Jaeheun Jung

I'm a Ph.D candidate at the AIMLK lab in Department of Mathematics, Korea University.
I'm interested in various methods and applications in AI researches.

Education

Ph.D in Mathematics

Korea University

Since 2020	Artificial Intelligence, Advisor: Donghun Lee
2019~2020	Algebraic geometry, Advisor: Euisung Park

B.S in Mathematics

2013~2018	Korea University

Publications

(*): equal contribution

- "Data-Driven Dimensional Synthesis of Diverse Planar Four-bar Function Generation Mechanism via Direct Parameterization," In preparation.

- "IPPRO: Importance-based Pruning with PRojective Offset for Magnitude-indifferent Structural Pruning," under review.

- "Catalyst: A Novel Regularizer for Structured Pruning with auxiliary extension of parameter space," under review

- "HyperUn: Controlling Uncertainty in Hyperbolic Space for Machine Unlearning," under review.

- **Jaeheun Jung**, Bosung Jung, Suhyun Bae and Donghun Lee, "OPC: One-Point-Contraction unlearning toward deep feature forgetting," Arxiv preprint, url:https://arxiv.org/abs/2507.07754.

- **Jaeheun Jung** and Donghun Lee, "Catalyst: Structured Pruning with Robust Bifurcation Dynamics", In ICML 2025 Workshop - 3rd Workshop on High-dimensional Learning Dynamics (HiLD), 2025.

- Jaehyuk Lee*, **Jaeheun Jung***, Yeajin Lee*, Changhae Jung and Donghun Lee, "Broadband Ground Motion Synthesis by Diffusion Model with Minimal Condition", In ICML 2025 workshop Machine Learning for Audio, 2025.

- **Jaeheun Jung***, Jaehyuk Lee*, Hanyoung Kim*, Changhae Jung and Donghun Lee, "Enhancing Generative Seismic Modeling via Paired Dataset Construction Method", In ICML 2025 workshop TerraBytes, 2025.

- **Jaeheun Jung***, Jaehyuk Lee*, Chang-Hae Jung, Hanyoung Kim, Bosung Jung and Donghun Lee, 2024, "Broadband Ground Motion Synthesis by Diffusion Model with Minimal Condition", In the 42nd International Conference on Machine Learning (ICML), 2025.

- **Jaeheun Jung** and Donghun Lee. 2024. "Bypassing Stationary Points in Training Deep Learning Models," in IEEE Transactions on Neural Networks and Learning Systems, vol. 35, no. 12, pp. 18859-18871, Dec. 2024, doi: 10.1109/TNNLS.2024.3411020.

- **Jaeheun Jung** and Euisung Park. 2024. "On Completely Decomposable Defining Equations of Finite Sets in Pn." Communications in Algebra 52, no. 6 (2024): 2527–33. doi:10.1080/00927872.2024.2302084.

- Taehun Cha*, **Jaeheun Jung*** and Donghun Lee. 2022. "Noun-MWP: Math Word Problems Meet Noun Answers." In Proceedings of the 29th International Conference on Computational Linguistics, 3847–57.

Gyeongju, Republic of Korea: International Committee on Computational Linguistics.

Patents

- Jaeheun Jung and Donghun Lee, 'Method for overcoming artificial neural network learning failure through local minima bypass and artificial neural network learning apparatus for performing the same', KR patent registered 10-2789913-0000, filed Oct 25, 2021, issued Mar 27, 2025.
- Jaeheun Jung, Jaehyuk Lee, Changhae Jung and Donghun Lee, 'Artificial neural network simulation device based on condition latent diffusion model for virtual seismic wave synthesis', KR10-2024-0185214, Patent pending.
- Jaeheun Jung and Donghun Lee, ' Artificial neural network structured pruning apparatus and method', KR10-2024-0145553, Patent pending.
- Jaeheun Jung, Woonryong Kim, Jungun Ha, Donghun Lee and Jaekyung Shim, 'Training method for dimensional synthesis of function generation mechanism in linkage apparatus and apparatus thereof', KR10-2025-0083085, Patent pending.
- Jaeheun Jung, Woonryong Kim, Jungun Ha, Donghun Lee and Jaekyung Shim, 'Training method for dimensional synthesis of function generation mechanism in slider-crank apparatus and apparatus thereof', KR10-2025-0083095, Patent pending.
- Jaeheun Jung, Jaehyuk Lee, Yeajin Lee and Donghun Lee, 'Apparatus and method for structured pruning of neural networks based on filter importance assessment using projective geometry', KR10-2025-0087784, Patent pending.
- Jaeheun Jung, Bosung Jung and Donghun Lee, 'Apparatus and method for neural network unlearning based on one-point contraction', KR10-2025-0092132, Patent pending.
- Jaeheun Jung, Bosung Jung, Suhyun Bae and Donghun Lee, 'Apparatus and method for recovering and evaluating machine unlearned neural networks', KR10-2025-0092136, Patent pending.
- 10+ more registered patents (related to old projects, non-ML) can be found with IN=[420090360374] in KIPRIS

Invited Talks

- Natural language processing using the Pretrained Language Model and solving a math word problem, Artificial intelligence symposium, GWNU (Gangneung-Wonju national university) Natural Science Research Institute, 2023

Conference oral presentations

- On completely decomposable defining equations of points in general position in Pn, Korean Mathematical Society 2020 Fall Meeting, 2020
- Bypassing stationary points in training deep learning models, Korean Mathematical Society 2024 Fall Meeting, 2024

Projects & Awards

AI-related (Group projects)

Since 2025   *Project Unlearning*

- Collaborators: Bosung Jung and Suhyun Bae from AIMLK
- Revealed: MU methods forgets shallowly; performance on forget set is easily recovered
- Proposed: OPC for MU, designed for the deep feature forgetting and robustness on recovery and inversion attack
- Role: Project leader, proposed attack scheme, evaluation criteria and new MU method, and full management of overall project.
- Status: 1 full Manuscript under review, uploaded to arxiv. 2 patents are pending.

Since 2025   *Project Pruning*

- Collaborators: Jaehyuk Lee and Yeajin Lee from AIMLK

- Structured pruning with projective geometry
- Proposed: Importance criteria for structured pruning with magnitude-independent property.
- Role: Project leader, proposed importance criteria and related theory, full management of overall project including experiment design, finetuning strategies, etc.
- Status: Manuscript under review with CNN results, further experiments on transformers are in progress.

2023-2025   *Project Autokinematics*

- Joint work with Woonryong Kim from Mechanical Design & CAD Lab in Korea University, and Jeong-un Ha (AIMLK)
- Automated machine design problem on kinematics, starting with 4-bar joint problem with arbitrary number of precision points.
  - curve fitting problem on torus T^2, where curve parameter lies on projective space P^3
- Role: Project leader. Implemented: data synthesis module with efficient algorithm, and automated train/ evaluation pipelines. Proposed: Domain specified metrics, neural network design and overall training processes.
- Status: Manuscript under internal review, 2 patents pending.

2023-2025   *Project Earthquake*

- Collaborators: Jaehyuk Lee, Chang-Hae Jung, Hanyoung Kim and Bosung Jung from AIMLK
- Imputation subproject: generating sythetic waveform at synthetic station using nearby station's observations and metadata.
  - Proposed diffusion-model based approach with domain-specific characteristics on seismic dataset.
- Role: Project leader. Managed: strategies for the generations, and model architectures, all evaluations and theoretical foundations.
- Status: 1 paper accepted to ICML 2025, 2 papers accepted to ICML 2025 workshops, 1 patent pending.

2023-2023   *AI Grand Challenge: Policy Supporting AI 2nd competition*

- Collaborators: Taehun Cha (Project leader), Yanggee Kim, Hanyoung Kim, Changhae Jung, Yejin Jeong and Nayoung Lee from AIMLK
- RAG (Retrieval augmented generation) task for automatic research report generation
- result: 7th place, award from the President of the Korea Electronics Research Institute
- Role: Group leader, managed assembly of hwp parer, retriever and generation module with proper prompt engineering, docker containers.

2023-2023   *AI Grand Challenge: Policy Supporting AI open track*

- Collaborators: Taehun Cha, Jeong-un Ha, Yanggee Kim, Hanyoung Kim, Jaehyuk Lee, Keunsuk Cho, Changhae Jung, Yejin Jeong and Sanga Yoon from AIMLK
- Continued from 2022
- result: 2nd winner
- Role: Project leader. Full management on overall tasks including GPT/rule-based data augmentation, multimodal retrieval model development and multi-hop QA solver development.

2022-2022   *AI Grand Challenge: Policy Supporting AI 1st competition*

- Collaborators: Taehun Cha, Jeong-un Ha, Hansol Jeon, Yanggee Kim, Hanyoung Kim, Jaehyuk Lee and Keunsuk Cho from AIMLK
- NLP task on document processing for structured & muti-hop QA with retrieval on open-domain conditions
- Achieved 7th place out of 54 teams
- Role: Project co-leader. Designed global solving pipeline, managed development processes and dataset, and implemented retrieval models, QG model for augmentation, evaluation server with Flask, docker containers, pdf and hwp parsers and preprocessor.

2022-2022   *Korean AI Competition*

- Collaborators: Taehun Cha, Yanggee Kim and Hansol Jeon from AIMLK
- ASR (automatic speech recognition) task on korean language.
- Held by Korean National Information Society Agency, supported by Naver Corp and Hyundai Motor Company

- Achieved 4th place out of 103 teams
- Role: Implementation of baseline models and korean decoder module for phonemes.

2021-2022   *Project Fashion*

- Collaborators: Yanggee Kim, Jaehyuk Lee and Wooyoung Jung from AIMLK
- Generating 3D model with VTON (virtual try-on) from given cloth and 2D model images.
- Role: Project leader. Designed pipeline of the solution, data processing and model architecture and implemented via transfer learning.

2021-2021   *AI Grand Challenge 2021*

- Collaborators: Taehun Cha, Hason Jeon and Dongwon Kim from AIMLK
- NLP task on Korean elementary school level math word problems, with various nonarithmetic operations required
- Awarded (ranking not published) and selected for the follow-up research
- Role: Project co-leader. Proposed global pipeline of solving problem with target sequence design, implemented pre and post-processing parts and managed model training.
- Paper published in COLING 2022, title: Noun-MWP: Math Word Problems Meet Noun Answers.

AI-related (Personal project)

Since 2023   *Project Mildpruning*

- personal research project on structured pruning
- pointed out the drawback of existing (group) lasso regularizer and proposed new regularizer.
    - which ensures lossless pruning and bifurcation
    - related to bypass algorithm for the implementation.
- status: 1 Manuscript under review and 1 Patent pending
- Extended to group project with multiple future directions.

2020-2023   *Project Bypass*

- personal research project on neural network training
- proposed and evaluated local-minima escaping algorithm for first order optimization on neural networks
- status: Done, paper published in IEEE TNNLS

Other projects

2019~2020	Graduate project on Defining equations of finite points
2018~2019	Personal startup project on Reinforced blind clutches
2016~2017	Undergraduate project on Commuting varieties
2011~2017	Personal project on safety blind clutches
2011~2012	R&E project for Study on the functional regulation of adipocytes
2009~2011	Personal project on Flat Light collecting devices

Research Interests

AI & ML   Various applications and methods are all interested. Especially, bridging geometric methods with AI researches.