW26010 Through Precise Performance Modeling”; The 32nd IEEE International Parallel and Distributed Processing Symposium, Vancouver, Canada, May 2018. <a href="#">[Paper]</a>

## Honors & Awards

2021	NCSU Computer Science Outstanding Research Award	US
2014	National Scholarships of China (highest scholarship for Chinese undergraduate)	China
2013	<b>Silver Medal</b> , ACM-ICPC Asia Regional Programming Contest	China

## Skills

<b>Programming Languages:</b>	C, C++, Rust, FORTRAN, Python, JAVA, MATLAB
<b>HPC Programming Models:</b>	OpenMP, MPI, CUDA, OpenACC
<b>Frameworks:</b>	TensorRT, LLVM, Spark, Hadoop
<b>Simulator:</b>	Sniper, Gem5, Ramulator