

# SUNHO LEE

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## RESEARCH INTERESTS

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**I am interested in the architecture of accelerators dedicated to machine learning.**

Since machine learning requires fast and secure processing, my research objective is to design high-performance accelerators with security guarantees. To achieve this goal, my recent studies proposed architectures to support efficient hardware-based protection for accelerators. In these works, I focus on security solutions that leverage characteristics of machine learning.

## EDUCATION

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**KAIST**, Daejeon, Republic of Korea Mar 2021 -  
Doctor of Philosophy, School of Computing  
Advisor: Jaehyuk Huh

**KAIST**, Daejeon, Republic of Korea Mar 2019 - Feb 2021  
Master of Science, School of Computing  
Advisor: Jaehyuk Huh  
Thesis: *Hardware Security Techniques for Trusted Machine Learning Accelerators*

**Yonsei University**, Seoul, Republic of Korea Mar 2015 - Feb 2019  
Bachelor of Science, Computer Science

## PUBLICATIONS

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- Seungbeom Choi, **Sunho Lee**, Yeonjae Kim, Jongse Park, Youngjin Kwon, and Jaehyuk Huh, “Serving Heterogeneous Machine Learning Models on Multi-GPU Servers with Spatio-Temporal Sharing”, *2022 USENIX Annual Technical Conference (USENIX ATC)*, July 2022
- Sunho Lee**, Jungwoo Kim, Seonjin Na, Jongse Park, and Jaehyuk Huh, “TNPU: Supporting Trusted Execution with Tree-less Integrity Protection for Neural Processing Unit”, *the 28th IEEE International Symposium on High-Performance Computer Architecture (HPCA)*, February 2022
- Seonjin Na, **Sunho Lee**, Yeonjae Kim, Jongse Park, and Jaehyuk Huh, “Common Counters: Compressed Encryption Counters for Secure GPU Memory”, *the 27th IEEE International Symposium on High-Performance Computer Architecture (HPCA)*, February 2021

## PATENTS

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- [Pending]** Jaehyuk Huh, Seungbeom Choi, **Sunho Lee**, Yeonjae Kim, Youngjin Kwon, Jongse Park, “Machine Learning Inference Time-spatial SW Scheduler Based on Multiple GPU”, *Korean Patent*
- [Pending]** Jaehyuk Huh, **Sunho Lee**, and Seonjin Na, “Hardware-based Security Architecture for Trusted Neural Processing Unit”, *Korean Patent* (with Samsung Electronics)
- [Pending]** Jaehyuk Huh, Seonjin Na, **Sunho Lee**, Yeonjae Kim, and Jongse Park, “Efficient Encryption Method and Apparatus for Hardware-based Secure GPU Memory”, *Korean Patent* (with Samsung Electronics)

## RESEARCH EXPERIENCES

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**KAIST**, Daejeon, Republic of Korea Mar 2019 -  
*Ongoing Researches at CASYS (Computer Architecture and SYStem) Lab*  
Advisor: Jaehyuk Huh

### Accelerator Hardware-based Security

- Memory protection optimization for GPU: Common counters for duplicate counters (Published at **HPCA 2021**)
- Memory protection optimization for multi-tenant GPU
- Trusted execution environment for NPU: Tensor-granularity counters (Published at **HPCA 2022**)

- Memory protection optimization for NPU: Partial memory protection
- Side-channel attack protection for NPU

#### **Accelerator Performance**

- Multi-tenancy support for a multi-GPU system: Time and spatial sharing (Accepted at **USENIX ATC 2022**)
- Multi-tenancy support for NPU: Shared resources management

**Yonsei University**, Seoul, Republic of Korea

*Sep 2017 - June 2018*

*Undergraduate Research Intern at ELC (Embedded systems Languages and Compilers) Lab*

Advisor: Bernd Burgstaller

#### **Parallelism**

- Accelerating big-data streaming engine: Multi-thread and shared-memory
- Parallelization of SFA (Simultaneous Deterministic Finite Automata) construction: MPI and Huang's algorithm

## **RECOGNITION**

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**KAIST**, Daejeon, Republic of Korea

Excellent Teaching Assistant Award - CS311 Computer Organization

*Spring 2021*

**Yonsei University**, Seoul, Republic of Korea

Dean's List

*Spring 2015, Spring 2018*

Undergraduate Capstone Project Award (Third Place) - Project Leader

*Spring 2018*

Title: *Cloud SFA: Parallel Construction of Simultaneous Deterministic Finite Automata in Distributed System*

## **SKILLS**

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**Programming Languages**

C, C++, Python

**NPU Simulators**

SCALE-Sim, MAESTRO, Gemmini

**GPU Programming**

CUDA, MPS

**Multi-core CPU Programming**

MPI, OpenMP

**Machine Learning Frameworks**

Pytorch, Tensorflow

## **TEACHING EXPERIENCES**

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**KAIST**, Daejeon, Republic of Korea

*Teaching Assistant*

CS230 System Programming

*Fall 2021*

CS311 Computer Organization

*Spring 2021, Fall 2019*

CS211 Digital System and Lab

*Spring 2019*

**KAIST Education Center**, Daejeon, Republic of Korea

*Mentor & Lecturer*

Seochon AI College

*Summer 2019, Summer 2021*

Python for Beginners

*Summer 2021*