# Jaehong Kim

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## Research Interest

AI for systems, AI for video streaming, Immersive video, Systems for large-scale AI, Networked system

## Work Experience

**Carnegie Mellon University**                                                                                    *Pittsburgh, PA, USA*
POSTDOCTORAL RESEARCHER IN COMPUTER SCIENCE DEPARTMENT                                *Sep. 2024 - Aug. 2025 (Expected)*
- Postdoctoral Fellowship Program granted by NRF. (Advisor: Srinivasan Seshan and Anthony Rowe)

## Education

**KAIST (Korea Advanced Institute of Science and Technology)**                                        *Daejeon, S.Korea*
PH.D. IN ELECTRICAL ENGINEERING                                                                    *Feb. 2020 - Aug. 2024*
- Thesis title: Enabling High-quality 2D and 3D Live Streaming at Ingest (Advisor: Prof. Dongsu Han)

**KAIST (Korea Advanced Institute of Science and Technology)**                                        *Daejeon, S.Korea*
M.S. IN ELECTRICAL ENGINEERING                                                                     *Sep. 2018 - Feb. 2020*
- Thesis title: Enhancing Live Video Quality at Ingest Using Online Trained DNNs (Advisor: Prof. Dongsu Han)

**KAIST (Korea Advanced Institute of Science and Technology)**                                        *Daejeon, S.Korea*
B.S. IN ELECTRICAL ENGINEERING (CUM LAUDE)                                                          *Mar. 2014 - Aug. 2018*

**University of Maryland**                                                                          *College Park, MD, USA*
EXCHANGE STUDENT PROGRAM                                                                            *Jan. 2016 - May. 2016*

## Publications / Preprints

| CONFERENCE PROCEEDINGS (C), WORKSHOPS (W), PREPRINTS (P) | TOPICS |
|---|---|

**[P-2] Pushing the Limits of Live 3D Streaming with BlenDR**                                      **Volumetric Video**
Jaehong Kim, Junha Kim, and Dongsu Han
**Under Review**

**[P-1] NerVast: Scaling Neural Video Representation with Enhanced Compression Efficiency**         **AI for Video**
Yunheon Lee, Jaehong Kim, Juncheol Ye, and Dongsu Han
**Under Review**

**[C-5] FlexPass: A Case for Flexible Credit-based Transport for Datacenter Networks**              **Datacenter Networking**
Hwijoon Lim, Jaehong Kim, Inho Cho, Keon Jang, Wei Bai, and Dongsu Han
**ACM EuroSys 2023**, ⌂ webpage

**[C-4] OutRAN: Co-optimizing for Flow Completion Time in Radio Access Network**                    **5G Networks**
Jaehong Kim, Yunheon Lee, Hwijoon Lim, Youngmok Jung, Song Min Kim, and Dongsu Han
**ACM CoNEXT 2022 (Best paper award nominee)**, ⌂ webpage

**[C-3] NeuroScaler: Neural Video Enhancement at Scale**                                            **AI for Live Streaming**
Hyunho Yeo, Hwijoon Lim, Jaehong Kim, Youngmok Jung, Juncheol Ye, and Dongsu Han
**ACM SIGCOMM 2022**, ⌂ webpage

**[C-2] Neural-Enhanced Live Streaming: Improving Live Video Ingest via Online Learning**           **AI for Live Streaming**
Jaehong Kim[*], Youngmok Jung[*], Hyunho Yeo, Juncheol Ye, and Dongsu Han
**ACM SIGCOMM 2020**, [*] Co-first authors, ⌂ webpage

**[C-1] Neural Adaptive Content-aware Internet Video Delivery**                                     **AI for Video Streaming**
Hyunho Yeo, Youngmok Jung, Jaehong Kim, Jinwoo Shin, and Dongsu Han
**USENIX OSDI 2018**, ⌂ webpage

**[P(W)-2] Towards AI-Native Transformation of Media and its Processing Pipeline**                  **AI for Video Systems**
Seyeon Lee[*], Jaehong Kim[*], Yunheon Lee, and Dongsu Han
**Under Review**, [*] Co-first authors

**[W-1] Neural Cloud Storage: Innovative Cloud Storage Solution for Cold Video**                    **AI for Cloud Storage**
Jinyeong Lim, Juncheol Ye, Jaehong Kim, Hwijoon Lim, Hyunho Yeo, and Dongsu Han
**ACM HotStorage 2023**, ⌂ webpage

## Honors and Awards

| | | |
|---|---|---|
| Sep. 2024 | **NRF Postdoctoral Fellowship Program** | *NRF* |
| | Selected as a principal investigator of Postdoctoral Fellowship Program (Nurturing Next-generation Researchers) in 2024 granted by the National Research Foundation of Korea (NRF) with ₩60,000,000 grant for one year. | |
| Feb. 2023 | **29th Samsung Humantech Paper Award** | *Samsung Electronics* |
| | Silver Prize (2nd place), Communication & Network | |
| Dec. 2022 | **Google Conference Scholarship** | *Google LLC* |
| | Travel grants for students giving oral presentations at top-tier CS conferences. | |
| Dec. 2022 | **ACM CoNEXT'22 Best Paper Award Nomination & ACM Student Grant** | *NSF & ACM* |
| | Received the highest review score with five "4 Accept" ratings. | |
| Feb. 2022 | **28th Samsung Humantech Paper Award** | *Samsung Electronics* |
| | Gold Prize (1st place), Communication & Network | |
| 2021 | **KAIST Breakthrough of the Year** | *KAIST* |
| | For the top 15 most significant research achievements. | |
| 2020 | **Donghwa Industry Moon Daewon AI Research Scholarship** | *KAIST* |
| | Awarded to a graduate student for outstanding AI research and collaborative spirit. | |
| 2018 | **USENIX OSDI Student Grant** | *USENIX* |

## Patents

### INTERNATIONAL

| | | |
|---|---|---|
| US17265680 | **Live video ingest system and method** | *KAIST* |
| US16612498 | **Method and apparatus for transmitting adaptive video in real time using content-aware neural network** | *KAIST* |

### DOMESTIC (SOUTH KOREA)

| | | |
|---|---|---|
| KR10-2338986-0000 | **Method for enhancing live video delivery at ingest point utilizing content-aware neural network** | *KAIST* |
| KR10-2023-0164365 (Filed) | **Unified Compression Method for RGB and Depth Video in Live 3D Video Streaming** | *KAIST* |
| KR10-2022-0091760 (Filed) | **Acceleration method for encoding selective super-resolved video** | *KAIST* |
| KR10-2022-0091726 (Filed) | **Acceleration and scheduling method for video super-resolution based on codec-level information** | *KAIST* |
| KR10-2022-0138553 (Filed) | **Practical flow scheduling algorithm designed for 4G/5G radio access network base stations for low-latency applications** | *Samsung Electronics & KAIST* |
| KR10-2022-0077669 (Filed) | **Method of scheduling flow and electronic device performing the method** | *Samsung Electronics & KAIST* |
| KR10-2023-0181034 (Filed) | **Cloud storage system for cold video with content-aware super-resolution** | *KAIST* |

## Research Experience

**AI-augmented Video Delivery for Immersive Media (NRF, PI)** *Sep. 2024 - Aug. 2025*

Funded by the National Research Foundation of Korea (NRF) with ₩60,000,000 for one year as a postdoctoral researcher and PI.

**Live Volumetric Video Streaming [P-2]** *Nov. 2022 - Feb. 2024*

Designed a novel RGB-D representation and delivery scheme for live 3D video streaming. It reduces depth error by **8.7×** (RMSE) and improves RGB quality by **3.18 dB** (PSNR) given the same bandwidth. Compared to Google's Draco , it offers **89.6%** better compression efficiency. Demonstrated real-time performance using **Azure Kinect** Camera attached to the Jetson device.

**Cross-layer Optimization for 5G Radio Access Networks [C-4]** *Aug. 2020 - June. 2022*

Developed a new transport-layer scheduling in 5G Networks that delivers better latency for latency-sensitive traffic without the QoS information. Implemented the design both on **NS-3** and on top of **srsRAN** gNodeB, which runs on **USRP** Software Defined Radios (**SDR**). Reduced the webpage load time up to **34%** outperforming legacy 4G/5G MAC schedulers. Funded by Samsung Electronics Modem S/W R&D Group.

**Neural-enhanced Live Video Delivery [C-2, C-3]**                                    *Nov. 2018 - July. 2020*

Designed a new live ingest framework that ensures high-quality live streaming to viewers by enhancing origin live video quality with online-trained super-resolution DNNs at ingest servers. Implemented the client and ingest server with **WebRTC**, **PyTorch**, and ffmpeg. Improved quality of experience for live stream viewers up to **69%** or saved streamer's bandwidth usage by 45.9%.

**Neural-enhanced Adaptive Streaming [C-1]**                                          *Mar. 2017 - Oct. 2018*

Contributed to the development of a neural adaptive content-aware video delivery system, a first application of neural enhancement in adaptive video streaming. Implemented an end-to-end system on top of **MPEG DASH (dash.js)** and **TensorFlow**. Improved the quality of user experience by **43.08%** or saved 17.13% of network bandwidth.

## Mentoring Experience

**Individual Study**

- Junha Kim (B.S. KAIST / Jun. 2023 - Present): Mentored research on live 3D streaming [P-2]. Read his experience 🏠 here.
- Yunheon Lee (B.S. KAIST → Ph.D. Candidate KAIST / Jun. 2021 - Present): Mentoring research on 5G [C-4], and AI for video [P-1].
- Jinyeong Lim (M.S. KAIST): Mentored research on AI for cloud storage [W-1].
- Euijun Jeong (B.S. KAIST): Mentored research on an efficient cluster-wise training scheme for content-aware neural-enhancement.

**Undergraduate Research Program (URP)**

- Hyojin Choi (B.S. KAIST / Jan.2023 - Jun.2023): Mentored research on deep neural video compression.

## Teaching Experience

**Teaching Assistant**

- Advanced Computer Networking and Cloud Computing (EE618)                          *Spring 2021*
- Network Programming (EE324)                                                       *Fall 2020, Fall 2021*
- SK Hynix ASK Program                                                              *Aug. 2020*
- Systems and Applications of Artificial Intelligence and Machine Learning (EE793)  *Spring 2020*
- Programming Structures for Electrical Engineering (EE209)                         *Spring & Fall 2019, Spring & Fall 2022*

## Presentation

**Computer Science & Engineering Department Seminar/Interview at UNIST**            *Ulsan, S.Korea*

Improving the Quality of Experience (QoE) of Internet Applications                  *Jun. 2024*

**Conference talk at CoNEXT'22**                                                    *Rome, Italy*

Presented OutRAN: Co-optimizing for Flow Completion Time in Radio Access Network. ▶ Demo  *Dec. 2022*

**Conference talk at SIGCOMM'20**                                                   *Virtual*

Presented Neural-Enhanced Live Streaming: Improving Live Video Ingest via Online Learning.  *Aug. 2020*

▶ 20-min talk , ▶ 10-min talk

**Demo & Poster session at OSDI'18**                                                *Carlsbad, CA, USA*

Presented demo of Neural Adaptive Content-aware Internet Video Delivery. ▶ Demo    *Oct. 2018*

## Academic Service

2023, 2024    **IEEE/ACM transactions on networking,** Role: Reviewer

## Skills

**Programming** Python, C/C++, JavaScript, CUDA                **AI Frameworks** TensorFlow, PyTorch, TensorRT

**Other Skills** dash.js, ffmpeg, NS-3, srsRAN, Docker         **Languages** Korean (native), English (fluent, IBT TOEFL 106)

## References

Available upon request.