Seungwan **Hong**

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Research Experience

New York Genome Center & Columbia University — *NY, United States*

Postdoctoral Research Associate — *Mar. 2022 - Present*

- In the G²Lab, I lead research on designing privacy-preserving methodologies for genomic data analysis using homomorphic encryption. Joint appointment at Columbia University.

Education

Seoul National University — *Seoul, South Korea*

Integrated M.S./Ph.D. in Mathematical Sciences — *Sep. 2016 - Feb. 2022*

- Thesis: Approximation of Multivariate Functions and Homomorphic Data Ordering (Awarded Best PhD Dissertation Award from the College of Natural Sciences)
- Advisor: Jung Hee Cheon

Seoul National University — *Seoul, South Korea*

B.S. in Mathematical Sciences — *Mar. 2010 - Aug. 2016*

- Honors: *Cum Laude*

Publications

- An asterisk (*) indicates co-first authors and a hash (#) indicates co-corresponding authors.
- A dagger (†) indicates authors listed in alphabetical order, with all authors contributing equally. For more information, see AMS Statement.

Journal

Secure and scalable gene expression quantification with pQuant
Seungwan Hong, Conor R. Walker, Annie Y. Choi, and Gamze Gürsoy
Nature Communication (Accepted) (2025)

Ultra-Secure Storage and Analysis of Genetic Data for the Advancement of Precision Medicine
Jacob Blindenbach*, Jiayi Kang*, **Seungwan Hong***#, Caline Karam, Thomas Lehner, and Gamze Gürsoy#
Genome Biology (2024)

Privacy-preserving model evaluation for logistic and linear regression using homomorphically encrypted genotype data
Seungwan Hong*, Yoolim A. Choi*, Daniel S. Joo, and Gamze Gürsoy
Journal of Biomedical Informatics (2024)

Secure Tumor Classification by Shallow Neural Network Using Homomorphic Encryption
Seungwan Hong, Jai Hyun Park, Wonhee Cho, Hyeongmin Choe, and Jung Hee Cheon
BMC Medical Genomics (2022)

Ultra-Fast Homomorphic Encryption Models Enable Secure Outsourcing of Genotype Imputation
Miran Kim*, Arif Harmanci*, Jean-Philippe Bossuat, Sergiu Carpov, Jung Hee Cheon, Ilaria Chillotti, Wonhee Cho, David Froelicher, Nicolas Gama, Mariya Georgieva, **Seungwan Hong**, Jean-Pierre Hubaux, Duhyeong Kim, Kristin Lauter, Yiping Ma, Lucila Ohno-Machado, Heidi Sofia, Yongha Son, Yongsoo Song, Juan Troncoso-Pastoriza, and Xiaoqian Jiang
Cell Systems (2021)

Efficient Sorting of Homomorphic Encrypted Data with k-way Sorting Network
Seungwan Hong, Seunghong Kim, Jiheon Choi, Younho Lee, and Jung Hee Cheon
IEEE Transactions on Information Forensics and Security (2021)

Privacy-preserving Approximate GWAS Computation Based on Homomorphic Encryption
Duhyeong Kim, Yongha Son, Dongwoo Kim, Andrey Kim, **Seungwan Hong**, and Jung Hee Cheon
BMC Medical Genomics (2020)

A Hybrid of Dual and Meet-in-the-Middle Attack on Sparse and Ternary Secret LWE
† Jung Hee Cheon, Minki Hhan, **Seungwan Hong**, and Yongha Son
IEEE Access (2019)

A Secure SNP Panel Scheme Using Homomorphically Encrypted K-mers Without SNP Calling on the User Side
Sungjoon Park, Minsu Kim, Seokjun Seo, **Seungwan Hong**, Kyoohyung Han, Keewoo Lee, Jung Hee Cheon, and Sun Kim
BMC Genomics (2019)

Conference

Logistic Regression on Homomorphic Encrypted Data at Scale
Kyoohyung Han, **Seungwan Hong**, Jung Hee Cheon, and Daejun Park
Innovative Applications of Artificial Intelligence (IAAI) (HI, United States, 2019)

Preprint

Composable Functional Encryption from Standard Lattice Assumptions
†**Seungwan Hong**, Jiseung Kim, Changmin Lee, and Minhye Seo
Preprint (2025)

Fully Encrypted Machine Learning Protocol using Functional Encryption
†**Seungwan Hong**, Jiseung Kim, Changmin Lee, and Minhye Seo
under revision in Journal of Cryptology (2024)

Remark on the Security of CKKS Scheme in Practice
†Jung Hee Cheon, **Seungwan Hong**, and Duhyeong Kim
IACR Cryptol. ePrint Arch. (2020)

Honors & Awards

International

Dec. 2020 **First Winner**, HE track - iDASH Competition 2020 — *NIH, United States*
Oct. 2019 **Second Winner**, HE track - iDASH Competition 2019 — *NIH, United States*

Domestic

Nov. 2019 **Excellent Award ($1,500)**, Korea Cryptography Contest — *KIISC, South Korea*
Sep. 2017 **Awards for Excellence in Teaching**, Teaching Awards: Differential and Integral Calculus Practice — *SNU, South Korea*
Nov. 2015 **Bronze Medal**, University Students Contest for Mathematics — *KMS, South Korea*

Presentations

International

RECOMB 2024 — *MA, United States*
Poster: Ultra-Secure Storage and Analysis of Genetic Data for the Advancement of Precision Medicine — *Apr. 2024*

RECOMB 2023 — *Istanbul, Turkey*
Poster: Privacy-preserving prediction of phenotypes from genotypes using homomorphic encryption — *Apr. 2023*

IDASH Privacy & Security Workshop — *Online*
Talk: Winning Teams' presentation (link) — *Dec. 2020*

Domestic

Columbia University — *NY, United States*
Talk: Linear Algebra: Basic Concepts — *Nov. 2023*

Korea Institute for Advanced Study (KIAS) — *Seoul, South Korea*
Talk: Introduction to Neural Networks: Theory and Implementation — *Oct. 2023*

Hanyang University — *Seoul, South Korea*
Talk: Homomorphic Encryption and Applications — *Apr. 2023*

Samsung SDS — *Online*
Talk: Private AI and Homomorphic Encryption — *Aug. 2021*

National Tax Service — *Sejong, South Korea*
Talk: Basics of Homomorphic Encryption — *Jul. 2020*

Teaching

- Institutions: Seoul National University (SNU), Columbia University (CU)

Lecture

Honor Calculus Practice · SNU — *2019*
Differential and Integral Calculus Practice · SNU — *2016, 2017, 2018*

Teaching assistant

Computational Number Theory · SNU *2018, 2020*
Introduction to Cryptography · SNU *2019*
Linear Algebra · SNU *2018*

Students supervised

Daniel Joo · Undergraduate student from CU *2022*

- Project: privacy-preserving neural network evaluation using homomorphic encryption

Other Scientific Activities

Committees

Nov. 2024 **Program Committee,** Genopri *CA, United States*

Reviewer / External Reviewer for

- ACM Transactions on Privacy and Security, IEEE Transactions on Information Forensics and Security, IEEE Transactions on Emerging Topics in Computing, Journal of Supercomputing, IEEE Access
- EUROCRYPT, ASIACRYPT, Public Key Cryptography
- BMC Medical Genomics

Extracurricular Activities

NCSOFT *Sungnam, South Korea*
Game AI Development Internship *Jun. 2017 - Aug. 2017*

- Developed and tested AI algorithms to improve PVE matches

Republic of Korea Army *South Korea*
Military service *Jan. 2013 - Oct. 2014*

- Discharged as a Sergeant

Skills

Programming	Python, Bash, C++, rust, go, LaTeX
Python Libraries	Numpy, Keras, Tensorflow, PyTorch, pandas, matplotlib, seaborn
C++ Libraries	NTL, GMP, Eigen
FHE Libraries	HEAAN, SEAL, OpenFHE, Lattigo
Coding practices	Git, Snakemake, Docker, Vim, Slurm
Operating Systems	Linux, MacOS
Languages	Korean, English