Siyuan Chai

Contact Information	siyuanchai2021@u.northwestern.edu https://schai.me
Research Interests	High-Performance Computing, Operating System, Systems for ML

Education

Northwestern University, Evanston, IL

B.S. Computer Science, B.S. Electrical Engineering   Expected: 2021
GPA: 4.0/4.0

Washington University in St. Louis, St. Louis, MO

B.S. Computer Science, B.S. Electrical Engineering   Transferred
GPA: 4.0/4.0

Research Experience

Research Assistant   Apr. 2020 to Present
Parallelism Group, Northwestern University
Advisor: Prof. Peter Dinda

KARAT: Replacing Paging in the Kernel via the Compiler and Runtime
KARAT is an allocation level address space implementation based on CARAT, which aims to replace virtual memory and paging with compile-time optimization on protection checks and runtime of tracking of allocations.
- Implemented a competitive paging address space in Nautilus, an Areokernel maintained in Dinda's group
- Designed C-style polymorphism that supported data structures include red black tree and splay tree to track VA-PA mapping
- Introduced support for 1GB/2MB page and PCID; performance measured with Performance Monitoring Counter
- Designed runtime protection check with address mapping data structures

Research Assistant   June 2019 to Present
Image and Video Processing Lab, Northwestern University
Advisor: Prof. Aggelos Katsaggelos

DeepCOVID-XR
- Co-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

ValveNet
- ValveNet aims to replace manual-force calculation of mitral regurgitation flow on Doppler images with automatic CNN approach
- Proved feasibility of CNN approach by training transfer learning models of AlexNet and DRCNN on in-vitro data, which achieved less than 5% of MSE
- Working on designing and training of a CNN to predict the Mitral Regurgitation from in-vivo Doppler Images

Research Assistant   June 2018 to May 2018
XZ Group, Washington University in St. Louis
Advisor: Prof. Xuan Zhang
- Implemented position approximation algorithm in C++ for autonomous driving on a self-3D-printed platform
- Calculated heading from geomagnetic sensor readings and approximated displacement with accelerometer

Publications and Submitted Papers	1. Brian Suchy, Souradip Ghosh, Drew Kersnar, **Siyuan Chai**, Zhen Huang, Aaron Nelson, Michael Cuevas, Gaurav Chaudhary, Alex Bernat, Nikos Hardavellas, Simone Campanoni, Peter Dinda. "KARAT: Replacing Paging in the Kernel via the Compiler and Runtime." *In submission.*
	2. 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." *Radiology.* [Online]. Available: https://doi.org/10.1148/radiol.2020203511.

Teaching Experience

Peer Mentor (Undergraduate TA) - Northwestern University

COMP_SCI 336 - Design & Analysis of Algorithms
Instructor: Konstantin Makarychev	Winter 2020
Instructor: Jason Hartline	Spring 2019, Fall 2019

Teaching Assistant - Washington University in St. Louis

ESE 205 - Introduction to Engineering Design	Spring 2018
Instructor: James Feher	

Awards and Honors

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

Projects

TrustZone
- Explored how OP-TEE implemented Trusted Execution Environment
- Deployed OP-TEE on Raspberry Pi 3 and coded within TEE

Ping-Pong shooting Car
- Built a Ping-Pong shooting car from Raspberry Pi and 3D printed parts
- Deployed server on Raspberry Pi with Flask to enable real-time wireless control from desktop browser with AJAX
- Connected a webcam installed on the car with the Python server to simulate a first-person video streaming
- Implemented facial recognition with OpenCV in streaming; prevented the car from shooting when human face detected

Sunlight Alarm
- Designed, and programmed an Arduino-Raspberry Pi system that pleasantly wakes user up with sunshine by automatically lifting the window shades at preset time
- Implemented a local time/weather reminder in C/Python which reads in users' location inputs, fetches weather data online and displays it

Skills

Programming languages:
  C/C++, Python, Java, JavaScript, Matlab, Ruby, mySQL, Racket
System-level Development:
  QEMU, VMware, Unix/Linux, Multi-threading, GNU Make, GDB, LLVM
Artificial Intelligence:
  Image Processing, Computer Vision, Docker, PyTorch, Tensorflow, Keras
Hardware:
  Raspberry Pi, Arduino, VHDL, 3D printing, SOLIDWORKS
Web Development:
  HTML, CSS, Flask, React, Bootstrap, AJAX