

Personal

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Research Interests

- **Lattice-based Cryptography**
- **Fully Homomorphic Encryption (FHE)**, including **Threshold FHE**
- **Post-Quantum Cryptography (PQC)**
- **Privacy Enhancing Technologies (PETs)**

Education

- **Ph.D. in Mathematical Sciences—Cryptography**
 - **Institution:** Department of Mathematical Sciences, Seoul National University, Seoul, Korea
 - **Adviser:** Professor Jung Hee Cheon
 - **Period:** September 2019 - February 2025
 - **Thesis Title:** Accelerating Homomorphic Computation through Machine-Efficient Arithmetic
 - **Note:** Integrated MA/PhD, 2 years for M.S. and 3+ years for Ph.D.
- **B.S. in Mathematical Sciences**
 - **Institution:** Department of Mathematical Sciences, Seoul National University, Seoul, Korea
 - **Period:** March 2013 - August 2019
 - **Grade of Qualification:** Cum Laude.

Awards & Honors

Awards

- **Korean Post-Quantum Cryptography Standardization (KpqC) Competition**, National Security Research Institute (NSR) and National Intelligence Service (NIS). A three-year competition (Sept. 2021 – Jan. 2025) for standardizing Korean PQC Algorithms: KEM/PKE and Digital Signature.
 - **Winner in KEM/PKE:** *SMAUG-T* Key Encapsulation Mechanism, based on [C01, J05].
 - ★ website: <https://www.kpqc.cryptolab.co.kr/smaug-t>.
 - **Winner in Digital Signature:** HAETAE Digital Signature scheme, based on [C02].
 - ★ website: <https://www.kpqc.cryptolab.co.kr/haetae>.
- **Korean National Cryptography Contest**, National Security Research Institute (NSR). An annual contest that awards cryptography research papers to encourage (under)graduate students and post-doctoral researchers in Korea.
 - **Grand Prize** for C03, **Honorable Mention** for M03, and **Special Award** for J05, Oct. 2024.
 - **Honorable Mention** for M01, Oct. 2022.
- **TA Awards**, Seoul National University, Dept. of Mathematical Sciences
 - **Excellence in Teaching:** for teaching “Honor Calculus Practice 1 (2023 Spring),” Aug. 2023.
- **2020 iDASH Genomic Data Privacy and Security Protection Competition**, American National Institutes of Health

- **First Place Prize** in Track I: “Secure Multi-label Tumor Classification using Homomorphic Encryption,” Dec. 2020. The result was later published as J04

Honors

- **BK 21+ Scholarship**, Ministry of Education of Korea
 - **Period:** Sep. 2019 – Feb. 2025.
- **Presidential Science Scholarship** (Undergraduate), Korea Student Aid Foundation
 - **Period:** Mar. 2013 – Dec. 2018.

Experiences

- **Cryptography Engineer**
 - **Institution:** CryptoLab Inc., Seoul, Korea.
 - **Period:** March 2025 - Present
 - **Topic:** Homomorphic Encryption (HE) and Lattice-based Post-Quantum Cryptography (PQC), focusing on improving HE, implementing practical HE applications, and improving and standardizing KpqC schemes.
- **Visiting Researcher**
 - **Institution:** École Normale Supérieure de Lyon, Lyon, France.
 - **Period:** September - October 2023 (2 months, during PhD studies)
 - **Topic:** Lattice-based cryptography, focusing on new concrete constructions of digital signatures.
- **Sergeant**
 - **Organization:** Intelligence System Management Group, Republic of Korea Air Force (ROKAF)
 - **Period:** July 2015 - July 2017 (2 years, mandatory military service)

Public & Professional Services

Invited Talks

Conferences and Workshops

- **2025 KMS Spring Meeting**, Korean Mathematical Society (KMS), KAIST, Korea
 - **Title:** HAETAE and SMAUG-T: Korean PQC Standards
 - **Date:** April 25, 2025 (1h)
- **KIAS-JBNU KpqC Workshop**, Korea Institute for Advanced Study (KIAS), Jeonbuk National University, Korea
 - **Title:** HAETAE: Rejecting on Hyperballs
 - **Date:** May 19, 2023 (2h)

Research Camps and Seminars

- **Ruhr Univ. Bochum, Germany**, Faculty of Computer Science, Security Engineering
 - **Title:** Recent Advances in Fully Homomorphic Encryption
 - **Date:** January 21, 2025 (1.5h), during a week of research visit
- **Sungshin Women's Univ., Korea**, Dept. of Convergence Security Engineering
 - **Title:** HAETAE: Shorter Lattice-based Fiat-Shamir Signatures
 - **Date:** May 21, 2024 (1.5h)
- **2024 KpqC Winter Camp**, KpqC Research Group, Sogang Univ., Korea
 - **Title:** HAETAE
 - **Date:** February 27, 2024 (1h)
- **2024 Algebra Camp**, QSMS, Yangpyeong Bloomvista, Korea
 - **Title:** Bridging Algebraic Number Theory to Post-Quantum Digital Signatures
 - **Date:** February 5, 2024 (30m)
- **Korea University, Korea**, School of Cybersecurity

- **Title:** HAETAE, a Post-Quantum Signature Scheme
- **Date:** July 24, 2023 (2h)
- **2023 KpqC Winter Camp**, KpqC Research Group, Chung-Ang Univ., Korea
 - **Title:** Introduction to HAETAE
 - **Date:** February 22, 2023 (1h)

Lectures and Training Programs

- **Cryptography Training for Information Security Professionals**, Korea Cryptography Forum.
 - **Details:** Pre-recorded lectures on lattice-based PQC, as part of a one-week training program.
 - **Date:** Pre-recorded in May, scheduled in June 2025 (3h)
- **Dongguk University, Korea**, Undergraduate Course at Dept. of CS & AI
 - **Title:** Security in the Post-Quantum Era: Post-Quantum Cryptography and Standardizations (Translated)
 - **Date:** May 29, 2025 (1.5h)
- **PQC Training Course**, CryptoLab Inc.
 - **Details:** The course was conducted by Dr. Damien Stehlé and Dr. Inkwon Yu. Two half-day lectures on the concrete security of lattice-based PQC were provided in English, as part of a 3-week training course.
 - **Material:** Available at https://github.com/hmchoe0528/PQC_training
 - **Date:** July 16-17, 2024 (7h)
- **2nd 10-10 Gauss Distinguished Lecture Series**, IMDARC, SNU
 - **Details:** A Pre-study of Damien Stehlé’s Distinguished Lecture on NIST PQC Standards, focusing on the mathematical foundations of Lattice Crypto (jointly with Prof. Jung Hee Cheon)
 - **Date:** September 15, 2023 (30m)

Journal & Conference Reviewing

- **Journals:** Design, Codes and Cryptography (DCC), Journal of Cryptology (JoC).
- **Conferences:** Sub/External reviewer for ANTS 2020, MathCrypt 2021, PQCrypto 2021, Asiacrypt 2021, 2022, ACM CCS 2022, FHE.org 2022, PQCrypto 2023, PKC 2024, Eurocrypt 2024, PQCrypto 2024, Asiacrypt 2025.

Publications

Authors are listed alphabetically by last name (see AMS 2004 statement), unless marked with an asterisk (*). A dagger (†) indicates the corresponding author, when applicable.

Conferences (refereed)

- C04 Hyeongmin Choe[†], “Toward Practical Threshold FHE: Low Communication, Computation and Interaction,” *ACM CCS 2024 Doctoral Symposium*. 3-Page Extended Abstract.
- C03 Jung Hee Cheon, Hyeongmin Choe[†], Alain Passelègue, Damien Stehlé, and Elias Suvanto, “Attacks Against the IND-CPA^D Security of Exact FHE Schemes,” *The ACM Conference on Computer and Communications Security 2024 (ACM CCS 2024)*.
- C02 Jung Hee Cheon, Hyeongmin Choe, Julien Devevey, Tim Güneysu, Dongyeon Hong, Markus Krausz, Georg Land, Marc Möller, Damien Stehlé, and MinJune Yi, “HAETAE: Shorter Lattice-Based Fiat-Shamir Signatures,” *The annual Conference on Cryptographic Hardware and Embedded Systems 2024 (CHES 2024)*.
- C01 Jung Hee Cheon, Hyeongmin Choe[†], Dongyeon Hong, and MinJune Yi, “SMAUG: Pushing Lattice-based Key Encapsulation Mechanisms to the Limits,” *Selected Areas in Cryptography 2023 (SAC 2023)*.

Journals (refereed)

- J06 Jung Hee Cheon, Hyeongmin Choe, and Jai Hyun Park, “Tree-based Lookup Table on Batched Encrypted Queries using Homomorphic Encryption,” *Accepted to Journal of the Korean Mathematical Society*.
- J05 Jung Hee Cheon, Hyeongmin Choe[†], Jungjoo Seo, Hyoeun Seong, “SMAUG(-T), Revisited: Timing-secure, More Compact, Less Failure,” *IEEE ACCESS*, vol. 12, pp. 188386-188397, Dec. 2024.

- *J04 Seungwan Hong, Jai Hyun Park, Wonhee Cho, Hyeongmin Choe and Jung Hee Cheon[†], “Secure tumor classification by shallow neural network using homomorphic encryption,” *BMC Genomics*, vol. 23, no. 284, Apr 2022.
- J03 Jung Hee Cheon, Hyeongmin Choe, Donghwan Lee and Yongha Son[†], “Faster Linear Transformations in **HElib**, revisited,” *IEEE Access*, vol. 7, pp. 50595–50604, Apr. 2019.
- *J02 Siyul Lee and Hyeongmin Choe, “On Fourth-order Iterative Methods for Multiple Roots of Nonlinear Equations with High Efficiency,” *Journal of Computational Analysis and Applications*, vol. 18(1), pp. 109–120, Jan. 2015.
- *J01 Siyul Lee and Hyeongmin Choe, “Multiplicational Combinations and A General Scheme of Single-step Iterative Methods for Multiple Roots,” *Journal of Computational Analysis and Applications*, vol. 15(6), pp. 1138–1149, Oct. 2013.

Manuscripts (non-refereed)

Manuscripts that are archived or near completion.

- M03 Jung Hee Cheon, Hyeongmin Choe, Yongdong Yeo, “Reusable Dynamic Multi-Party Homomorphic Encryption.” *Cryptology ePrint Archive, Paper 2025/581*, April 2025.
- M02 Jung Hee Cheon, Hyeongmin Choe, Minsik Kang, Jaehyung Kim, Seonghak Kim, Johannes Mono, Taeyeong Noh “Grafting: Decoupled Scale Factors and Modulus in RNS-CKKS,” *Cryptology ePrint Archive, Paper 2024/1014*, June 2024. *In submission*.
- M01 Jung Hee Cheon, Hyeongmin Choe, Saebyul Jung, Duhyeong Kim, Dah Hoon Lee, and Jai Hyun Park, “Arithmetic PCA for Encrypted Data,” *Cryptology ePrint Archive, Paper 2023/1544*, Oct. 2023.

Teaching Record

- **Calculus TA Seminar**, Dept. of Mathematical Sciences, SNU, 2024 Spring
 - **Role:** TA. Guided new TAs on teaching skills and student management strategies.
- **Calculus Practice Sessions**, College of Natural Sciences, SNU, 2020 - 2023 (7 semesters)
 - **Role:** TA and Lecturer. Delivered 2-hour weekly practice sessions with summarized content and guided students.
 - **Teaching Evaluation (Student Survey):** Avg. 94.6 / 100. Awarded “*Excellence in Teaching*” in 2023 Spring.
- **(i-TAP) Post-Quantum Cryptography**, SK Hynix Inc., April - May (5 weeks), 2021
 - **Role:** TA and Co-lecturer. Delivered 8 of 26 total hours as a co-lecturer. Also contributed to course material development and led Q&A and discussion sessions on lattice-based PQC.
- **Korean Mathematical Olympiad (KMO) Winter/Summer Schools**, Korean Mathematical Society, 2013-2014
 - **Period:** Jan. & Aug., 2013, and Jan. & Aug., 2014 (each 2-3 weeks)
 - **Role:** Residential TA. Managed and supported gifted students during intensive camps. Led problem-solving exercises and evaluations.

Patents

- Jung Hee Cheon, Hyeongmin Choe, “Apparatus for conversion of homomorphic encrypted message and method thereof,”
 - Korea Patent No. KR1027825570000, Granted, Feb. 2025.
- Jung Hee Cheon, Hyeongmin Choe, “Apparatus for generating blind signature and method thereof,”
 - Applications No. KR20230127905A and US20230291573A1, Pending.
- Jung Hee Cheon, Hyeongmin Choe, Dongyeon Hong, “Electronic device for encrypting data by public key and methods thereof,”
 - Applications No. KR20240081407A and US20240178992A1, Pending.
- Jung Hee Cheon, Hyeongmin Choe, Jai Hyun Park, “Electronic device for searching encrypted data and methods thereof,”
 - Applications No. KR20240118024A and US20240354343A1, Pending.
- Jung Hee Cheon, Hyeongmin Choe, Jai Hyun Park, “Electronic device for making decision and methods thereof,”
 - Applications No. KR20240118 025A and US20240289650A1, Pending.

Conferences and Workshops

- **ACM CCS 2024 Doctoral Symposium**, Salt Lake City, US
 - **Title:** Toward Practical Threshold FHE: Low Communication, Computation and Interaction
 - **Date:** October 14, 2024
- **Selected Areas in Cryptography (SAC) 2023**, Univ. of New Brunswick, Canada
 - **Title:** SMAUG: Pushing Lattice-based Key Encapsulation Mechanisms to the Limits
 - **Date:** August 16, 2023

Research Camps and Colloquiums

- **KpqC Contest 2nd Round Colloquium**, KpqC Research Group, Hansung Univ., Korea
 - **Title:** HAETAE v3.0
 - **Date:** August 28, 2024 (20m)
- **2024 KMS Spring Meeting**, Korean Mathematical Society (KMS), Daejeon Convention Center, Korea
 - **Title:** IND-CPA^D and KR^D Security of Exact (F)HEs
 - **Date:** April 19, 2024 (20m)
- **2024 Crypto Winter Camp**, SNU Cryptography Lab, Vivaldi Park, Korea
 - **Title:** IND-CPA^D and KR^D security of FHE and application to Threshold-FHE
 - **Date:** January 4, 2024 (1h)
- **2023 Crypto Winter Camp**, SNU Cryptography Lab, Konjiam Resort, Korea
 - **Title:** Introduction to SMAUG KEM and HAETAE signature schemes
 - **Date:** January 5, 2023 (1h)
- **2022 KMS Spring Meeting**, Korean Mathematical Society (KMS), Virtual
 - **Title:** Efficient, round-optimal blind signatures from standard assumptions
 - **Date:** April 28, 2022 (20m)
- **2020 KMS Annual Meeting**, Korean Mathematical Society (KMS), Virtual
 - **Title:** Conversion between two RLWE-based FHE schemes and its application
 - **Date:** October 24, 2020 (20m)