

# Yueun Lee

[mathlife@snu.ac.kr](mailto:mathlife@snu.ac.kr) | [yueunlee.github.io](https://yueunlee.github.io)

## 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

---

**Numerical Analysis:** Numerical Linear Algebra, Numerical Optimization

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

## 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 to *Journal of the American Statistical Association*. 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

## 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 general graph structures [3] Jul. 2024 – Present
  - Introduced a generalized Modified Incomplete LU (MILU) preconditioner for arbitrary graph structures
  - 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)