

# Junseo Lee

---

CONTACT INFORMATION	Seoul National University Research Institute of Mathematics 1 Gwanak-ro, Gwanak-gu Seoul 08826, Republic of Korea	Norma Inc. Quantum AI Team 52 Achasan-ro 15-gil, Seongdong-gu Seoul 04799, Republic of Korea
	E-mail: <a href="mailto:harris.junseo@gmail.com">harris.junseo@gmail.com</a> Website: <a href="https://harris-junseo-lee.github.io/">https://harris-junseo-lee.github.io/</a>	TEL: +82 10-6768-3451
EDUCATION	<b>Yonsei University</b> , Seoul, Korea B.S. in Electrical and Electronic Engineering, Mar. 2019 – Feb. 2023 Fully funded by the <a href="#">Hyundai Motor Chung Mong-Koo (CMK) Scholarship</a>	
	<b>Chungnam Science High School</b> , Gongju, Korea Concentration in Mathematics, Early Graduation, Mar. 2017 – Dec. 2018	
RESEARCH INTERESTS	<b>Quantum Information and Theoretical Computer Science</b> Quantum tomography, learning, and many-body systems Quantum algorithms and computational complexity	
RESEARCH EXPERIENCE	<b>Research Institute of Mathematics, Seoul National University</b> , Seoul, Korea <i>Research Affiliate</i> , Quantum Information Theory Group, Jan. 2023 – Present <i>Undergraduate Research Assistant</i> , Mar. 2021 – Dec. 2022	
	<b>(Military Service) Norma Inc.</b> , Seoul, Korea Technical Research Personnel of the Republic of Korea Army <sup>1</sup> <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>	
Preprints	<ol style="list-style-type: none"><li>1. <a href="#">J. Lee<sup>†</sup></a>, M. Shin, “Optimal certification of constant-local Hamiltonians,” <a href="https://arxiv.org/abs/2512.09778">arXiv:2512.09778</a>.</li><li>2. M. Fanizza, V. Iyer, <a href="#">J. Lee<sup>†</sup></a>, A. A. Mele, F. A. Mele, “Efficient learning of bosonic Gaussian unitaries,” <a href="https://arxiv.org/abs/2512.09778">arXiv:2512.09778</a>. ► Contributed Talk, <a href="#">QIP 2026</a>.</li><li>3. N. A. Nghiem, <a href="#">J. Lee</a>, T.-C. Wei, “Hybrid quantum-classical framework for Betti number estimation with applications to topological data analysis,” <a href="https://arxiv.org/abs/2508.01516">arXiv:2508.01516</a>.</li><li>4. K. Anand, K. Jeong, <a href="#">J. Lee<sup>†</sup></a>, “Collapses in quantum-classical probabilistically checkable proofs and the quantum polynomial hierarchy,” <a href="https://arxiv.org/abs/2506.19792">arXiv:2506.19792</a>.</li><li>5. <a href="#">J. Lee<sup>†</sup></a>, N. A. Nghiem, “New aspects of quantum topological data analysis: Betti number estimation, and testing and tracking of homology and cohomology classes,” <a href="https://arxiv.org/abs/2506.01432">arXiv:2506.01432</a>.</li></ol>	
Journal Articles	<ol style="list-style-type: none"><li>6. D. Ji, <a href="#">J. Lee</a>, M. Shin, I. Sohn, K. Jeong, “Bounding quantum uncommon information with quantum neural estimators,” <i>Quantum Science and Technology</i> <b>11</b>, 015001 (2026). <a href="https://doi.org/10.1088/2058-9565/ae18f4">doi:10.1088/2058-9565/ae18f4</a>.</li></ol>	

---

<sup>1</sup>A 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/](https://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*, [N<sup>3</sup>etFraST Workshop](#), Nov. 2025
  - *Invited talk*, [Yonsei Quantum Data Science & AI Lab Seminar](#), Nov. 2025
  - *Contributed talk*<sup>2</sup>, [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\*

<sup>2</sup>Presented 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"> <li>• <i>Contributed talk</i>, Annual Meeting of Korean Mathematical Society, Oct. 2024</li> <li>• <i>Poster</i>, QIP 2025, Feb. 2025</li> </ul> <p>“Mutual information maximizing quantum generative adversarial network”</p> <ul style="list-style-type: none"> <li>• <i>Invited talk</i>, Triangle Quantum Computing Seminar, NC State University Quantum Initiative, Nov. 2023*</li> </ul> <p>“Estimating quantum mutual information through a quantum neural network”</p> <ul style="list-style-type: none"> <li>• <i>Invited talk</i>, CS Katha Barta, National Institute of Science Education and Research Bhubaneswar, Aug. 2023*</li> </ul> <p>“Quantum Rényi entropy functionals for bosonic Gaussian systems”</p> <ul style="list-style-type: none"> <li>• <i>Poster</i>, QIP 2022, Mar. 2022</li> </ul> <p>“High-dimensional private quantum channels and regular polytopes”</p> <ul style="list-style-type: none"> <li>• <i>Invited talk</i>, KISTI-KU-SNU Joint Workshop, Sep. 2023*</li> <li>• <i>Invited talk</i>, SNU Quantum Information Theory Seminar, Aug. 2021*</li> <li>• <i>Contributed talk</i>, Winter Meeting of the Optical Society of Korea, Feb. 2022</li> <li>• <i>Contributed talk</i>, Fall Meeting of the Korean Physical Society, Oct. 2021*</li> <li>• <i>Poster</i>, QIP 2022, Mar. 2022</li> </ul>
Tutorials and Public Lectures	<p>“Learning theory in <math>\infty</math>-dimensional quantum systems”</p> <ul style="list-style-type: none"> <li>• <i>Invited talk</i>, Team QST Summer Workshop, Seoul National University, Aug. 2025</li> </ul> <p>“Introduction to quantum machine learning”</p> <ul style="list-style-type: none"> <li>• <i>Invited talk</i>, AWS Korea Healthcare &amp; Research Team Seminar, Mar. 2025</li> </ul> <p>“Topics in theoretical quantum computer science”</p> <ul style="list-style-type: none"> <li>• <i>Invited talk</i>, Shinil High School, Aug. 2024</li> </ul> <p>“Quantum machine learning models for drug library generation”</p> <ul style="list-style-type: none"> <li>• <i>Invited talk</i>, Yonsei Quantum Computing and Monte Carlo Workshop, Aug. 2024</li> </ul> <p>“QMA <math>\stackrel{?}{=}</math> NP: The NLTS theorem and the quantum PCP conjecture”</p> <ul style="list-style-type: none"> <li>• <i>Invited talk</i>, SNU Center for Quantum Network’s Channel Capacity Summer Workshop, Jul. 2024</li> </ul> <p>“Minimal data may be sufficient for quantum artificial intelligence”</p> <ul style="list-style-type: none"> <li>• <i>Invited talk</i>, SNU Department of Mathematical Sciences Seminar, Jun. 2023*</li> </ul>
SKILLS AND TECHNICAL EXPERIENCE	<p><b>Programming Languages:</b> Proficient in C, C++ (Informatics Olympiad), and Python; experienced with Java.</p> <p><b>Quantum Software:</b> Proficient in PennyLane and IBM Qiskit (certified); experienced with Q# and PyZX (ZX-calculus).</p> <ul style="list-style-type: none"> <li>• <i>IBM Certified Associate Developer</i>, Quantum Computation using Qiskit, 2023</li> <li>• <i>Advanced Achievement</i>, IBM Quantum Spring Challenge, 2023</li> <li>• <i>Advanced Achievement</i>, Xanadu QHack Coding Challenges, 2023</li> </ul>
REFERENCES	Available upon request.