

# Junseo Lee

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## Research Interests

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My research interests are in **computer architecture** and **the architectural support for emerging workloads**, particularly vision/graphics tasks such as neural rendering.

- **Keywords:** Computer Architecture, GPU Microarchitecture, Hardware-Software Co-Design for Emerging Applications, Computer Vision/Graphics

## Education

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**Seoul National University** Seoul, Republic of Korea  
M.S./Ph.D., Electrical and Computer Engineering Mar 2022 – Present  
• Computer Architecture and Systems Lab (Advisor: Prof. Jaewoong Sim)  
B.S., Electrical and Computer Engineering Mar 2018 – Feb 2022

## Research Experience

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**Graduate Research Assistant** Mar 2022 - Present  
Seoul National University Seoul, Republic of Korea

- Advisor: Prof. Jaewoong Sim
- Worked on algorithm-hardware co-design to efficiently execute Neural Radiance Fields (NeRF) rendering.
  - Proposed **NeuRex**, an algorithm-hardware co-design that achieves significant speedups compared to GPUs.
  - Co-designed a restricted hashing algorithm and an encoding engine that eliminate irregular off-chip memory accesses in the encoding stage.
  - Implemented NeuRex in SystemVerilog, demonstrating small area overhead and low power consumption.
- Worked on designing hardware architecture to efficiently support 3D Gaussian splatting (3DGS) rendering.
  - Designed **GSCore**, a specialized accelerator that efficiently executes 3D Gaussian splatting rendering pipeline.
  - Proposed three algorithmic optimizations and tailored hardware to reduce ineffective computations.
  - Showed that the proposed algorithmic optimizations improve rendering performance in GPU by 2×.
- Worked on extending a hardware graphics pipeline in modern GPUs to accelerate volume rendering.
  - Proposed **VR-Pipe**, a hardware extension for a modern GPU graphics pipeline to reduce the pressure on the fixed-function blending unit (ROP).
  - Designed two innovations to effectively reduce the number of fragments processed by programmable/fixed-function units in the early stages of the rendering pipeline.

## Publications

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### **VR-Pipe: Streamlining Hardware Graphics Pipeline for Volume Rendering**

Junseo Lee, Jaisung Kim, Junyong Park, Jaewoong Sim

*Proc. of the 31st International Symposium on High Performance Computer Architecture (HPCA), March 2025*

### **GSCore: Efficient Radiance Field Rendering via Architectural Support for 3D Gaussian Splatting**

Junseo Lee, Seokwon Lee, Jungi Lee, Junyong Park, Jaewoong Sim

*Proc. of the 2024 International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), April 2024*

### **NeuRex: A Case for Neural Rendering Acceleration**

Junseo Lee, Kwansoek Choi, Jungi Lee, Seokwon Lee, Joonho Whangbo, Jaewoong Sim

*Proc. of the 50th International Symposium on Computer Architecture (ISCA), June 2023*

## Teaching

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### Graduate Research Assistant

Seoul National University

Seoul, Republic of Korea

- ECE 315.A: Digital Systems Design and Experiments
- ECE 322: Computer Organization

Led lab sessions and the final project that implements a CNN accelerator in RTL on FPGA (ECE 315.A).

Prepared the assignments, such as a C++-based cycle-level cache simulator (ECE 322).

## Skills

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**Languages:** C/C++, CUDA, Python, Verilog/System Verilog, GLSL

**Tools:** PyTorch, Intel VTune, Nsight Compute/Graphics/Systems

**APIs:** OpenGL, Vulkan, OptiX