

Juhyung Lee

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RESEARCH INTERESTS

- On-Device AI/LLM
- AI Solutions for Wireless Communication Systems

EXPERIENCE

- **Nokia** Sunnyvale, CA, USA
Principal Researcher, AI/ML Aug. 2024 - Present
 - Developed an on-device LLM PoC (Llama3, Phi4) for cross-layer (Application ↔ PHY/MAC) optimization; applied fixed-point quantization (GGUF) and achieved near real-time inference on MacBook Pro. [1] [\[Github\]](#) [\[Demo\]](#)
 - Lead LLM RAG Assistant for 802.11 Wi-Fi docs
 - Active in Wi-Fi standardization (e.g., , IEEE 802.11bn and AIML TIG)
- **University of Southern California** Los Angeles, CA, USA
Postdoctoral Researcher, Wireless Devices and Systems Group (Head: [Prof. Andreas Molisch](#)) Apr. 2022 - Aug. 2024
 - On-Device Semantic Communication** [\[Github\]](#)
 - Fine-tuned a pre-trained LLM as a neural source coder, integrated into Link-Level simulator (Nvidia Sionna) [2, 3]
 - Developed a compression & quantization for AI-to-AI comm.; Tested in 5G-NR PHY setup
 - Site-Specific Channel Modeling for RAN Optimization** [\[Github-1\]](#) [\[Github-2\]](#)
 - Developed an fast (~ 1 [msec]) and accurate (RMSE ~ -14 [dB]) Digital Twin Network framework [4, 5, 6]
 - Designed optimization methods for Mobility Management, Localization, and BS deployment for O-RAN
- **Samsung Research America** Dallas, USA
AI/Wireless Senior Research Engineer Dec. 2023 - Jan. 2024 (Seasonal)
 - Generative Model for Channel Feedback Compression in mMIMO System** [\[Github\]](#)
 - Developed low-complexity generative model for mMIMO channel feedback (e.g., DMRS, SRS) compression based on 3GPP TR-38.843 [7]
- **Korea University** Seoul, Korea
Research Professor, Research Institute for Information & Communication Sep. 2021 - Feb. 2023
 - Reinforcement Learning-based PHY/MAC Access Protocol Design for LEO Satellite Networks**
 - Designed and tested 3GPP-compatible PHY/MAC access protocols for mobility management (e.g., RACH [8, 9], handover [10]) in System-Level Simulation (3GPP TR-38.821).

SKILLS

- **Languages & Frameworks:** Python, MATLAB, C/C++, Swift; PyTorch, CoreML, TensorFlow Lite
- **AI/ML Expertise:** LLM (Llama3, Phi4, Gemma3, RAG, LoRA, DPO; DRL (PP0); Generative (Diffusion, VAE); Quantization (GGUF, AWQ)
- **Wireless & Simulation:** MATLAB (5G Toolbox), Nvidia (Sionna), Apple (CoreWLAN), Remcom (WirelessInSite)

EDUCATION

- **Korea University** Seoul, Korea
Ph.D. in Electrical and Computer Eng. (Awarded by Research Excellence) Mar. 2016 – Aug. 2021
 - **RAN Optimization:** Developed DRL-based initial access [8, 9], handover [10], radio resource scheduling [11, 12, 13], and beam management [14] for high-mobility networks
 - **[Demo] Radio-over-FSO (RoFSO):** Developed a RoFSO system integrating 802.11 RF USRP and laser-based optical transceivers; Demonstrated ~ 20 [Gbps] transmission over with ~ 100 [m] outdoor [15, 16] [\[Demo-1\]](#) [\[Demo-2\]](#)
- **Korea University** Seoul, Korea
B. Eng. in Electrical and Electronic Eng. (Awarded by National Sci. & Tech. Scholarship) Mar. 2011 – Feb. 2016

PROJECTS

- **On-Device LLM-based Context-Aware Handover (Wi-Fi Roaming)** [\[Github\]](#) [\[Demo-1\]](#) [\[Demo-2\]](#)
 - Developed context-aware handover on Macbook Pro using on-device LLM inference (Llama3, Phi4); used Chain-of-Thought prompting, post-training (SFT, DPO, ORPO), and quantization (GGUF, AWQ) leveraging context data (location, time) [\[1\]](#)
- **LLM-Based Neural Source Coding: Integrating Pre-Trained LLM with Link-Level Simulator** [\[Github\]](#)
 - Developed a framework integrating pre-trained LLM (BART) with 5G-NR link-level simulator (NVIDIA Sionna), utilizing a compression technique (VQ-VAE)
 - Demonstrated the framework in 5G-NR scenario (Setup: MIMO-OFDM; Polar Code; QAM) [\[3\]](#)
 - Achieved $\sim 50\%$ compression in source data, retaining high robustness under 3GPP CDL- $\{A\sim E\}$ channel models.
- **Large-Scale Channel Prediction (aka. Digital Network Twins)** [\[Github\]](#)
 - **1st-rank** in *IEEE ICASSP Radio Map Prediction Challenge* [\[5\]](#), with the highest accuracy (RMSE ~ -14 [dB])
 - Created a channel measurement dataset using ray-tracing simulations (WirelessInsite, Sionna-RT) across real-world locations (USC, UCLA, Boston); implemented an ML-based site-specific channel prediction framework [\[6\]](#)
 - Achieved ~ 31 [dB] RMSE gain compared to UMi channel model (3GPP TR-38.901)
- **Generative Model for Channel Feedback Compression** [\[Github\]](#)
 - Designed a low-complexity Generative Model (*e.g.*, Diffusion, VQ-VAE) for CSI compression for mMIMO [\[7\]](#)
 - Demonstrated high channel feedback compression efficiency ($\sim \frac{1}{8}$), retaining up to NMSE ~ -15 [dB]

HONORS AND AWARDS

- 1st-Rank, *IEEE ICASSP Signal Processing Grand Challenges*, Jun. 2023 [\[5\]](#)
- Best Paper Award, *IEEE ICTC*, Oct. 2022 [\[17\]](#)
- Best Paper Award, *IEEE ICTC*, Oct. 2021 [\[18\]](#)
- Grand Prize, *Graduate Research Excellence Award*, Korea University, Feb. 2021
- Travel Grant, *IEEE GLOBECOM*, Dec. 2020;
- Bronze Prize, *IEEE Seoul Section Student Paper Award*, Dec. 2020
- Best Paper Award, *Korea Institute of Commun., and Info. Sciences*, Feb. 2020
- Full Tuition Scholarship (B. Eng.), *National Science & Technology Scholarship*, Korea, 2011

PATENTS

- [USA #2 - pending] **J.-H. Lee** and Y.-C. Ko, "Deep reinforcement learning-based random access method for low earth orbit satellite network and terminal for the operation", US20230189353A1 (06/15/2023)
- [USA #1 - pending] J.-M. Kim, **J.-H. Lee**, and Y.-C. Ko, "Apparatus based on wireless optical communication", US20230083544A1 (03/16/2022)
- [Korea #3] B.-H. Lee, **J.-H. Lee**, and Y.-C. Ko, "Minimum transmission rate maximization using power control and association in ground base station-to-UAV communication", 10-2508442 (03/06/2023)
- [Korea #2] J.-M. Kim, **J.-H. Lee**, and Y.-C. Ko, "Apparatus based on wireless optical communication", 10-2506809 (03/02/2023)
- [Korea #1] **J.-H. Lee**, J. Lee, "Method and apparatus for uploading or downloading file based on tag," 10-2014-0128406 (01/26/2016)

PROFESSIONAL REFERENCES

- **Prof. Andrea F. Molisch** : Professor (IEEE & AAAS Fellow), University of Southern California, molisch@usc.edu
- **Dr. Hao Chen** : Manager, Samsung Research America, hao.chen1@samsung.com
- **Prof. Young-Chai Ko** : Professor, Korea University, koyc@korea.ac.kr

SELECTED PUBLICATIONS [\[LINK FOR FULL-LIST\]](#)

- [1] J.-H. Lee, Y. Lu, and K. Doppler, “On-device LLM for context-aware Wi-Fi roaming,” *to be presented at ICML25*. [\[paper\]](#) [\[code\]](#) [\[Demo-1\]](#) [\[Demo-2\]](#).
- [2] J.-H. Lee*, D.-H. Lee, J. Lee, and J. Pujara, “Integrating pre-trained language model with physical layer communications,” *IEEE Trans. Wireless Commun.*, 2024. [\[paper\]](#) [\[code\]](#).
- [3] J.-H. Lee*, D.-H. Lee, E. Sheen, T. Choi, and J. Pujara, “Seq2seq-sc: End-to-end semantic communication systems with pre-trained language model,” in *Asilomar Conf. on Signals, Systems, and Computers*, 2023. [\[paper\]](#) [\[code\]](#).
- [4] J.-H. Lee and A. F. Molisch, “AutoBS: Autonomous base station deployment with reinforcement learning and digital network twins,” *arXiv preprint arXiv:2502.19647*. [\[paper\]](#) [\[code\]](#).
- [5] J.-H. Lee*, A. F. Molisch, and et al., “PMNet: Large-scale channel prediction system for radio map prediction challenge,” in *IEEE International Conf. on Acoustics, Speech and Signal Processing (ICASSP)*, 2023. **[1st-Rank in ML Competition]** [\[code\]](#).
- [6] J.-H. Lee* and A. F. Molisch, “A scalable and generalizable pathloss map prediction,” *IEEE Trans. Wireless Commun.*, 2024. [\[paper\]](#) [\[code\]](#).
- [7] J.-H. Lee, J. Lee, and A. F. Molisch, “Generative vs. predictive models in massive MIMO channel prediction,” *arXiv preprint arXiv:2411.16971*, 2024. [\[paper\]](#) [\[code\]](#).
- [8] J.-H. Lee*, H. Seo, J. Park, M. Bennis, and Y.-C. Ko, “Learning emergent random access protocol for LEO satellite networks,” *IEEE Trans. Wireless Commun.*, 2023. [\[paper\]](#).
- [9] J.-H. Lee*, H. Seo, J. Park, M. Bennis, Y.-C. Ko, and J. Kim, “Random access protocol learning in LEO satellite networks via reinforcement learning,” in *Proc. IEEE Vehicular Technology Conf. (VTC)*, 2022. **[Invited Paper]**.
- [10] J.-H. Lee*, A. F. Molisch, and et al., “Handover protocol learning for LEO satellite networks: Access delay and collision minimization,” *IEEE Trans. Wireless Commun.*, 2024. [\[paper\]](#).
- [11] J.-H. Lee*, J. Park, M. Bennis, and Y.-C. Ko, “Integrating LEO satellites and multi-UAV reinforcement learning for hybrid FSO/RF non-terrestrial networks,” *IEEE Trans. Veh. Technol.*, 2022.
- [12] J.-H. Lee*, J. Park, M. Bennis, and Y.-C. Ko, “Integrating LEO satellite and UAV relaying via reinforcement learning for non-terrestrial networks,” in *Proc. IEEE Global Commun. Conf. (GLOBECOM)*, 2020. **[Travel Grant]**.
- [13] J.-H. Lee*, K.-H. Park, Y.-C. Ko, and M.-S. Alouini, “Spectral-efficient network design for high-altitude platform station networks with mixed RF/FSO system,” *IEEE Trans. Wireless Commun.*, 2022.
- [14] Y. Lee, J.-H. Lee*, and Y.-C. Ko, “Beamforming optimization for IRS-assisted mmWave V2I communication systems via reinforcement learning,” *IEEE Access*, 2022.
- [15] J.-M. Kim, J.-H. Lee*, and et al., “Experimental demonstration of RoFSO transmission combining WLAN standard and WDM-FSO over 100m distance,” in *IEEE Conf. on Comput. Commun. Workshop (INFOCOM-Demo)*, May 2022.
- [16] J.-M. Kim, J.-H. Lee*, and Y.-C. Ko, “WLAN standard-based Non-Coherent FSO transmission over 100m indoor and outdoor environments,” in *IEEE Conf. on Comput. Commun. Workshop (INFOCOM-Demo)*, May 2021.
- [17] J.-H. Lee*, A. F. Molisch, and et al., “Reinforcement learning empowered massive IoT access in LEO-based non-terrestrial networks,” in *Proc. IEEE Int. Conf. on Inf. and Commun. Techn. Conv.*, 2022. **[Best Paper Award]**.
- [18] J.-H. Lee* and Y.-C. Ko, “Optimization for LEO satellite-ground integrated networks via deep reinforcement learning,” in *Proc. IEEE Int. Conf. on Inf. and Commun. Techn. Conv.*, 2021. **[Best Paper Award]**.