

Junseo Lee

CONTACT INFORMATION	Seoul National University Research Institute of Mathematics 1 Gwanak-ro, Gwanak-gu Seoul 08826, Republic of Korea E-mail: harris.junseo@gmail.com Website: harris-junseo-lee.github.io	Norma Inc. Quantum AI Team 52 Achasan-ro 15-gil, Seongdong-gu Seoul 04799, Republic of Korea TEL: +82 10-6768-3451
EDUCATION	Yonsei University , Seoul, Korea <i>B.S. in Electrical and Electronic Engineering</i> , 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 <i>Concentration in Mathematics</i> , Early Graduation (Top 20%), Mar. 2017 – Dec. 2018	
RESEARCH EXPERIENCE	Research Institute of Mathematics, Seoul National University , Seoul, Korea <i>Research Affiliate</i> , Quantum Information Theory Group, Jan. 2023 – Present <i>Undergraduate Research Assistant</i> , Mar. 2021 – Dec. 2022	
	(Mandatory Military Service) Norma Inc. , Seoul, Korea Technical Research Personnel of the Republic of Korea Army ¹ <i>Research Scientist</i> , Quantum AI Team, Jan. 2023 – Present	
PUBLICATIONS (Google Scholar)	<p><i>Note:</i> Authors marked with an asterisk (*) contributed equally; authors marked with a dagger (†) are listed in alphabetical order.</p> <p><i>Research Interests:</i> Quantum Information, Learning Theory, Complexity Theory</p> <p>Preprints</p> <ol style="list-style-type: none">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. <p>Journal Articles</p> <ol style="list-style-type: none">6. D. Ji, J. Lee, M. Shin, I. Sohn, K. Jeong, “Bounding quantum uncommon information with quantum neural estimators,” <i>Quantum Science and Technology</i> 11, 015001 (2026). doi:10.1088/2058-9565/ae18f4.7. M. Shin*, J. Lee*, S. Lee, K. Jeong, “Resource-efficient algorithm for estimating the trace of quantum state powers,” <i>Quantum</i> 9, 1832 (2025). doi:10.22331/q-2025-08-27-1832.	

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

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.
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.
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.
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
► 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
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
► 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
► 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

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 CMK Scholarship** in Intelligent Information Technology, full tuition and living stipend, 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*
- *Contributed talk*, Annual Meeting of Korean Mathematical Society, Oct. 2024
- *Poster*, QIP 2025, Feb. 2025

“Mutual information maximizing quantum generative adversarial network”

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>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>
Tutorials and Public Lectures	<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 <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 $\stackrel{?}{=}$ 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.

(Last updated on December 22, 2025)