Heasung Kim

Address: Engineering Education and Research Center, The University of Texas at Austin, 78712, TX, USA
Email: heasung.kim@utexas.edu

Summary

• Expertise in **deep learning-based lossy compression**, **federated learning**, **reinforcement learning**, and **wireless communications/networks** (PHY layer & resource management).
• Ph.D. student at The University of Texas at Austin possessing a deep understanding of **optimization** and **probability** (4.0/4.0 GPA).
• Proven work experience with industry such as **InterDigital** and **Samsung**.
• Skilled in programming languages, including Python, C, and various machine learning libraries.
• The first author of the top-tier journals (e.g., **J-SAC**) and conferences in the fields of machine learning (e.g., **ICML**) and wireless communications (e.g., **ISIT, Globecom**).

Education

Ph.D. Student, Electrical and Computer Engineering — Fall 2021-Present
Advisors: Prof. Hyeji Kim and Prof. Gustavo De Veciana
The University of Texas at Austin, TX, USA

Master of Science in Electrical and Computer Engineering — 2019
Advisor: Prof. Jungwoo Lee
Seoul National University, Seoul, Korea

Bachelor of Science in Computer and Communication Engineering — 2017
Korea University, Seoul, Korea

Exchange Student — Spring 2016
The University of Texas at Austin, TX, USA

Work Experience

Intern — May 2024-Aug 2024 (Expected)
InterDigital AI Wireless Lab, NewYork
Research Topics:
— Diffusion models for compression/Building ray tracing channel environment and its applications

Graduate Research Assistant — Sep 2021-Present
Research Topics:
— Lossy compression (with applications to CSI compression), rate-distortion, federated learning, wireless networks

Researcher — Jun 2021-Aug. 2021
Research Advisor: Prof. Wonjae Shin
Ajou University, Suwon, South Korea
Research Topics:
— RL with optimized shallow neural networks for wireless resource management

Machine Learning Engineer — Aug. 2019-Apr. 2021
Network Analytics Lab, Samsung Networks Business, Samsung
(Received an *Excellent (Highest) Grade* in 2020 Performance Appraisal)
Responsibilities:
— Designing reinforcement learning algorithms for self-organizing networks (SON)
— Designing key point indicator prediction models for LTE base stations (data-driven models)
— Networks data analysis, data management, and database construction

Research in Progress

J5. **Heasung Kim**, Hyeji Kim, and Gustavo De Veciana. "Fundamental Limits in Exploiting Side Information for CSI Feedback in Wireless Systems." Presented at 6G@UT Research Showcase, Apr 2024. *Under Review.*

J4. **Heasung Kim**, Hyeji Kim, and Gustavo De Veciana. "Learning Context-Dependent CSI Feedback Autoencoders." Presented at 6G@UT Research Showcase, Nov 2023. Planned submission.

Journal Articles

J3. **Heasung Kim**, Jungwoo Lee, Wonjae Shin, and H. Vincent Poor. "Shallow Reinforcement Learning for Energy Harvesting Communications with Imperfect Channel Knowledge." in *IEEE Journal of Selected Topics in Signal Processing*, Jun. 2021.

J2. **Heasung Kim**, Taehyun Cho, Jungwoo Lee, Wonjae Shin, and H. Vincent Poor. "Optimized Shallow Neural Networks for Sum-Rate Maximization in Energy Harvesting Downlink Multiuser NOMA Systems." *IEEE Journal on Selected Areas in Communications*, vol. 39, no. 4, pp. 982-997, Apr 2021.

J1. **Heasung Kim**, Jungtae Kim, Wonjae Shin, Heecheol Yang, Nayoung Lee, Seong Jin Kim, and Jungwoo Lee. "On the Design of Tailored Neural Networks for Energy Harvesting Broadcast Channels: A Reinforcement Learning Approach." *IEEE Access*, vol. 8, pp. 179678-179691, Aug. 2020.

Conference Proceedings

C8. **Heasung Kim**, Hyeji Kim, and Gustavo De Veciana. "Clustered Federated Learning via Gradient Partitioning." *International Conference on Machine Learning* **(ICML)**, 2024.

C7. **Heasung Kim**, Hyeji Kim, and Gustavo De Veciana. "Estimation of Rate-Distortion Function for Computing with Decoder Side Information." In *Proc. IEEE International Symposium on Information Theory* **(ISIT)**, pp. 1-6. IEEE, 2024. (**Spotlight Paper** for ISIT 'Learn to Compress' workshop presentation)

C6. **Heasung Kim**, Hyeji Kim, and Gustavo De Veciana. "Learning Variable-Rate Code for CSI Feedback." In *Proc. IEEE Global Communications Conference* **(GLOBECOM)**, pp. 1-6. IEEE, 2022.

C5. **Heasung Kim**, Taehyun Cho, Jungwoo Lee, Wonjae Shin, and H. Vincent Poor. "An Efficient Neural Network Architecture for Rate Maximization in Energy Harvesting Downlink Channels." In *Proc. IEEE International Symposium on Information Theory* **(ISIT)**, pp. 2498-2503. IEEE, 2020.

C4. **Heasung Kim**, Wonjae Shin, Heecheol Yang, and Jungwoo Lee. "RL-Based Transmission Completion Time Minimization with Energy Harvesting for Time-Varying Channels." In *Proc. IEEE International Conference on Communications Workshops* **(ICC Workshops)**, pp. 1-7. IEEE, 2020.

C3. **Heasung Kim**, Wonjae Shin, Heecheol Yang, Nayoung Lee, and Jungwoo Lee. "Rate Maximization with Reinforcement Learning for Time-Varying Energy Harvesting Broadcast Channels." In *Proc. IEEE Global Communications Conference* **(GLOBECOM)**, pp. 1-6. IEEE, 2019.

C2. **Heasung Kim**, Heecheol Yang, Yeongmo Kim, and Jungwoo Lee. "Action-Bounding for Reinforcement Learning in Energy Harvesting Communication Systems." In *Proc. IEEE Global Communications Conference* **(GLOBECOM)**, pp. 1-7. IEEE, 2018.

C1. Jiwoo Mun, **Heasung Kim**, and Jungwoo Lee. "A Deep Learning Approach for Automotive Radar Interference Mitigation." In *Proc. IEEE Vehicular Technology Conference* **(VTC)**, pp. 1-5. IEEE, 2018.

Domestic Papers

D3. **Heasung Kim**, Wongeun Song, Kyeongjun Ko, Jungtai Kim, and Jungwoo Lee. "Speed Scheduling of Autonomous Train through Reinforcement Learning." In *Proc. The 29th Joint Conference on Communications and Information*, May. 2019.

D2. Jiwoo Mun, **Heasung Kim**, and Jungwoo Lee. "A Real-time Food Detection on Mobile Phones for Diet Management Service." In *Proc. The 29th Joint Conference on Communications and Information*, May. 2019.

D1. **Heasung Kim**, Yeongmo Kim, and Jungwoo Lee. "Actor-Critic Method for Power Allocation Optimization in Energy Harvesting Systems." In *Proc. the Korean Institute of Communication Sciences Conference*, Jun. 2018.

Awards and Honors

Professional Development Award Jul. 2024
The University of Texas at Austin

Friends of Alec Graduate Student Fellowship Jun. 2024
The Cockrell School of Engineering, The University of Texas at Austin

Student Travel Grant Award for ISIT 2024 Jun. 2024

Grad Site Travel Award for Fall 2021 Aug. 2021
The Cockrell School of Engineering, The University of Texas at Austin

The University of Texas at Austin Engineering Fellowship Apr. 2021
The Cockrell School of Engineering, The University of Texas at Austin

Second Place Award, Super Rookie Project May 2020
Samsung Network Business
— Designed mobile user movement prediction systems to prevent car accidents

Distinguished M.S. Dissertation Award (The Best M.S. Dissertation Award) Aug. 2019
Seoul National University

Grand Prize (First Place), **Smart Museum Implementation** Aug. 2019
National Research Foundation of Korea and The Independence Hall of Korea
— Designed AI-based image colorization systems for restoring old portraits

Brain Korea 21 Plus Research Scholarship Fall 2017, Spring 2018, Fall 2018
Brain Korea 21 Plus

Excellence Award (First Place), **Artificial Intelligence Capstone Project** Dec. 2018
SK Telecom Co. Ltd. and Seoul National University (Graduate Course, Topics in Computer and VLSI)
— Developed hardware-efficient neural networks for object detection systems in smartphones
— Designed interactive user interface using Android Studio and developed prototypes, including implementation of voice recognition, for a smart speaker-based diet service

Tuition Fee Scholarship (100% tuition) Fall 2011—Fall 2013, Spring 2016—Spring 2017
Jin-Air Co. Ltd.

Semester High Honors, Fall 2016, Spring 2017 and **Semester Honors**, Fall 2012, Fall 2013
Korea University

Key Projects

Beyond-5G Extreme Mobility : Issues and Solutions
Sponsored research project by Interdigital and 6G@UT Sep. 2023—Present

Distributed Coordinated Multipoints
Sponsored research project by Interdigital and 6G@UT Sep. 2021—Aug. 2023
— Designed explicit CSI feedback algorithms for distributed CoMP.
— Designed Clustered federated learning algorithms for context-dependent CSI feedback modules.

Cell Load Balancing
Network Analytics Lab in Samsung Electronics Oct. 2019—Apr. 2021
— Designed and implemented model-based reinforcement learning algorithms for LTE cell load balancing
— Developed state-transition models and traffic prediction models for networks

Deep and Reinforcement Learning Techniques for Smart IoT Networks
Funded by the Korean Ministry of Science Mar. 2018—Jul. 2019
— Researched and developed lightweight and shallow artificial neural networks for energy-efficient communications
— Researched power allocation policies based on deep learning for advanced IoT Networks

Development of Artificial Intelligence for Automatic Train Operation
Funded by the Korea Railroad Research Institute Apr. 2018—Dec. 2018
— Developed reinforcement learning algorithms for speed scheduling of railway vehicles
— Implemented real-time packet communications between reinforcement learning agents and a virtual railway simulator that reflects the Korean railway systems

Low-Powered Jamming in Cyber and Electronic Warfare
Funded by the Korean Agency for Defense Development Jan. 2018—Dec. 2018
- — Designed algorithms for low-powered jamming using generative adversarial neural networks, which generate fake signals that mimic enemy signals
- — Implemented jamming scenarios on GNU Radio simulator with C/C++

Teaching Experience

Teaching Assistant, **Introduction to Reinforcement Learning** (430.758) Spring 2019
Graduate Course, Seoul National University
- — Ran Teaching Assistant session for over 70 students, answered questions in person and online, graded assignments and projects, and proctored exams

Teaching Assistant, **Introduction to Communications** (420.317.002) Fall 2017
Undergraduate Course, Seoul National University
- — Answered questions in person and online, graded assignments, and proctored exams

Military Service

Sergeant, **Korean Army and Korean National Police Agency** Feb. 2014—Nov. 2015
- — Served in Korean Army and Korean Police Agency (mandatory military service)
- — Received *Seoul Gangbuk Police Chief's Commendation Award*

Talks

Reinforcement Learning Approaches for Sum-Rate Maximization in Energy Constrained Systems Aug. 2021
Hanyang University, Seoul, South Korea (invited by Prof. Songnam Hong)
- — Covered the basic theories of dynamic programming with applications to sum-rate maximization problems on NOMA scheme

Reinforcement Learning with Applications to Communications May 2020
Pusan National University, Busan, South Korea (invited by Prof. Wonjae Shin)
- — Covered the basic theories and implementation methods of tabular-based reinforcement learning and deep reinforcement learning, both with applications to sum-rate maximization problems

Reinforcement Learning Implementation with TensorFlow Jan. 2018
Soongsil University, Korea Information and Communications Society, Seoul, South Korea
- — Provided tutorials on implementation of deep reinforcement learning algorithms through TensorFlow for OpenAI game simulators and wireless communication simulators