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

Numerical Analysis: Numerical Linear Algebra, Numerical Optimization

Machine Learning: Deep Learning Theory, Reinforcement Learning, Statistical Machine Learning, Optimal Transport

Publications

Published:

[1] Geonho Hwang, Yesom Park, **Yueun Lee**, and Myungjoo 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

In Preparation:

[2] Hyunjong Lee, **Yueun Lee**, Masaaki Imaizumi, and Joong-Ho Won. "Wasserstein Autoencoders and Exact Penalty Methods". Manuscript in preparation. 2024

[3] Geonho Hwang, Yesom Park, **Yueun Lee**, Jooyoung Hahn, and Myungjoo Kang. "Localized Estimation of Condition Numbers for MILU Preconditioners on General Graph Structures". Manuscript in preparation. 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)