Jaeheun Jung

I'm a Ph.D candidate at the 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

- 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.
- 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.
- 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*, Jaehyuk Lee*, Chang-Hae Jung, Hanyoung Kim, Bosung Jung and Donghun Lee, 2024, "Broadband Ground Motion Synthesis by Diffusion Model with Minimal Condition", Arxiv preprint, url: https://arxiv.org/abs/2412.17333

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, 'Optimal Dimensional Design Method for Four-Bar Function Generator Linkage Using a Machine Learning Model', KR10-2024-0202142, Patent pending.
- 10+ more 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 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 pruning*

- Collaborators: Jaehyuk Lee (aimlk), Yejin Lee (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.
- Manuscript under review.

2023-2025 *Project autokinematics*

- Joint work with Mechanical Design & CAD Lab in Korea University
- Automated machine design problem on kinematics, starting with 4-bar joint problem with arbitrary number of observations.
    - curve fitting problem on torus T^2, where curve parameter lies on projective space P^5
- Role: Project co-leader. Implemented: data synthesis module with efficient algorithm, and automated train/evaluation pipelines. Proposed: Domain specified metrics, neural network design and overall training processes.
- Manuscript under internal review, and patent pending.

2023-2025 *Project earthquake*

- Imputation subproject: generating sythetic waveform at synthetic station using nearby station's observations and metadata.
- Preprint uploaded to arxiv, currently under review.
- Role: Project leader. Managed: strategies for the generations, and model architectures, all evaluations and theoretical foundations.

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

- 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*

- 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*

- 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 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*

- 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*

- Generating 3D model with VTON (virtual try-on) from given cloth and 2D model images.
- Role: Designed pipeline of the solution, data processing and model architecture and implemented via transfer learning.

2021-2021 *AI Grand Challenge 2021*

- 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: 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: Manuscript under review, Patent pending
- Multiple branches are active for future research.

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.