Siyuan Chai

CONTACT INFORMATION

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https://schai.me

EDUCATION

University of Illinois, Urbana Champaign, IL
Computer Science Ph.D. — Start Aug. 2021
Advisor: Prof. Tianyin Xu

Northwestern University, Evanston, IL
M.S. Computer Science, B.S. Electrical Engineering — Graduated June 2021
GPA: 4.0/4.0 (Summa Cum Laude)

SKILLS

Programming languages:
C/C++, Assembly, Python, Java, Go, JavaScript, MATLAB
System-level Development:
Unix/Linux, QEMU, Docker, GDB, Make, Linker, LLVM, OpenMP
Artificial Intelligence:
CUDA, PyTorch, Tensorflow, Keras, Image Processing, Computer Vision
Hardware:
Raspberry Pi, Arduino, VHDL, Verilog, 3D printing, SOLIDWORKS
Web Development:
HTML, CSS, Flask, Django, React

RESEARCH EXPERIENCE

UIUC Xlab, Prof. Tianyin Xu — Aug. 2021 to Present
Support Linux Kernel for Elastic Cuckoo Page Table

- Adapting Linux kernel, primarily the memory management portion, to support Elastic Cuckoo Page Table (ECPT), a hash page table that aims to replace paging by enabling memory-level parallelism
- Extensively modified memory translation portion of QEMU to simulate ECPT's hardware behavior
- Exploring the design space like page management, allocation and cache policy in linux running on ECPT

NU Compilers Group, Prof. Simone Campanoni — Jan. 2021 to July 2021
Enhance Parallelism by Utilizing Commutative Loop iterations

- Coded a LLVM pass to tell the commutativity of <load, ALU operation, store> triplet across loop iterations
- Extend the idea to develop tools for loop iteration commutativity for further utilization of parallelism

NU Parallelism Group, Prof. Peter Dinda — June 2020 to May 2021
CARAT CAKE: Replacing Paging via Compiler/Kernel Cooperation

- Designed and implemented CARAT CAKE, an allocation level address space which aims to replace virtual memory and paging with protection checks inserted at compile time and allocations tracked in runtime
- Implemented a competitive paging address space with support for red black tree and splay tree data structures to track VA-PA mapping, Transparent Huge Pages, and PCID; performance measured with Performance Monitoring Counter
- Designed runtime protection check with address mapping data structures

Image & Video Processing Lab, Prof. Aggelos Katsaggelos — June 2019 to July 2021
DeepCOVID-XR

- Designed and implemented a CNN model to flag out positive COVID cases based on patients' chest X-ray images

- Outperformed experienced radiologists with an accuracy of 85% compared to 76 - 82% and AUC of 0.935 compared to 0.819 - 0.856

Publications and Working Papers

1. Ramsey M Wehbe, Jiayue Sheng, Shinjan Dutta, **Siyuan Chai**, Amil Dravid, Semih Barutcu, Yunan Wu, Donald R. Cantrell, Nicholas Xiao, Hatice Savas, Rishi Agrawal, Nishant Parekh, Aggelos K. Katsaggelos. "Deepcovid-xr: An artificial intelligence algorithmto detect covid-19 on chest radiographs trained and tested on a large us clinical dataset." *Radiological Society of North America*. [Online]. Available: https://doi.org/10.1148/radiol.2020203511.

2. Brian Suchy, Souradip Ghosh, Aaron Nelson, Zhen Huang, Drew Kersnar, **Siyuan Chai**, Michael Cuevas, Gaurav Chaudhary, Alex Bernat, Nikos Hardavellas, Simone Campanoni, Peter Dinda. "CARAT CAKE: Replacing Paging via Compiler/Kernel Cooperation." *Submitted for ASPLOS 2022*.

Work Experience

Research Intern, Tencent Network Group — June 2021 to Aug. 2021

Service Driven Network Verification tool

- Contributed to design a scalable network verification that supports quantitative query and covers all data plane with global formal modeling and local simulation
- Designed easy-to-use geo-based intent language for network verification

Projects

C-style Language Compiler, CS 322 Compiler Construction

- Created, from scratch, a compiler to translate C-style language to x86_64 assembly
- Implemented features including graph-coloring register allocation, liveness analysis, instruction selection with tiling, control flow graph, and memory access checking

Middle End Analysis for a C-based API, CS 323 Code Analysis & Transformation

- Coded a LLVM pass to reduce calls to a custom C-based API by implementing analysis like reaching-definition, constant propagation and folding, alias analysis for the specific API, function inlining, and dead code elimination

Professional Activities

SOSP 2021: Artifact Evaluation Committee, Slack Co-chair

Teaching Experience

Peer Mentor (Undergraduate TA) - Northwestern University

Spring 2021	CS 336 - Design & Analysis of Algorithms	with Prof. Jason Hartline
Winter 2021	CS 343 - Operating Systems	with Prof. Peter Dinda
Winter 2020	CS 336 - Design & Analysis of Algorithms	with Prof. Konstantin Makarychev
Fall 2019	CS 336 - Design & Analysis of Algorithms	with Prof. Jason Hartline
Spring 2019	CS 336 - Design & Analysis of Algorithms	with Prof. Jason Hartline

Teaching Assistant - Washington University in St. Louis

Spring 2018	ESE 205 Introduction to Engineering Design	with Prof. James Feher

Awards and Honors

Dean's List, all quarters	2017 - 2021
ACM-ICPC, Mid-Central Regional, **Top 20%**	2018
VEX Robotics International Championship, **Top 4 Alliance**	2016