

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 Harmanaci*, 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

PREPRINT

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

STUDENTS SUPERVISED

Daniel Joo · Undergraduate student from CU
• Project: privacy-preserving neural network evaluation using homomorphic encryption

2022

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
GAME AI DEVELOPMENT INTERNSHIP
• Developed and tested AI algorithms to improve PVE matches

Sungnam, South Korea
Jun. 2017 - Aug. 2017

Republic of Korea Army
MILITARY SERVICE
• Discharged as a Sergeant

South Korea
Jan. 2013 - Oct. 2014

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