

Young-Han Son

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RESEARCH INTERESTS

Physics-informed machine learning for scientific imaging and optimization. I develop neural architectures that explicitly model physical structure in complex scientific systems, with a current focus on computational lithography for semiconductor manufacturing. My work aims to improve accuracy, efficiency, and robustness under real-world process variation, while extending these ideas to molecular design and scientific discovery.

EDUCATION

Korea University, Seoul, South Korea

2021 – 2027 (Expected)

Ph.D. Candidate in Artificial Intelligence | Advisor: Prof. Tae-Eui Kam

Korea University, Seoul, South Korea

2015 – 2021

B.S. in Mechanical Engineering

SELECTED PUBLICATIONS

** denotes equal contribution; names in bold denote the applicant*

[CVPR 2026] Optical Diffraction-based Convolution for Semiconductor Lithography

Young-Han Son, Dong-Hee Shin, Deok-Joong Lee, Hyun Jung Lee, and Tae-Eui Kam

IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2026

[ICML 2025] Offline Model-based Optimization for Real-World Molecular Discovery

Dong-Hee Shin*, Young-Han Son*, Hyung Jung Lee, Deok-Joong Lee, and Tae-Eui Kam

International Conference on Machine Learning (ICML), 2025

[IJCAI 2024] Dynamic Many-Objective Molecular Optimization: Unfolding Complexity with Objective Decomposition and Progressive Optimization

Dong-Hee Shin*, Young-Han Son*, Deok-Joong Lee, Ji-Wung Han, and Tae-Eui Kam

International Joint Conference on Artificial Intelligence (IJCAI), 2024 — Long Presentation

[IEEE JBHI] FTMMR: Fusion Transformer for Integrating Multiple Molecular Representations

Young-Han Son*, Dong-Hee Shin*, and Tae-Eui Kam

IEEE Journal of Biomedical and Health Informatics (IEEE JBHI), 2024

[IEEE TSMC] MARS: Multiagent Reinforcement Learning for Spatial-Spectral and Temporal Feature Selection in EEG-based BCI

Dong-Hee Shin*, Young-Han Son*, Jun-Mo Kim, Hee-Jun Ahn, Jun-Ho Seo, Chang-Hoon Ji, Ji-Wung Han, and Tae-Eui Kam

IEEE Transactions on Systems, Man, and Cybernetics: Systems (IEEE TSMC), 2024

RESEARCH EXPERIENCE

Computational Lithography and Design Automation

2024 – Present

Developing physics-informed neural architectures for semiconductor lithography by explicitly embedding optical diffraction principles into model design. This research began with diffraction-aware operators and optimization techniques for improved manufacturability, and has expanded toward robust modeling under realistic process variation, including illumination source, defocus, and dose conditions. Current work further aims to scale neural lithography from local mask clips to full-chip design using neural operator learning.

Molecular AI for Drug Discovery

2022 – Present

My research in molecular AI has progressed from multimodal molecular representation learning to practical molecular design and optimization. I developed a fusion transformer integrating multiple molecular representations for property prediction, then advanced to many-objective and offline model-based optimization for real-world molecular discovery. Current work extends this direction toward deployable drug discovery systems integrating modular learning, mass spectrometry, and federated/meta-learning under heterogeneous institutional data environments.

Collaborative Research in Medical AI

2022 – Present

Contributed to collaborative projects in medical AI spanning fMRI, MRI, X-ray imaging, microscopy, and EEG-based brain-computer interfaces. These collaborations strengthened my experience in multimodal fusion, inverse problems, and robust learning from heterogeneous scientific data, while also supporting junior researchers in project development and experimentation.

LEADERSHIP & RESEARCH INITIATIVES

K-MELLODDY Federated Drug Discovery Initiative

2025 – Present

Leading the development of a federated-learning-based drug discovery initiative centered on modular multimodal modeling, mass spectrometry integration, and federated/meta-learning for heterogeneous institutional data. Contributing to project design, technical direction, and cross-team research planning.

TEACHING EXPERIENCE

Introduction to Generative Models — Instructor, Tech University of Korea	Spring 2023
Introduction to Artificial Intelligence — Tutor, LG CNS	2022
Advanced Big Data Analysis — Teaching Assistant, Korea University	Fall 2023, Fall 2024
Deep Learning — Teaching Assistant, Korea University	Spring 2022

HONORS & AWARDS

Research Challenger Program, Korea University (\$2,200 grant)	2022
Big Data-Driven Local Business Consulting Competition, KT (\$1,500 prize)	2022
Capstone Design Fair, Korea University (Silver Prize)	2020
Capstone Design Fair, Innovation Center for Engineering, Seoul District (Encouragement Award)	2020

PROFESSIONAL SERVICE

Conference Reviewer: CVPR 2026, ECCV 2026, NeurIPS 2026, ICLR 2025–2026, AAAI 2026, MICCAI 2025
Journal Reviewer: Nature Communications (2026–Present), IEEE TMI (2025–Present), IEEE JBHI (2025–Present)