

Junseo Lee

CONTACT INFORMATION

Seoul National University
Research Institute of Mathematics
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EDUCATION

Yonsei University, Seoul, Korea
B.S. in Electrical and Electronic Engineering, Mar. 2019 – Feb. 2023
Fully funded by the [Hyundai Motor Chung Mong-Koo \(CMK\) Scholarship](#)
High Honors (2022); Honors (2021, 2020)

Chungnam Science High School, Gongju, Korea
Concentration in Mathematics, Early Graduation, Mar. 2017 – Dec. 2018

RESEARCH INTERESTS

Quantum Information and Theoretical Computer Science
Quantum tomography, learning, and many-body systems
Quantum algorithms and computational complexity

RESEARCH EXPERIENCE

Research Institute of Mathematics, Seoul National University, Seoul, Korea
Research Affiliate, Quantum Information Theory Group, Jan. 2023 – Present
Undergraduate Research Assistant, Mar. 2021 – Dec. 2022

(Military Service) Norma Inc., Seoul, Korea
Technical Research Personnel of the Republic of Korea Army¹
Research Scientist, Quantum AI Team, Jan. 2023 – Present

PUBLICATIONS ([Google Scholar](#))

Note: Authors marked with an asterisk (*) contributed equally; authors marked with a dagger (†) are listed in alphabetical order.

Preprints

1. [J. Lee[†]](#), M. Shin, “Optimal certification of constant-local Hamiltonians,” [arXiv:2512.09778](#).
2. M. Fanizza, V. Iyer, [J. Lee[†]](#), A. A. Mele, F. A. Mele, “Efficient learning of bosonic Gaussian unitaries,” [arXiv:2512.09778](#).
► **Contributed Talk, QIP 2026.**
3. N. A. Nghiem, [J. Lee](#), T.-C. Wei, “Hybrid quantum-classical framework for Betti number estimation with applications to topological data analysis,” [arXiv:2508.01516](#).
4. K. Anand, K. Jeong, [J. Lee[†]](#), “Collapses in quantum-classical probabilistically checkable proofs and the quantum polynomial hierarchy,” [arXiv:2506.19792](#).
5. [J. Lee[†]](#), N. A. Nghiem, “New aspects of quantum topological data analysis: Betti number estimation, and testing and tracking of homology and cohomology classes,” [arXiv:2506.01432](#).

Journal Articles

6. D. Ji, [J. Lee](#), M. Shin, I. Sohn, K. Jeong, “Bounding quantum uncommon information with quantum neural estimators,” *Quantum Science and Technology* **11**, 015001 (2026). [doi:10.1088/2058-9565/ae18f4](#).

¹A designation under South Korea’s Military Service Act for qualified scientists completing mandatory service through three years of full-time industry research.

7. M. Shin*, J. Lee*, S. Lee, K. Jeong, “Resource-efficient algorithm for estimating the trace of quantum state powers,” *Quantum* **9**, 1832 (2025).
[doi:10.22331/q-2025-08-27-1832](https://doi.org/10.22331/q-2025-08-27-1832).
 8. M. Lee, M. Shin, J. Lee, K. Jeong, “Mutual information maximizing quantum generative adversarial networks,” *Scientific Reports* **15**, 32835 (2025).
[doi:10.1038/s41598-025-18476-y](https://doi.org/10.1038/s41598-025-18476-y).
 9. M. Shin*, S. Lee*, J. Lee*, D. Ji, H. Yeo, K. Jeong, “Disentanglement provides a unified estimation for quantum entropies and distance measures,” *Physical Review A* **110**, 062418 (2024). [doi:10.1103/PhysRevA.110.062418](https://doi.org/10.1103/PhysRevA.110.062418).
 10. M. Shin, J. Lee, K. Jeong, “Estimating quantum mutual information through a quantum neural network,” *Quantum Information Processing* **23**, 57 (2024).
[doi:10.1007/s11128-023-04253-1](https://doi.org/10.1007/s11128-023-04253-1).
 11. J. Lee, K. Jeong, “Quantum Rényi entropy functionals for bosonic gaussian systems,” *Physics Letters A* **490**, 129183 (2023). [doi:10.1016/j.physleta.2023.129183](https://doi.org/10.1016/j.physleta.2023.129183)
► Special Issue, [Foundations and applications of Quantum Optics](#) (2024).
 12. J. Lee, H. Yeo, K. Jeong, “Weighted p -Rényi entropy power inequality: Information theory to quantum Shannon theory,” *International Journal of Theoretical Physics* **62**, 253 (2023). [doi:10.1007/s10773-023-05512-8](https://doi.org/10.1007/s10773-023-05512-8)
 13. J. Lee, K. Jeong, “High-dimensional private quantum channels and regular polytopes,” *Communications in Physics* **31**, 189 (2021). [doi:10.15625/0868-3166/15762](https://doi.org/10.15625/0868-3166/15762)
► Third Prize, [Undergraduate Research Exhibition, Korean Physical Society](#) (2021).
 14. K. Jeong, J. Lee, J. Choi, S. Hong, M. Jung, G. Kim, J. Kim, S. Kim, “Single qubit private quantum channels and 3-dimensional regular polyhedra,” *New Physics: Sae Mulli* **68**, 232 (2018). [doi:10.3938/NPSM.68.232](https://doi.org/10.3938/NPSM.68.232)
► Bronze Award, [The Humantech Paper Award, Samsung Electronics](#) (2018).
- Book Chapters
15. J. Lee, “Assessing Quantum Integer Factorization Performance with Shor’s Algorithm,” In: *Quantum Computing: A Journey into the Next Frontier of Information and Communication Security*, CRC Press (2024). [doi:10.1201/9781003475286](https://doi.org/10.1201/9781003475286)
- Patents
16. K. Jeong, M. Shin, J. Lee, “Method for estimating quantum mutual information through a quantum neural network,” *Korea Patent Application* No. 10-2024-0104765 (pending, 2024).

HONORS AND AWARDS

Funding and Fellowships

- PhD Study Abroad Fellowship, Hyundai Motor CMK Foundation, 2026 (Expected)
- Academic Travel Grant (QIP 2022), Hyundai Motor CMK Foundation, 2022
- **Hyundai Motor Chung Mong-Koo (CMK) Scholarship**, 2021 – 2022
- Teaching Fellowship for Software Courses, Yonsei University, 2021 – 2022

Additional Honors and Awards

- Selected Paper Award, Finance and Economics Contest, DB Group, 2022
- Best Tutor Award, Yonsei University, 2021 – 2022
- Third Prize, Undergraduate Research Exhibition, Korean Physical Society, 2021
- Bronze Award, The Humantech Paper Award, Samsung Electronics, 2018
- Best Translator Award, NAVER Connect Foundation and Khan Academy, 2018
- National Honorable Mention, Korean Olympiad in Informatics, 2016
- Regional Gold Award, Korean Olympiad in Informatics, 2016

PROFESSIONAL ACTIVITIES

Journal Reviewer: Physical Review Letters, IEEE Transactions on Information Theory, npj Quantum Information, Physical Review Research, Physical Review Applied, Physical Review A, Physics Letters A, Annalen der Physik

Conference Reviewer: Quantum Techniques in Machine Learning (QTML 2025)

Community Service:

- *Creator and Maintainer*, [Quantum Learning Theory Zoo](#), curated repository of quantum learning theory papers, 2025 – Present
- *Selection Committee*, [Quantum Internship Program](#), National Information Society Agency and Korea Quantum Industry Center, 2024 – 2025
- *Co-organizer*, [SNU Quantum Information Theory Seminar](#), 2024 – 2025
- *Co-organizer*, [Quantum AI Hackathon](#), jointly organized by Kakao Enterprise Corp. and Jeonju University, 2025
- *Facilitator (Mentor)*, Mathematics Section, Korea Scholar’s Conference for Youth (KSCY), Yonsei University, 2019

TEACHING

Quantum Information Science Club Association (QISCA)

(Teaching materials are available at: harris-junseo-lee.github.io/teaching/)

- *Invited Lecturer*, [Quantum Learning Theory for Bosonic Systems](#), Winter 2025
- *Invited Lecturer*, [Quantum Complexity Reading Group](#), Fall 2025
- *Invited Lecturer*, [Quantum Learning and Complexity Theory](#), Summer 2025

University–Industry Research Internship

- *Instructor*, AAA558/AAA559: College of Informatics Internship, Korea University (Graduate Course), Fall 2025
- *Instructor*, SW4343: Software Field Placement 1 ([Quantum Internship Program](#)), Korea Aerospace University, Fall 2024

Yonsei University

- *Teaching Assistant*, YCS1009: Change the World through Programming, Fall 2022
- *Teaching Assistant*, YCS1002: Software Programming, Fall 2022
- *Teaching Assistant*, EEE1108: Engineering Information Processing, Fall 2021
- *Course Tutor*, MAT2016: Engineering Math 3, Spring 2022 [Best Tutor Award]
- *Course Tutor*, MAT1012: Engineering Math 2, Fall 2021 [Best Tutor Award]

SELECTED TALKS

Note: Talks marked with an asterisk (*) were delivered online.

Research Talks

“Efficient learning of bosonic Gaussian unitaries”

- *Invited talk*, [Annual Meeting of the Quantum Information Society of Korea](#), Feb. 2026
- *Invited talk*, [N³etFraST Workshop](#), Nov. 2025
- *Invited talk*, [Yonsei Quantum Data Science & AI Lab Seminar](#), Nov. 2025
- *Contributed talk*², [QIP 2026](#), Jan. 2026

“New aspects of quantum topological data analysis”

- *Invited talk*, KISTI-SNU Joint Workshop, Jun. 2025

“Resource-efficient algorithm for estimating the trace of quantum state powers”

- *Invited talk*, Electronics & Telecommunications Research Institute, Dec. 2024
- *Invited talk*, SNU Quantum Information Theory Seminar, Dec. 2024*
- *Invited talk*, [IBM-Yonsei Qiskit Fall Fest](#), Nov. 2024*

²Presented under the title “Efficient Learning Algorithms for Structured Bosonic and Fermionic Unitary Operators”, as a merged submission with [arXiv:2504.11318](https://arxiv.org/abs/2504.11318).

	<ul style="list-style-type: none"> • <i>Contributed talk</i>, Annual Meeting of Korean Mathematical Society, Oct. 2024 • <i>Poster</i>, QIP 2025, Feb. 2025 <p>“Mutual information maximizing quantum generative adversarial network”</p> <ul style="list-style-type: none"> • <i>Invited talk</i>, Triangle Quantum Computing Seminar, NC State University Quantum Initiative, Nov. 2023* <p>“Estimating quantum mutual information through a quantum neural network”</p> <ul style="list-style-type: none"> • <i>Invited talk</i>, CS Katha Barta, National Institute of Science Education and Research Bhubaneswar, Aug. 2023* <p>“Quantum Rényi entropy functionals for bosonic Gaussian systems”</p> <ul style="list-style-type: none"> • <i>Poster</i>, QIP 2022, Mar. 2022 <p>“High-dimensional private quantum channels and regular polytopes”</p> <ul style="list-style-type: none"> • <i>Invited talk</i>, KISTI-KU-SNU Joint Workshop, Sep. 2023* • <i>Invited talk</i>, SNU Quantum Information Theory Seminar, Aug. 2021* • <i>Contributed talk</i>, Winter Meeting of the Optical Society of Korea, Feb. 2022 • <i>Contributed talk</i>, Fall Meeting of the Korean Physical Society, Oct. 2021* • <i>Poster</i>, QIP 2022, Mar. 2022
Tutorials and Public Lectures	<p>“Learning theory in ∞-dimensional quantum systems”</p> <ul style="list-style-type: none"> • <i>Invited talk</i>, Team QST Summer Workshop, Seoul National University, Aug. 2025 <p>“Introduction to quantum machine learning”</p> <ul style="list-style-type: none"> • <i>Invited talk</i>, AWS Korea Healthcare & Research Team Seminar, Mar. 2025 <p>“Topics in theoretical quantum computer science”</p> <ul style="list-style-type: none"> • <i>Invited talk</i>, Shinil High School, Aug. 2024 <p>“Quantum machine learning models for drug library generation”</p> <ul style="list-style-type: none"> • <i>Invited talk</i>, Yonsei Quantum Computing and Monte Carlo Workshop, Aug. 2024 <p>“QMA $\stackrel{?}{=} \text{NP}$: The NLTS theorem and the quantum PCP conjecture”</p> <ul style="list-style-type: none"> • <i>Invited talk</i>, SNU Center for Quantum Network’s Channel Capacity Summer Workshop, Jul. 2024 <p>“Minimal data may be sufficient for quantum artificial intelligence”</p> <ul style="list-style-type: none"> • <i>Invited talk</i>, SNU Department of Mathematical Sciences Seminar, Jun. 2023*
SKILLS AND TECHNICAL EXPERIENCE	<p>Programming Languages: Proficient in C, C++ (Informatics Olympiad), and Python; experienced with Java.</p> <p>Quantum Software: Proficient in PennyLane and IBM Qiskit (certified); experienced with Q[#] and PyZX (ZX-calculus).</p> <ul style="list-style-type: none"> • <i>IBM Certified Associate Developer</i>, Quantum Computation using Qiskit, 2023 • <i>Advanced Achievement</i>, IBM Quantum Spring Challenge, 2023 • <i>Advanced Achievement</i>, Xanadu QHack Coding Challenges, 2023
REFERENCES	Available upon request.