

Yueun Lee

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EDUCATION

Seoul National University (SNU), Korea

Mar. 2021 – Jun. 2025 (Expected)

B.S. in Statistics, Mathematics, and Computer Science & Engineering (**Triple Major**)

- Major GPA: Overall 4.07, Stats 4.04, Math 4.3, CS&E 3.99 (out of 4.3)

Seoul Science High School, Korea

Mar. 2018 – Feb. 2021

School for gifted students in science and mathematics

RESEARCH INTERESTS

Machine Learning (ML): Deep Learning Theory, Optimal Transport, Reinforcement Learning, Statistical ML

Numerical Analysis: Numerical Linear Algebra, Numerical Optimization

PUBLICATIONS

Published:

- [1] G. Hwang, Y. Park, **Y. Lee**, and M. Kang. “Analysis of efficient preconditioner for solving Poisson equation with Dirichlet boundary condition in irregular three-dimensional domains”. In: *Journal of Computational Physics* 519 (2024), p. 113418. DOI: <https://doi.org/10.1016/j.jcp.2024.113418>

Submitted:

- [2] H. Lee, **Y. Lee**, M. Imaizumi, and J. Won. *Minimax Optimal Estimation of Distributions with Wasserstein Autoencoders using Exact Penalties*. Submitted. 2024
- [3] G. Hwang, Y. Park, **Y. Lee**, J. Hahn, and M. Kang. *Localized Estimation of Condition Numbers for MILU Preconditioners on a Graph*. Submitted to *SIAM Journal on Numerical Analysis*. 2024. URL: <https://arxiv.org/abs/2501.00245>

HONORS AND AWARDS

The National Presidential Science Scholarship in Mathematics

2021 – 2024

Korea Student Aid Foundation

- Full tuition and a \$5,000 annual stipend for distinguished undergraduates from the Korean government

Undergraduate Mathematics Competition: 1st Award

Dec. 2023

Korean Mathematics Society

- Achieved the highest score among all participants, receiving a monetary prize of \$800

Korea Mathematics Olympiad - Final round: Excellence Award

Jul. 2020

Korean Mathematics Society

- Top 27 participants in a competitive qualifier for the national IMO team selection

Korea Mathematics Olympiad: Gold Award

Dec. 2018, Dec. 2019

Korean Mathematics Society

- Top 28, 26 participants in a prestigious mathematics competition for high school students

International Mathematics Tournament of Towns: Gold Award (Top Gold Winner) **Dec. 2018**

Korean Organizing Committee

- 1st place nationally in the Senior A-level (Advanced) with challenges similar to IMO

Iranian Geometry Olympiad: Gold Award (Top Gold Winner)

Oct. 2018

Iranian Mathematical Society

- 1st place among international participants in a prestigious geometry competition

RESEARCH EXPERIENCE

Numerical Computing & Image Analysis Research Group

Mar. 2024 – Present

Advisor: Myungjoo Kang (Department of Mathematics, SNU)

- Topic: Analyzing Modified Incomplete LU (MILU) preconditioners on a graph [3] Jul. 2024 – Present
 - Introduced a generalized MILU for a graph structure
 - Proposed the Localized Estimator of Condition Number (LECN), which provides an upper bound for the condition number of the preconditioned system
 - Demonstrated the versatility of LECN through case studies on uniform grids, high-order schemes, and hierarchical grid structures(e.g., Quadtree/Octree meshes)
- Topic: MILU-type preconditioner analysis for Poisson equation on irregular domains [1] Mar. 2024 – Jun. 2024
 - Confirmed the second-order accuracy of the Gibou method and MILU's condition number reduction from $O(h^{-2})$ to $O(h^{-1})$, both proven in two dimensions, also holds in three dimensions
 - Suggested that increasing order path lengths impact MILU performance, leading to the introduction of Sectored-MILU, which supports parallel computing
 - Demonstrated that Sectored-MILU achieves an $O(h^{-1})$ reduction in condition number and consistently outperforms MILU in various domains

Statistical Computing Lab

Dec. 2023 – Present

Advisor: Joong-Ho Won (Department of Statistics, SNU)

- Topic: A simulation study of the penalty method for Wasserstein Autoencoders [2] Mar. 2024 – Present
 - Demonstrated that a specific nonlinear transformation of f -divergences serve as an exact penalty
 - Conducted one-dimensional simulations that showcase the superior performance of the exact penalties compared to other f -divergences
 - Analyzed the effectiveness of the exact penalties in multidimensional simulations
- Topic: Study of Stochastic Optimization Dec. 2023 – Feb. 2024
 - Studied Stochastic Optimization through Taiji Suzuki's book “確率的最適化（機械学習プロフェッショナルシリーズ）” and presented on specific topics within Batch Stochastic Optimization, particularly focusing on SDCA, SVRG, and SAG methods
 - Composed a section rigorously proving the KKT conditions and Lagrange duality
 - Winter 2023 Undergraduate's Research Internship (Research Fund of \$500) by SNU

Oh Reinforcement Learning Group

Jun. 2024 – Sep. 2024

Advisor: Min-hwan Oh (Graduate School of Data Science, SNU)

- Topic: Study of Bandit Algorithms Jun. 2024 – Sep. 2024
 - Reviewed the comprehensive content of the book “Bandit Algorithms” by Tor Lattimore and Csaba Szepesvári
 - Examined the concepts of reinforcement learning, focusing on regret analysis
 - Analyzed the theories of stochastic/adversarial bandits and linear bandits, along with their upper and lower bounds on regret

Intelligent Data Exploration and Analysis (IDEA) Lab

Jun. 2023 – Aug. 2023

Advisor: Yongdai Kim (Department of Statistics, SNU)

- Topic: Study of Optimal Transport Jun. 2023 – Aug. 2023
 - Reviewed recent optimal transport papers, focusing on fast large-scale algorithms and applications in generative modeling
 - Explored various gradient descent algorithms, focusing on their motivations and intuitions
 - Summer 2023 Undergraduate's Research Internship (Research Fund of \$500) by SNU

SKILLS

C/C++, **Python** (advanced), **Java**, **R**, **Julia** (intermediate)

LANGUAGES

English (fluent), **Korean** (native)