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Soobin Um

202, KMU Law Building, Seoul
02707, South Korea
☎ +82-2-910-4808
✉ soobin.um@kookmin.ac.kr
🌐 soobin-um.github.io
in [soobin-um](https://www.linkedin.com/in/soobin-um)
🔗 [soobin-um](https://github.com/soobin-um)



Education

- Aug. 2021 – **Ph.D. in Artificial Intelligence**, KAIST, Daejeon
Aug. 2025 Advisor: Prof. Jong Chul Ye
- Feb. 2012 – **M.S. in Electrical Engineering**, KAIST, Daejeon
Feb. 2014 Advisor: Prof. Wan Choi
- Mar. 2008 – **B.S. in Media Communication Engineering**, Hanyang University, Seoul
Feb. 2012 *Summa Cum Laude* (GPA: 4.13/4.5)

Work Experience

- Sep. 2025 – **Assistant Professor**, Kookmin University, Seoul
Present Department of Artificial Intelligence
- Feb. 2014 – **Senior Researcher**, Agency for Defense Development (ADD)
Aug. 2021 Wireless communication and network systems for military applications

Research Interests

Generative models, Trustworthy/Inclusive AI, Scientific discovery with AI

Publications

- Journal Papers [J1] Physics-guided and fabrication-aware inverse design of photonic devices using diffusion models
Dongjin Seo*, **Soobin Um***, Sangbin Lee, Jong Chul Ye, Haejun Chung
ACS Photonics (2025)
- Conference Papers [C7] DPAIL: Training Diffusion Policy for Adversarial Imitation Learning without Policy Optimization
Yunseon Choi, Minchan Jeong, **Soobin Um**, Kee-Eung Kim
NeurIPS 2025
- [C6] Boost-and-Skip: A Simple Guidance-Free Diffusion for Minority Generation
Soobin Um*, Beomsu Kim*, Jong Chul Ye
ICML 2025
- [C5] Minority-Focused Text-to-Image Generation via Prompt Optimization
Soobin Um, Jong Chul Ye
CVPR 2025 (Oral presentation, top 0.74%)

[C4] Physics-guided Optimization of Photonic Structures using Denoising Diffusion Probabilistic Models

Dongjin Seo*, **Soobin Um***, Sangbin Lee, Jong Chul Ye, Haejun Chung
NeurIPS 2024 Workshop (ML4PS)

[C3] Self-Guided Generation of Minority Samples Using Diffusion Models

Soobin Um, Jong Chul Ye
ECCV 2024

[C2] Don't Play Favorites: Minority Guidance for Diffusion Models

Soobin Um, Suhyeon Lee, Jong Chul Ye
ICLR 2024

[C1] A Fair Generative Model Using LeCam Divergence

Soobin Um, Changho Suh
AAAI 2023 (Oral presentation)

Projects

- Oct. 2025 – **AI-Driven Long-Range EO/IR/SWIR Sensor Fusion System** for Future Defense Innovative Technology Program (Ministry of Science & ICT, Republic of Korea). Awarded ~KRW 400M (~USD 300K). Role: Principal Investigator
Mar. 2028
- Aug. 2024 – **Basic Science Research Program** on Robust Generative AI (NRF and Ministry of Education, Republic of Korea). Role: Principal Investigator
Aug. 2025
- Sep. 2024 – **Basic Science Research Program Grant** on Robust Generative AI
Aug. 2025 Funded by the NRF and Ministry of Education, Republic of Korea
Role: Principal Investigator
- Jun. 2023 – **Development of AI-Based X-Ray Computer-Based Training Program:** Field-oriented Technology Development Project for Customs Administration, Ministry of Science & ICT (MSIT) and Korea Customs Service
Jun. 2024
- Jan. 2023 – **Development of AI Technology for Personalized Plug-and-Play Explanation and Verification of Explanation** for Institute of Information & communications Technology Planning & Evaluation (IITP) and the Korea government (MSIT)
Jun. 2023
- Sep. 2021 – **Development of a Framework to Analyze, Detect, and Mitigate/Remove Bias in AI Models and Training Data** for Institute of Information & communications Technology Planning & Evaluation (IITP) and the Korea government (MSIT)
Aug. 2022

Patents

- Registered **[PR18]** Apparatus, Method, Computer-Readable Storage Medium and Computer Program for Assigning Dynamic Frequencies in Wireless Network
Patent No. 10-2212367, Jan. 2021.
- [PR17]** Method and Apparatus for Satisfaction Degree based Weighted Fair Resource Allocation Optimization in Cognitive Radio Wireless Network
Patent No. 10-2204935, Jan. 2021.
- [PR16]** Apparatus and Method for Controlling Performance of Receiver for Sub-Device in MIMO Cognitive Radio Systems
Patent No. 10-2192564, Dec. 2020.

[PR15] Full Duplex Pair Matching Method for Improving Network Performance in Full Duplex Network Environment
Patent No. 10-2178266, Nov. 2020.

[PR14] Successive-Cancellation Fano Decoding Apparatus and Method for Decoding Using the Same
Patent No. 10-2158312, Sep. 2020.

[PR13] Apparatus and Method for Controlling Channel of Cognitive Radio
Patent No. 10-2107015, Apr. 2020.

[PR12] Data Convergence Method for Reducing Overhead of Cognitive Radio Networks
Patent No. 10-2085205, Feb. 2020.

[PR11] Method and Apparatus for Selecting Frequency Band in Cognitive Radio Network
Patent No. 10-2042260, Nov. 2019.

[PR10] Method and Apparatus for Allocating Frequency Resource in Cognitive Radio Ad-Hoc Network
Patent No. 10-2039650, Oct. 2019.

[PR9] Apparatus and Method for Scheduling Slots for Communication of Data Packets
Patent No. 10-2038051, Oct. 2019.

[PR8] Apparatus and Method for Constructing Rate-compatible Polar Code
Patent No. 10-1996026, Jun. 2019.

[PR7] Time Mirroring Method and System for Airborne Relay Communications
Patent No. 10-1901616, Sep. 2018.

[PR6] Space-Time Dynamic Spectrum Access Apparatus Combined by Multi-Beam Array Antenna and Time Division Duplexing and Frequency Division Duplexing
Patent No. 10-1873102, Jun. 2018.

[PR5] Radio Set System and Setting Channel Method for the Radio Set System
Patent No. 10-1832971, Feb. 2018.

[PR4] Phased Array Antenna System
Patent No. 10-1773481, Aug. 2017.

[PR3] Radio Apparatus for Sensing Space Frequency Spectrum
Patent No. 10-1764655, Jul. 2017.

[PR2] Polarization tracking system using dual polarization antenna with variable gain attenuator and the control method of the same
Patent No. 10-1747789, Jun. 2017.

[PR1] A Dynamic Spectrum Access Technique based on OFDM for P2P Communication
Patent No. 10-1632267, Jun. 2016.

Research Grants

- Oct. 2025 – **Future Defense Innovative Technology Program:** AI-Driven Long-Range
Mar. 2028 EO/IR/SWIR Sensor Fusion System
Funded by the Ministry of Science & ICT (MSIT), Republic of Korea
Role: Principal Investigator
- Sep. 2024 – **Basic Science Research Program Grant** on Robust Generative AI
Aug. 2025 Funded by the NRF and Ministry of Education, Republic of Korea
Role: Principal Investigator

Honors & Awards

- Aug. 2020 Bronze Medal, National Defense Science Award, ADD
Aug. 2020 Achievement Award, ADD
Jun. 2018 Outstanding Paper Award, KICS Winter Conference
Feb. 2012 *Summa Cum Laude*, Excellence Award, Hanyang University

Invited Talks

- Aug. 2025 *MinorityPrompt*, Korean AI Association - KAIA Summer Conference
Aug. 2025 *MinorityPrompt*, Poster Session at KCCV 2025
Jul. 2025 *MinorityPrompt and BnS: Recent Advances in Diffusion-Based Minority Sample Generation*, Visual AI Lab, Princeton University
Jul. 2025 *Physics-Guided and Fabrication-Aware Inverse Design Using Diffusion Models*, The McMahon Lab, Cornell University (Co-presented with Dongjin Seo)
Aug. 2022 *Diffusion Probabilistic Models: A Gentle Introduction*, SpiderCore

Teaching Experience

- Instructor**
- 1623802: Generative AI (Fall 2025, KMU)
 - 1568703: Data Science (Fall 2025, KMU)
- TA**
- AI501: Machine Learning for AI (Spring 2023, KAIST)
 - AI619: AI for Medical Imaging (Fall 2022, KAIST, **Head TA**)
 - EE424: Introduction to Optimization (Fall 2021, KAIST)
 - EE210: Probability and Introductory Random Processes (Fall 2013, KAIST)
 - EE321: Communication Engineering (Spring 2013, KAIST)
 - Data Science: Modeling for Prediction (Feb. 2022, Hyundai Motors)
 - Data Science Master Program (Sep. 2021 – Nov. 2021, Hyundai Motors)

Reviewer Services

- Conferences CVPR (2024–2026), ICLR (2025–2026), WACV (2026)
Journals IEEE Transactions on Image Processing (TIP)