

Hanseul Cho (조한슬)

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Personal Profile

I am a Ph.D. student in the Optimization & Machine Learning (OptiML) Laboratory, advised by Prof. Chulhee Yun at Kim Jaechul Graduate School of AI (GSAI) in Korea Advanced Institute of Science and Technology (KAIST). Before this, I received my Bachelor's degree in Mathematical Sciences (major) and Computing Sciences (minor) at KAIST in 2022.

My primary research interests lie in optimization, machine learning, and deep learning, mainly focusing on theoretical analysis of them. Recently, I have been looking at topics on various constrained and/or multi-level optimization problems, including minimax optimization (i.e., saddle point problem), fair machine learning, reinforcement learning, continual/incremental learning, and more, with particular interest.

Education

Korea Advanced Institute of Science and Technology (KAIST)

Seoul, Republic of Korea

Ph.D. in Artificial Intelligence

Sept. 2023 – Current

- Advisor: Prof. Chulhee Yun (Optimization & Machine Learning (OptiML) Laboratory, Kim Jaechul Graduate School of AI (GSAI), KAIST)

Korea Advanced Institute of Science and Technology (KAIST)

Seoul, Republic of Korea

M.Sc. in Artificial Intelligence

Mar. 2022 – Aug. 2023

- Advisor: Prof. Chulhee Yun (Optimization & Machine Learning (OptiML) Laboratory, Kim Jaechul Graduate School of AI (GSAI), KAIST)
- Thesis: "Improved Convergence Rate of SGDA by Shuffling: Focusing on the Nonconvex-PL Minimax Problems" (Approved by Chulhee Yun, Se-Young Yun, & Donghwan Kim)
- GPA: 4.22/4.3

Korea Advanced Institute of Science and Technology (KAIST)

Daejeon, Republic of Korea

B.Sc. in Mathematical Sciences

Mar. 2017 – Feb. 2022

- Minor in Computer Sciences
- Summa Cum Laude (GPA: 4.05/4.3)

University of Twente

Enschede, Netherlands

Exchange Student Program

Feb. 2020 – Jul. 2020

- Major in Applied Mathematics

Incheon Science High School

Incheon, Republic of Korea

High School

Mar. 2015 – Feb. 2017

- Early Graduation (two-year course)

Publications

PREPRINTS

- Hanseul Cho*, Jaeyoung Cha*, Pranjali Awasthi, Srinadh Bhojanapalli, Anupam Gupta, Chulhee Yun. "Position Coupling: Leveraging Task Structure for Improved Length Generalization of Transformers." *Under Review*. 2024. [arXiv]

INTERNATIONAL CONFERENCES/JOURNALS

- Lee, Jaewook*, Hanseul Cho*, Chulhee Yun. "Fundamental Benefit of Alternating Updates in Minimax Optimization." **ICML 2024 & ICLR 2024 Workshop** on Bridging the Gap Between Practice and Theory in Deep Learning (BGPT). [OpenReview] [arXiv]
 - **Spotlight at ICML 2024.** (Acceptance rate: (144+191)/9473 = 3.5%)
- Lee, Junghyun*, Hanseul Cho*, Se-Young Yun, Chulhee Yun. "Fair Streaming Principal Component Analysis: Statistical and Algorithmic Viewpoint." **NeurIPS 2023**. [OpenReview] [arXiv]
- Lee, Hojoon*, Hanseul Cho*, Hyunseung Kim*, Daehoon Gwak, Joonkee Kim, Jaegul Choo, Se-Young Yun, Chulhee Yun. "PLASTIC: Improving Input and Label Plasticity for Sample Efficient Reinforcement Learning." **NeurIPS 2023**. [OpenReview] [arXiv]
- Cho, Hanseul and Chulhee Yun. "SGDA with Shuffling: Faster Convergence for Nonconvex-PL Minimax Optimization." **ICLR 2023**. [OpenReview] [arXiv]

DOMESTIC CONFERENCES/JOURNALS

- Cho, Hanseul*, Junghyun Lee*, Se-Young Yun, Chulhee Yun. "Fair Streaming Principal Component Analysis: Statistical and Algorithmic View-point." 2023 *Korea AI Association Summer Conference (CKAIA 2023)*.
- Lee, Hojoon*, Hanseul Cho*, Hyunseung Kim*, Daehoon Gwak, Joonkee Kim, Jaegul Choo, Se-Young Yun, Chulhee Yun. "Enhancing Generalization and Plasticity for Sample Efficient Reinforcement Learning." *CKAIA 2023*.
- Cho, Hanseul and Chulhee Yun. "SGDA with Shuffling: Faster Convergence for Nonconvex-PL Minimax Optimization." Short version in 2022 *Korea AI Association + NAVER Autumnal Joint Conference (JKAIA 2022)*.
 - NAVER Outstanding Theory Paper Award & Spotlight presentation.

Ongoing Projects

Fair Principal Component Analysis - Complexity Lower Bound

Seoul, Republic of Korea

KAIST AI

Mar. 2023 – Current

- In Lee et al. (2023), we have studied the memory-efficient & group-wise fair principal component analysis (PCA) methodology called 'Fair Streaming PCA'.
- We proved the upper bound of sample complexity of our main algorithm 'Fair Noisy Power Method (FNPM)' mainly exploiting matrix Bernstein inequality. However, the tightness of the bound has not been checked yet.

Implicit Bias of Continual Learning in Logistic Regression

Seoul, Republic of Korea

KAIST AI

Jul. 2023 – Current

- Theoretical understanding of continual learning is mostly done in a simple regression setting, where the objective function is mostly based on a quadratic loss. In such a setting, gradient-based algorithms typically found a minimum for each task at a finite point.
- In contrast, however, the trajectory of continual learning has not been well understood in the classification setup, including even a logistic regression. In logistic regression, the iterates of the gradient-based algorithm diverge to infinity, which makes the theoretical analysis difficult.

Overcoming Loss of Plasticity of Neural Network

Seoul, Republic of Korea

KAIST AI

Nov. 2023 – Current

- Neural networks often struggle with the problem called 'loss of plasticity,' which refers to the phenomenon that a model loses the ability to adapt to the shifts in data distribution, especially when new data points appear.
- Interestingly, re-initializing the model partially or entirely, so-called "re-learning," greatly helps the model to recover its adaptability in practice.
- Why is it beneficial? Furthermore, can we develop a "smart" way of re-learning instead of re-initializing the whole model?

Experiences

Machine/Deep Learning Theory + Physics (MDLTP) Seminar

Seoul, Republic of Korea

(Co-)Organizer

Jul. 2022 – Feb. 2023

- Homepage: sites.google.com/view/mdlt-p
- Jointly organized by OSI Lab, OptiML, and CSSPL
- Topics: Learning theory, loss landscape, trajectory analysis, (stochastic) optimization, high-dimensional statistics, statistical/mathematical physics, scientific machine learning, and more.

KAIST 2021 Post-AI Research Project

Daejeon, Republic of Korea

Undergraduate Researcher

May 2021 – Dec. 2021

- Jointly advised by Prof. Sangyoon Yi (DS Lab, GSFS, KAIST) & Prof. Jinkyoo Park (Sys. Int. Lab, ISysE, KAIST)
- Project: Research on 'AI-augmented Organizations' of Collaborative Decision Making and Learning
- Contribution: (1) Devised a model-based randomized algorithm for a single-player finite-horizon NK landscape optimization game; (2) Conducted some experiments on human-AI cooperation based on the algorithm that I devised

Korea Advanced Institute of Science and Technology (KAIST)

Daejeon, Republic of Korea

Individual Study

Mar. 2021 – Jun. 2021

- Advised by Prof. Jinwoo Shin (ALIN Lab, GSAI, KAIST)
- (1) gradient-based optimizers for large-batch setting (e.g., LARS & LAMB); (2) theoretical analysis on gradient clipping (paper reading)

Korea Advanced Institute of Science and Technology (KAIST)

Daejeon, Republic of Korea

Individual Study

Sep. 2020 – Feb. 2021

- Advised by Prof. Jong-chul Ye (BISPL, BBE, KAIST)
- Assignment: Semantic Segmentation of Kidney Tumor with U-Net (with KiTS19 Challenge Dataset)

Korea Advanced Institute of Science and Technology (KAIST)

Daejeon, Republic of Korea

Individual Study

Jun. 2020 – Aug. 2021

- Advised by Prof. Yeonseung Chung (MAS, KAIST)
- Statistical learning theory

Services

Reviewer

- NeurIPS 2024.
- ICLR 2024. (2 papers)
- NeurIPS 2023. (2 papers)

GPU server manager of OptiML lab

- Be involved in installing new GPU servers, allocating GPU nodes to lab members, and managing errors occurred in the servers.
- June 2022 – Feb 2024

Awards

2022	NAVER Outstanding Theory Paper Award , JKAIA 2022	<i>Republic of Korea</i>
2022	Summa Cum Laude , Bachelor's, KAIST	<i>Republic of Korea</i>
2017 – 2020	The National Scholarship for Science and Engineering , Korea Student Aid Foundation	<i>Republic of Korea</i>
2017 Fall	Dean's List , The School of Freshman, KAIST	<i>Republic of Korea</i>

Skills

Programming	Familiar: Python (PyTorch, NumPy, Scikit-learn, Jupyter, Pandas, etc.), MATLAB. Novice: C, C++, R, HTML/CSS, Scala
Computer Misc.	Familiar: \LaTeX (Overleaf/VSCode), Git, Microsoft Office. Novice: Adobe (Lightroom, Premiere Pro, After Effects, Photoshop)
Music	Playing the drums and percussions

Languages

English	Sufficient for academic activities: TOEIC score 925 (LC 460, RC 465) (2021.04.11)
Korean	Native proficiency
Others	Had some introductory courses on French, German, Classical Latin, & Chinese.