Seungjun Lee

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Research Interests

My research goal is to develop artificial general intelligence having the ability to think in a scientific way. It is common in fields of science and engineering that a well-established governing rule can explain similar phenomena, not just fitting on data from a narrow domain. Therefore, it is more scientifically important, and at the same time very challenging, to develop a general model that can explain many related phenomena rather than a narrow model. In the field of machine learning, such discussions are considered very important problems, and I am enthusiastic about the study of approaching and applying learning-based models and algorithms from a scientific modeling perspective.

Education & Career History

Brookhaven National Laboratory — Upton, New York
Research Staff in Computer Science Initiative — 2025–Present

Brookhaven National Laboratory — Upton, New York
Research Associate in Computer Science Initiative — 2024–2025

Alsemy — Seoul, Korea
AI Researcher — 2022–2024

Seoul National University — Seoul, Korea
Ph.D. in Naval Architecture and Ocean Engineering (Prof. Woojae Seong) — 2017–2022

Seoul National University — Seoul, Korea
B.S. in Naval Architecture and Ocean Engineering — 2012–2017

Hansung Science High School — Seoul, Korea
Student — 2009–2012

Publications

1. Minju Jo, Woojin Cho, Uvini Balasuriya Mudiyanselage, **Seungjun Lee**, Noseong Park, Kookjin Lee, "PDEfuncta: Spectrally-Aware Neural Representation for PDE Solution Modeling", *Advances in Neural Information Processing Systems, 2025.*

2. David Keetae Park, Xihaier Luo, Guang Zhao, **Seungjun Lee**, Miruna Oprescu, and Shinjae Yoo, "SCENT: Robust Spatiotemporal Learning for Continuous Scientific Data via Scalable Conditioned Neural Fields", *International Conference on Machine Learning, 2025.*

3. Guang Zhao, Xihaier Luo, **Seungjun Lee**, Yihui Ren, Shinjae Yoo, Luke Van Roekel, Balu Nadiga, Sri Hari Krishna Narayanan, Yixuan Sun, and Wei Xu, "Generalizable Implicit Neural Representations via Parameterized Latent Dynamics for Baroclinic Ocean Forecasting", *International Conference on Learning Representations Workshop on Tackling Climate Change with Machine Learning, 2025.*

4. Chanwoo Park, **Seungjun Lee**, Junghwan Park, Kyungjin Rim, Jihun Park, Seonggook Cho, Jongwook Jeon, and Hyunbo Cho, "Large-Scale Training in Neural Compact Models for Accurate and Adaptable MOSFET Simulation", *IEEE Journal of the Electron Devices Society, 2024.*

5. **Seungjun Lee**, and Tail Oh, "Inducing Point Operator Transformer: A Flexible and Scalable Architecture for Solving PDEs", *AAAI Conference on Artificial Intelligence, 2024.*

6. **Seungjun Lee**, "Mesh-Independent Operator Learning for Partial Differential Equations", *International Conference On Machine Learning Workshop on AI for Science, 2022.*

7. **Seungjun Lee**, Haesang Yang, and Woojae Seong, "Identifying Physical Law of Hamiltonian Systems via Meta-Learning", *International Conference on Learning Representations, 2021.*

8. **Seungjun Lee**, Haesang Yang, Hwiyong Choi, and Woojae Seong, "Zero-Shot Single-Microphone Sound Classification and Localization in a Building via the Synthesis of Unseen Features", *IEEE Transactions on Multimedia, 2021.*

9. **Seungjun Lee**, and Woojae Seong, "Meta-Learned Hamiltonian", *Neural Information Processing Systems Workshop on Machine Learning and Physical Sciences, 2020.*

10. Hwiyong Choi, Haesang Yang, **Seungjun Lee**, and Woojae Seong, "Type/position classification of inter-floor noise in residual buildings with a single microphone via supervised learning", *IEEE European Signal Processing Conference, 2020.*

11. Haesang Yang, Hwiyong Choi, **Seungjun Lee**, and Woojae Seong, "A Learning-based Classification of Indoor Noise Type/Position in an Apartment Building", *Acoustical Society of America, 2019.*

12. Hwiyong Choi, Haesang Yang, **Seungjun Lee**, and Woojae Seong, "Classification of Inter-Floor Noise Type/Position Via Convolutional Neural Network-Based Supervised Learning", *Applied Science, 2019.*

13. Hwiyong Choi, Haesang Yang, **Seungjun Lee**, and Woojae Seong, "Classification of Inter-Floor Noise Type/Position via Supervised Learning", *Acoustical Society of America, 2019.*

14. Hwiyong Choi, **Seungjun Lee**, Haesang Yang, and Woojae Seong, "Classification of Noise Between Floors in a Building using Pre-Trained Deep Convolutional Neural Networks", *International Workshop on Acoustic Signal Enhancement, 2018.*

Teaching

- **Teaching Assistant** at Seoul National University — Fall 2021
  Theory of Sound Wave Propagation in the Ocean
- **Teaching Assistant** at Seoul National University — Spring 2021
  Fundamentals of Underwater Acoustics
- **Teaching Assistant** at Seoul National University — Spring 2020
  Creative Experiments in Naval Architecture and Ocean Engineering
- **Teaching Assistant** at Seoul National University — Fall 2019
  Creative Experiments in Naval Architecture and Ocean Engineering

Service

- **Conference Reviewer:** ICLR (2025, 2026), ICML (2025), Neurips (2025), AAAI (2026), TMLR (2025)

Skills

- Python, PyTorch, JAX, Tensorflow, MATLAB, Julia, LATEX, SPICE

Projects

- **Generative AI for particle physics** 2025.10 –2026.09
  Main content: Develop and evaluate AI-based surrogate models for fast spatiotemporal hydrodynamic simulations to accelerate physical modeling and prediction.

  - Evaluate performance of multiple AI model architectures for multi-dimensional quark-gluon-plasma simulations

  - Validate surrogate model outputs by comparing them against results from standard hydrodynamic simulations.

  - Extend the model evaluation to high-dimensional hydrodynamic simulations, testing scalability and stability.

- **Developing a generative models for ptychography** 2025.01 –2026.09
  Main content: Develop and apply a diffusion-based generative model for solving the inverse problem of ptychography. The goal is to generate high-quality reconstructions of the target phase of the materials.

  - Obtain diffusion model results using real experimental diffraction data, including preprocessing and postprocessing to make results physically plausible.

  - Collaborate with domain scientists to analyze the results from the diffusion-based inverse solver.

- **Developing foundation models for gamma spectra** 2024.10 –2025.09
  Main content: Developing a robust and computationally efficient Transformer to learn gamma spectra data.

- **Developing ocean foundation models for forecasting the ocean circulation** 2024.09 –2024.12
  Main content: Developing a robust and efficient foundation model to analyze and forecast Atlantic meridional overturning circulation.

- **Developing efficient architecture for solving physical systems** 2022.09 –2024.02
  Main content: Developing a flexible and computationally efficient Transformer to learn physical systems handling continuous functions.

  - Proposing a Transformer that is flexible in handling arbitrary discretization and scalable to large discretization sizes.

  - Handling arbitrary input/output discretization by processing them in the latent space to avoid quadratic complexity.

  - Achieving high accuracy and efficient computational costs in several PDE benchmarks and real-world scenarios.

- **Developing robust physics-based neural networks for analyzing dynamic systems** 2021.03 –2022.08
  Main content: Proposing a method using meta-learning algorithms to model governing equations from similar dynamical systems, enabling rapid learning for new systems even with limited measurement data.

  - Using a meta-learning algorithm to extract governing rules across similar dynamical systems.

  - Using Neural ODEs and the Hamiltonian equations to continuously model dynamical systems and utilize the energy conservation principle.

  - Simulating various systems with different physical properties and initial conditions and validating the capability to efficiently learn new systems even with limited data.

- **Learning-based sound source classification and localization with limited data** 2019.03 –2021.02
  Main content: Developing a generative model to robustly estimate the position of sound sources, even from unseen locations within a building during the training.

  - Applying Zero-shot learning techniques to the problem of sound classification and localization, involving simultaneously classifying the type and location of sound sources.

  - Using a conditional GAN to map sound data to their corresponding types and locations of sound sources and to augment data for unseen locations.

  - Collecting extensive real-world environment sound datasets, including various types and locations, to develop a robust sound generative model.

Awards

- [BK] Education Research Group selected excellent graduate students 2022
- Korean Mathematical Olympiad (high school) - bronze prize 2010

- Korean Mathematical Olympiad (middle school) - gold prize 2008
- Korean Physics Olympiad (middle school) - silver prize 2007
- Korean Mathematical Olympiad (middle school) - silver prize 2006