(Harris) Junseo Lee – Curriculum Vitae

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EDUCATION

Yonsei University   Seoul, South Korea
B.S. in Electrical and Electronic Engineering   Mar. 2019 – Feb. 2023
Thesis: *Combinatorial Designs for Information Theory* (Supervisor: Prof. Hong-Yeop Song)
Recipient of the *Hyundai Motor CMK Scholarship* including full tuition and research grant

Chungnam Science High School   Gongju, South Korea
High School Diploma (Mathematics Major, Early Graduation for Top 20% Students)   Mar. 2017 – Dec. 2018

NATIONAL SERVICE

Research Scientist (Technical Research Personnel) – Alternative to Military Conscription
Quantum Computing Research Scientist at Norma Inc.   Jan. 2023 – present
Completed Basic Military Training, Korea Army Training Center   Dec. 2023 – Jan. 2024

RESEARCH EXPERIENCE

Quantum Data Science & AI Lab, Yonsei University   Seoul, South Korea
Research Collaboration (with Prof. Daniel Kyungdeock Park)   Sep. 2024 – present

Quantum Software Lab, University of Edinburgh   Edinburgh, UK
Research Collaboration (with Prof. Chris Heunen)   May 2024 – present

Research Institute of Mathematics, Seoul National University   Seoul, South Korea
Research Collaboration (with Dr. Kabgyun Jeong)   Jan. 2023 – present
Research Assistant (Supervisor: Dr. Kabgyun Jeong)   Mar. 2020 – Jan. 2023

High Dimensional Signal Processing Lab, Yonsei University   Seoul, South Korea
Research Intern (Supervisor: Prof. Chulhee Lee)   Jul. 2022 – Dec. 2022

Mathematical Biology Lab, Yonsei University   Seoul, South Korea
Lead Research Intern (Supervisor: Prof. Jeehyun Lee)   Dec. 2021 – Jun. 2022

PUBLICATIONS

Journal Articles

[J6] M. Shin[†], S. Lee[†], **J. Lee**[†] **(co-first author)**, M. Lee, D. Ji, H. Yeo, K. Jeong. Disentanglement provides a unified estimation for quantum entropies and distance measures. Accepted at *Physical Review A* (2024).

[J5] M. Shin, **J. Lee**, K. Jeong. Estimating quantum mutual information through a quantum neural network. *Quantum Information Processing*, **23**, 57 (2024).

[J4] **J. Lee**, K. Jeong. Quantum Rényi entropy functionals for bosonic gaussian systems. *Physics Letters A*, **490**, 129183 (2023).

[J3] **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).

[J2]   **J. Lee**, K. Jeong. High-dimensional private quantum channels and regular polytopes. *Communications in Physics*, **31**, 189 (2021).

[J1]   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).

Book Chapters

[B1]   **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 (1st ed.)*, edited by M. Hammoudeh, A. T. Essa, A. M. Sherbeeni, C. M. Firth, A. S. Essa. CRC Press (2024).

arXiv Preprints

[A2]   M. Shin[†], **J. Lee**[†] **(co-first author)**, S. Lee, K. Jeong. Rank is all you need: Estimating the trace of powers of density matrices. arXiv:2408.00314 (2024).

[A1]   M. Lee, M. Shin, **J. Lee**, K. Jeong. Mutual information maximizing quantum generative adversarial network and its applications in finance. arXiv:2309.01363 (2023).

Patents

[P1]   K. Jeong, M. Shin, **J. Lee**. Method for estimating quantum mutual information through a quantum neural network. Korea Patent: App. No. 10-2024-0104765 (2024).

PROFESSIONAL ACTIVITIES

Journal Reviewer: IEEE Transactions on Information Theory

Internship Reviewer: 3rd Quantum Internship Program – Korea Quantum Industry Center and National Information Society Agency

MAJOR HONORS & SCHOLARSHIPS

High Honor Student, Yonsei University	2022
Research Travel Grant for Academic Conference Participation, Hyundai Motor Foundation	2022
Selected Paper Award, DB Group Finance and Economics Contest	2022
Teaching Scholarship for Software Courses, Yonsei University	2021, 2022
Best Tutor Award, Innovation Center for Teaching and Learning, Yonsei University	2021, 2022
Tutoring Scholarship, Innovation Center for Teaching and Learning, Yonsei University	2021, 2022
Student Research Grant, Hyundai Motor Foundation	2021, 2022
Full-Tuition Scholarship, Hyundai Motor Foundation	2021, 2022
Third Prize, Korean Physical Society Undergraduate Research Project Exhibition	2021
Honor Student, Yonsei University	2020, 2021
Bronze Award, The Humantech Paper Award, Samsung Electronics	2018
Excellent Translator Award, NAVER Connect Foundation	2018
Gold Award, Korean Olympiad in Informatics – Regional Qualifiers	2016

CERTIFICATIONS & ACHIEVEMENTS

Advanced Achievement, IBM Quantum Spring Challenge	2023
Advanced Achievement, QHack Coding Challenges, Xanadu Quantum Technologies	2023
Advanced Data Analytics Semi-Professional, Korea Data Agency	2023
IBM Certified Associate Developer – Quantum Computation, IBM Professional Certification	2023

TALICS AND POSTERS

TALKS AND POSTERS

Invited and Contributed Talks

[T19] "Rank-dependent estimator for q-Tsallis entropy" Invited talk at Electronics and Telecommunications Research Institute, Dec. 18th, 2024.

[T18] "Rank-dependent complexity in estimating traces of quantum state powers" Invited talk at Seoul National University QST Seminar, Dec. 13th, 2024.

[T17] "Rank is all you need to estimate the trace of the powers of density matrices" Invited talk at IBM-Yonsei Qiskit Fall Fest 2024, Nov. 7th, 2024.

[T16] "Efficient estimation of trace of powers of density matrices via rank-based methods" Contributed talk at the Annual Meeting of Korean Mathematical Society, Oct. 25th, 2024.

[T15] "Rank is all you need to estimate the trace of the powers of density matrices" Invited talk at the 4th Korea Institute of Science and Technology Information-Korea University-Seoul National University Joint Workshop, Oct. 15th, 2024.

[T14] "Quantum machine learning models for drug library generation" Invited talk at Yonsei University Quantum Computing and Monte Carlo Workshop, Aug. 30th, 2024.

[T13] "Topics in theoretical quantum computer sciences" Invited lecture at Shinil High School, Aug. 28th, 2024.

[T12] "QMA $\neq$ NP? The remaining journey in quantum complexity theory: The NLTS theorem and the quantum PCP conjecture" Invited talk at Center for Quantum Network's Channel Capacity Summer Workshop, Jul. 25th, 2024.

[T11] "Disentanglement provides a unified estimation for quantum entropies and distances" Contributed talk at the Spring Meeting of the Korean Physical Society, Apr. 25th, 2024.

[T10] "Disentanglement provides a unified estimation for quantum entropies and distance measures" Contributed talk at the Annual Meeting of the Quantum Information Society of Korea, Apr. 23rd, 2024.

[T9] "Mutual information maximizing quantum generative adversarial network and its applications in finance" Invited talk at North Carolina State University Triangle Quantum Computing Seminar, Nov. 3rd, 2023.

[T8] "Estimating quantum mutual information through a quantum neural network" Invited talk at National Institute of Science Education and Research Bhubaneswar, Aug. 18th, 2023.

[T7] "Generalized private quantum channel and randomizing quantum states" Invited talk at the 2nd Korea Institute of Science and Technology Information-Korea University-Seoul National University Joint Workshop, Sep. 22nd, 2023.

[T6] "Minimal data may be sufficient for quantum artificial intelligence" Invited talk at Seoul National University QST Seminar, Jun. 30th, 2023.

[T5] "Isotropic measure and ε-randomizing maps on the high-dimensional quantum system" Contributed talk at Center for Quantum Network's Channel Capacity Winter Kick-off Workshop, Jan. 15th, 2023.

[T4] "Geometric representation of quantum randomizing maps on high-dimensional quantum systems" Contributed talk at the Winter Meeting of the Optical Society of Korea, Feb. 17th, 2022.

[T3] "Structure of private quantum channels: to higher dimensional regular polytopes" Invited talk at Seoul National University QST Seminar, Aug. 27th, 2021.

[T2] "Quantum Rényi entropy power inequality for bosonic gaussian systems" Contributed talk at the Annual Meeting of the Korean Society for Industrial and Applied Mathematics, Dec. 3rd, 2021.

[T1] "Geometric approach to private quantum channels: High-dimensional cases and regular polytopes" Contributed talk at the Fall Meeting of the Korean Physical Society, Oct. 21st, 2021.

Posters

[12] "Disentanglement provide a unified estimation for quantum entropies and distance measures" 24th Asian Quantum Information Science Conference (AQIS 2024), Aug. 2024.

[11] "Disentangling to a reduction for estimating quantum information fundamental properties" 2nd Annual Conference on Quantum Simulation (QSim 2024), Aug. 2024.

[10] "Disentanglement provide a unified estimation for quantum entropies and distance measures" 28th International Conference on Atomic Physics (ICAP 2024), Jul. 2024.

[9] "Mutual information maximizing quantum generative adversarial network and its applications" 27th Annual Conference on Quantum Information Processing (QIP 2024), Jan. 2024.

[8] "Estimation of quantum entropies using quantum convolutional neural networks" 27th Annual Conference on Quantum Information Processing (QIP 2024), Jan. 2024.

[7] "Quantum neural networks for quantum mutual information estimation" 23rd Asian Quantum Information Science Conference (AQIS 2023), Aug. 2023.

[6] "Optimizing quantum integer factorization performance: A scalable evaluation approach with parameter pre-selection Method" 23rd Asian Quantum Information Science Conference (AQIS 2023), Aug. 2023.

[5] "Quantum Rényi entropy functionals for bosonic gaussian systems" 27th edition of the Central European Workshop on Quantum Optics (CEWQO 2023), Jul. 2023.

[4] "Quantum neural network approach to measuring von Neumann entropy" 18th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC 2023), Jul. 2023.

[3] "Quantum Rényi entropy functionals for bosonic gaussian systems" 17th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC 2022), Jul. 2022.

[2] "Quantum Rényi entropy functionals for bosonic gaussian systems" 25th Annual Conference on Quantum Information Processing (QIP 2022), Jan. 2022.

[1] "Geometry of random unitary channels in high-dimensional quantum states" 25th Annual Conference on Quantum Information Processing (QIP 2022), Jan. 2022.

TEACHING EXPERIENCE

Research Internship Supervisor

SW4343: Software Field Placement 1 (Korea Aerospace University & Korea Quantum Industry Center) Fall 2024

Teaching Assistant at Yonsei University

YCS1009: Change the World through Programming	Fall 2022
YCS1002: Software Programming	Fall 2022
EEE1108: Engineering Information Processing	Fall 2021

Course Tutor at Yonsei University

MAT2016: Engineering Mathematics 3 – Linear Algebra and Differential Equations	Spring 2022
MAT1012: Engineering Mathematics 2 – Multivariable and Vector Calculus	Fall 2021

RESEARCH INTERESTS

Theoretical Perspectives on Quantum Information and Quantum Computation: Quantum Shannon Theory, Quantum Learning Theory, Quantum Complexity Theory, Quantum Algorithms, Quantum Error Correction Codes, Topological Quantum Computation, Fault-Tolerant Quantum Computation

LANGUAGE PROFICIENCY

Korean (Native or bilingual proficiency) and English (Professional working proficiency)

REFERENCES

References available upon request