

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

Alsemy (alsemy.com) AI Researcher	Seoul, Korea 2022–Present
Seoul National University Ph.D. in Naval Architecture and Ocean Engineering	Seoul, Korea 2017–2022
Seoul National University B.S. in Naval Architecture and Ocean Engineering	Seoul, Korea 2012–2017
Hansung Science High School Student	Seoul, Korea 2009–2012

PUBLICATIONS

1. **Seungjun Lee**, and Tail Oh, “Inducing Point Operator Transformer: A Flexible and Scalable Architecture for Solving PDEs”, *AAAI Conference on Artificial Intelligence*, 2024.
2. **Seungjun Lee**, “Mesh-Independent Operator Learning for Partial Differential Equations”, *International Conference On Machine Learning Workshop on AI for Science*, 2022.
3. **Seungjun Lee**, Haesang Yang, and Woojae Seong, “Identifying Physical Law of Hamiltonian Systems via Meta-Learning”, *International Conference on Learning Representations*, 2021.
4. **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.
5. **Seungjun Lee**, and Woojae Seong, “Meta-Learned Hamiltonian”, *Neural Information Processing Systems Workshop on Machine Learning and Physical Sciences*, 2020.
6. 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.
7. 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.

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

SKILLS

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

PROJECTS

- **Developing efficient architecture for solving physical systems** 2022.08 –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 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