

Hyeongmin Choe

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OVERVIEW

I am a Ph.D. candidate at the Department of Mathematical Sciences, Seoul National University (SNU), Republic of Korea. My advisor is Prof. Jung Hee Cheon. I work on cryptography, currently focusing on, but not limited to, Homomorphic Encryption (HE) and Lattice-based Post-Quantum Cryptography (PQC). I am a member of *Team SMAUG(-T)* and *Team HAETAE*, participating in PQC standard efforts in KpqC competition and NIST Additional Signatures.

EDUCATION

Seoul National University, Seoul, Republic of Korea

- Integrated Ph.D. in Mathematical Sciences Sep 2019 – Present
 - Consists of a two-year M.S. course and a three-year Ph.D. course
 - Adviser: Jung Hee Cheon
 - Focus: Cryptography (Homomorphic Encryption, Lattice-based Post-Quantum Cryptography)
- B.S. in Mathematical Sciences Mar 2013 – Aug 2019

PUBLICATIONS

Authors are listed in alphabetical order by last name, unless an asterisk(*) is indicated.

CONFERENCES

- C04 Hyeongmin Choe, “Toward Practical Threshold FHE: Low Communication, Computation and Interaction,” *ACM CCS 2024 Doctoral Symposium (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 (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 (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 (SAC) 2023*.

JOURNALS

- 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. (High school R&E)
- 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. (High school R&E)

MANUSCRIPTS

- M05 Jung Hee Cheon, Hyeongmin Choe, Jungjoo Seo, Hyoeun Seong, “SMAUG(-T), Revisited: Timing-secure, More Compact, Less Failure,” Nov 2024. *In submission*.
- M04 Jung Hee Cheon, Hyeongmin Choe, Yongdong Yeo, “Reusable Dynamic Multi-Party Homomorphic Encryption,” Jun 2024.
- M03 Jung Hee Cheon, Hyeongmin Choe, Minsik Kang, Jaehyung Kim, “Grafting: Complementing RNS in CKKS,” *Cryptology ePrint Archive, Paper 2024/1014*, Jun 2024. *In Submission*.

- M02 Jung Hee Cheon, Hyeongmin Choe, and Jai Hyun Park, “Tree-based Lookup Table on Batched Encrypted Queries using Homomorphic Encryption,” *Cryptology ePrint Archive, Paper 2024/087*, Jan 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.

SPECIFICATIONS Specifications submitted to standardization processes.

- HAETAE (based on C02), submitted to *KpqC Competition Round 2* (Feb 2024), *NIST Additional Digital Signature Schemes Round 1* (May 2023), and *KpqC Competition Round 1* (Dec 2022).
- SMAUG(-T) (based on C01), submitted to *KpqC Competition Round 2* (Feb 2024) and *KpqC Competition Round 1* (Dec 2022).

AWARDS & HONORS

AWARDS

- Korean National Cryptography Contest, National Security Research Institute (NSRI)
An annual contest encouraging Korean students to work on cryptography research papers. Grand, Best, Excellence, Encouragement, and Special prizes.
 - Grand Prize for C03 Oct 2024
 - Encouragement Prize for M04 Oct 2024
 - Special Prize for M05 (with a slightly different working title) Oct 2024
 - Encouragement Prize for M01 Oct 2022
- TA Awards, Seoul National University Aug 2023
 - Excellence in Teaching, for teaching “Honor Calculus Practice 1 (2023 Spring)”
- iDASH Genomic Data Privacy and Security Protection Competition, American NIH Dec 2020
 - First Place Prize in Track I: “Secure Multi-label Tumor Classification using Homomorphic Encryption”

HONORS

- *BK 21+ Scholarship* Sep 2019 – Present
Ministry of Education of Korea
- *Presidential Science Scholarship (Undergraduate)* Mar 2013 – Dec 2018
Korea Student Aid Foundation

TALKS

Lists of selective talks.

2024

- *Toward Practical Threshold FHE: Low Communication, Computation and Interaction* Oct 2024
ACM CCS 2024 Doctoral Symposium (affiliated with ACM CCS 2024), Salt Lake City, U.S.A.
- *HAETAE v3.0* Aug 2024
Invited Talk, KpqC Contest 2nd Round Colloquium, Hansung University, South Korea
- *HAETAE: Shorter Lattice-based Fiat-Shamir Signatures* May 2024
Invited Talk, Sungshin Women’s University, South Korea
- *Bridging Algebraic Number Theory to Post-Quantum Digital Signatures* Feb 2024
2024 Algebra Camp, Bloomvista, South Korea

2023

- *Mathematical Foundation of Lattice Crypto (jointly with Jung Hee Cheon)* Sep 2023
Pre-study of Damien Stehlé’s talk, “CRYSTALS-KYBER, CRYSTALS-DILITHIUM and Beyond”
Distinguished Lecture on NIST PQC Standards, Seoul National University, South Korea
- *SMAUG: Pushing Lattice-based Key Encapsulation Mechanisms to the Limits* Aug 2023
SAC 2023, University of New Brunswick, Canada
- *HAETAE, a Post-Quantum Signature Scheme* Jul 2023
Invited Talk, Korea University, South Korea
- *HAETAE: Rejecting on Hyperballs* May 2023
KIAS-JBNU KpqC Workshop, Jeonbuk National University, South Korea
- *Introduction to HAETAE* Feb 2023
2023 KpqC Winter Camp, Chung-Ang University, South Korea

2022 & BEFORE

	<ul style="list-style-type: none"> ▪ <i>Efficient, Round-optimal Blind Signatures from Standard Assumptions</i> Apr 2022 2022 KMS Spring Meeting, virtual ▪ <i>Security Analysis on NIST PQC Lattice-based Finalists</i> Nov 2021 3rd KpqC Workshop, Alpensia Resort, South Korea ▪ <i>Conversion between Two RLWE-based FHE Schemes and its Application</i> Oct 2020 2020 KMS Fall Meeting, virtual
PROJECTS	<p>List of selective projects.</p> <ul style="list-style-type: none"> ▪ <i>DARPA Data Protection in Virtual Environments (DPRIVE)</i> 2022 – 2023 ▪ <i>HE Technology for 6G Security (LG Elec.)</i> 2022 – 2023 ▪ <i>Security Analysis on NIST PQC Finalists (NSR)</i> 2021 ▪ <i>Sensitive Data Protection using HE and its Acceleration (Samsung Elec.)</i> 2020 – 2024 ▪ <i>Development and Library Implementation of Fully Homomorphic ML Algorithms supporting Neural Network Learning over Encrypted Data (IITP)</i> 2020 – 2023
EXPERIENCES	<p>TEACHING</p> <ul style="list-style-type: none"> ▪ <i>Invited Lecturer for PQC Training Course, conducted by CryptoLab Inc.</i> 2024 Concrete Security of Lattice-based PQC Schemes–Lectures and Tutorials (7h) ▪ <i>Seoul National University, Math Courses TA</i> <ul style="list-style-type: none"> • <i>Calculus TA Seminar</i> 2024 • <i>Computational Number Theory, Honor Calculus Practice 1, 2</i> 2023 • <i>Differential & Integral Calculus Practice 1</i> 2022 • <i>Number Theory, Differential & Integral Calculus Practice 1, Honor Calculus Practice 2</i> 2021 • <i>Calculus TA Seminar, Calculus Practice 1, Honor Calculus Practice 2</i> 2020 ▪ <i>Korean Mathematical Olympiad (KMO) Winter/Summer School TA</i> 2013 – 2014 2013 & 2014 Winter/Summer Schools <p>MILITARY</p> <ul style="list-style-type: none"> ▪ <i>Republic of Korea Air Force (ROKAF)</i> Jul 2015 – Jul 2017 Intelligence System Management Group, Gyeryong, discharged as a Sergeant <p>INTERNSHIPS</p> <ul style="list-style-type: none"> ▪ <i>Undergraduate Research Internships</i> <ul style="list-style-type: none"> • <i>Stochastic Representations of the Hyperbolic PDEs</i> 2019 Seoul National University, advised by Prof. Seung Yeal Ha • <i>Homomorphic Signature Schemes and Threshold Cryptosystems</i> 2018 – 2019 Sejong University, advised by Prof. Ji Sun Shin • <i>Lattice Reductions and Homomorphic Encryption with C++</i> 2018 – 2019 Seoul National University, advised by Prof. Jung Hee Cheon • <i>Machine Learning (Image Processing) with Python, Matlab</i> 2017 Seoul National University, advised by Prof. Myungjoo Kang <p>SKILLS</p> <ul style="list-style-type: none"> ▪ <i>L^AT_EX, Matlab, Python: Proficient</i> ▪ <i>C/C++, Mathematica, SageMath, HTML: Working Knowledge</i> ▪ <i>R, PyTorch, TensorFlow: Basic</i> <p>SERVICES</p> <p>REVIEWER (JOURNALS)</p> <ul style="list-style-type: none"> ▪ <i>Design, Codes and Cryptography (DCC), Journal of Cryptology (JoC).</i> <p>REVIEWER (CONFERENCES)</p> <ul style="list-style-type: none"> ▪ <i>ANTS 2020, MathCrypt 2021, PQCrypto 2021, Asiacrypt 2021, 2022, ACM CCS 2022, FHE.org 2022, PQCrypto 2023, PKC 2024, Eurocrypt 2024, PQCrypto 2024.</i>

Last updated on 2024-10-23