Jin Heo

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Research Interest

My research interest has been about **edge/cloud computing for real-time and interactive multimedia applications, XR**. I have been working on the research projects, developing technologies to enable streaming high-quality XR experiences and building scalable systems for adaptively serving perception and 3D rendering workloads.

Education

- **Georgia Institute of Technology**   Atlanta, GA, USA
  Doctor of Philosophy in Computer Science; GPA: 4.0   *Aug. 2019 – Aug. 2025 (Expected)*

- **Ajou University**   Suwon, South Korea
  Bachelor of Science in Computer Engineering; Summa Cum Laude (1/213)   *Mar. 2016 – Aug. 2018*

Publications

[1] **Heo, Jin** and A. Gavrilovska, "Poster: Adapting xr perception serving for edge server scalability", in *2024 IEEE/ACM 9th Symposium on Edge Computing (SEC)*, IEEE, 2024.

[2] **Heo, Jin**, T. Novlan, S. Akoum, and A. Gavrilovska, "Gt-craft: A framework for fast prototyping geospatial-based digital twins in unity 3d", in *2024 IEEE/ACM 9th Symposium on Edge Computing (SEC)*, IEEE, 2024.

[3] **Heo, Jin**, K. Bhardwaj, and A. Gavrilovska, "Flexr: A system enabling flexibly distributed extended reality", in *Proceedings of the 14th Conference on ACM Multimedia Systems*, 2023, pp. 1–13.

[4] **Heo, Jin**, C. Phillips, and A. Gavrilovska, "Flicr: A fast and lightweight lidar point cloud compression based on lossy ri", in *2022 IEEE/ACM 7th Symposium on Edge Computing (SEC)*, IEEE, 2022, pp. 54–67.

[5] **Heo, Jin**, G. Phillips, P.-E. Brodin, and A. Gavrilovska, "Poster: Making edge-assisted lidar perceptions robust to lossy point cloud compression", in *2022 IEEE/ACM 7th Symposium on Edge Computing (SEC)*, IEEE, 2022, pp. 293–295.

[6] **Heo, Jin**, K. Bhardwaj, and A. Gavrilovska, "Poster: Enabling flexible edge-assisted xr", in *2021 IEEE/ACM Symposium on Edge Computing (SEC)*, IEEE, 2021, pp. 465–467.

[7] S. Taheri, **Heo, Jin**, P. Behnam, J. Chen, A. Veidenbaum, and A. Nicolau, "Acceleration framework for fpga implementation of openvx graph pipelines", in *2018 IEEE 26th Annual International Symposium on Field-Programmable Custom Computing Machines (FCCM)*, IEEE, 2018, pp. 227–227.

Experience

- **Dolby Laboratories**   San Francisco, CA, USA
  Graduate Research Intern   *May. 2024 - Aug. 2024*
  - To relieve the preinstallation and storage burden of 3D assets, **developed a method enabling on-demand and progressive streaming of interactable and modifiable 3D assets for XR** under the mentorship of *Jeffrey Riedmiller*.
  - The method allows the spatial query to the 3D scene of universal scene description (USD) and the partial and progressive loading of the 3D assets, enabling the user modification and interaction on the streamed 3D assets without preinstallation.

- **AT&T Labs**   Austin, TX, USA
  Graduate Research Intern   *May. 2023 - Aug. 2023*
  - To reduce the implementation costs for city-scale digital twin, **developed a framework for fast prototyping geospatial-based digital twins in Unity 3D** [2] under the mentorship of *Dr. Thomas Novlan and Dr. Salam Akoum*.
  - The framework uses satellite images with ML models for semantic segmentation, and the 3D scene is reconstructed as a Unity scene by using the semantic information.
  - The resulted digital twin is used in the AT&T Lab's internal wireless network simulator, WiNGS, and enables more accurate simulation for estimating the wireless network performance of the base stations.

- **Ericsson Research**   Santa Clara, CA, USA
  Graduate Research Intern (Remote)   *Mar. 2021 - Dec. 2022*
  - To enable offloading real-time LiDAR perception to the edge cloud, **developed a lightweight and low-latency LiDAR point cloud compression method, FLiCR** [4] under the mentorship of *Christopher Phillips*.
  - With proper representation of unstructured point clouds and its subsampling and quantization, FLiCR achieves up to $12\times$ compression ratio with 80% less latency compared to the state-of-the-art methods.

- To reduce the performance degradation of LiDAR perception on the encoded-decoded point clouds with lossy compression, **developed an interpolation method to improve the quality of the encoded-decoded point clouds** [5].

- **Kernel Lab, Georgia Tech** Atlanta, GA, USA
  Graduate Research Assistant *Aug. 2019 - Present*
  - To improve multi-user serving capability of edge servers in XR perception tasks, **developing a ML-based inference serving system, AdaXR** [1].
  - To enable scalable cloud gaming for more users with limited GPU resources, **developing an adaptive rendering optimization system, Stimpack**.
  - By optimizing the game rendering quality on the server based on the resource capacity and estimated user-received frame quality with lossy compression, Stimpack achieves up to $5\times$ more users served by each GPU card with 41% higher service quality compared to other baseline scenarios.
  - To enable efficient edge offloading for diverse distributed environments, **developed a system, FleXR, for flexibly distributed XR** [3, 6].
  - FleXR enables flexible distribution of XR functionalities between the edge server and user devices at runtime, allowing optimal offloading decisions for given environment factors, *i.e.*, network conditions, device and server resources, rendering and perception costs, and offloading overheads.

- **Parallel Architectures and Systems Lab, UC Irvine** Irvine, CA, USA
  Undergraduate Research Assistant (UROP) *Jul. 2017 - Jan. 2018*
  - To enable efficient pipeline processing of computer vision algorithms, **developed a framework for FPGA acceleration of OpenVX graph pipeline** [7] under the mentorship of *Dr. Sajjad Taheri and Dr. Alex Nicolau*.

- **Computer Communication Lab, Ajou University** Suwon, South Korea
  Undergraduate Research Assistant (UROP) *Mar. 2017 - Jul. 2017*
  - To enable continuous session-based communication of mobile users at the application level, **investigated network protocols including HIP and Mobile IPv6, and proposed a network protocol stack** under the guidance of *Dr. KyungRan Kang*.

- **Commonwealth Scientific and Industrial Research Organisation (CSIRO)** Brisbane, Australia
  Undergraduate Research Assistant (UROP) *Sep. 2016 - Feb. 2017*
  - To enable efficient communication among commodity sensor devices of limited batteries, **developed a radio communication method for wireless sensor networks** under the guidance of *Dr. JeongGil Ko and Dr. Brano Kusy*.

Technical Skills

- **Programming Language**: C/C++, C#, Python, Bash Script
- **Software Platforms and Tools**: OpenGL, OpenCV, OpenVX, Pytorch, Tensorflow, Docker, gRPC, ZMQ, GStreamer, RaftLib, FFmpeg, Makefile, CMake, Unity3D, Unreal Engine
- **Project Management and Documentation**: Git, Agile Method, Test-Driven Development, Doxygen, Markdown

Miscellaneous (chronological order)

- External reviewer - IEEE Open Journal of the Communications Society (OJ-COMS)
- Teaching (Head TA) - Advanced Operation System (CS6210/4210) at Georgia Tech, Spring 24
- Presentation (Principles and Practice of Scalable Systems (PPoSS) Workshop 23) - *Adaptive XR Serving from the Edge*
- Open-source contribution (RaftLib) - resolved the issue of the pipeline scheduler for resource efficiency
- Open-source contribution (uvgRTP) - added the build system support for Linux installation with pkg-config
- Presentation (Application Driving Architecture (ADA) Symposium 22) - *MEC-based Edge-assisted XR*
- Teaching (Head TA) - Advanced Operation System (CS6210/4210) at Georgia Tech, Spring 22
- Presentation (TECHCON of Application Driving Architecture (ADA) Center 21) - *Enabling Flexible Edge-assisted XR*