

## 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

<b>Brookhaven National Laboratory</b> Research Associate in Computer Science Initiative	Upton, New York 2024–Present
<b>Alsemy</b> AI Researcher	Seoul, Korea 2022–2024
<b>Seoul National University</b> Ph.D. in Naval Architecture and Ocean Engineering (Prof. Woojae Seong)	Seoul, Korea 2017–2022
<b>Seoul National University</b> B.S. in Naval Architecture and Ocean Engineering	Seoul, Korea 2012–2017
<b>Hansung Science High School</b> Student	Seoul, Korea 2009–2012

## PUBLICATIONS

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

7. 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.
8. 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.
9. 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.
10. Hwiyong Choi, Haesang Yang, **Seungjun Lee**, and Woojae Seong, "Classification of Inter-Floor Noise Type/Position via Supervised Learning", *Acoustical Society of America*, 2019.
11. 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

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- **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

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

## PROJECTS

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- **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 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

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| • [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 |