

Miran Kim

📍 50 UNIST-gil, Ulju-gun, Ulsan, South Korea
✉ mirankim@unist.ac.kr ☎ +82 (052) 217-2256

EDUCATION

Seoul National University, Seoul, Republic of Korea

- Ph.D. in Mathematical Sciences Mar 2012 – Feb 2017
 - Thesis: Arithmetics of Ciphertexts under Homomorphic Encryption
 - Advisor: Prof. Jung Hee Cheon
- M.S. in Mathematical Sciences Mar 2010 – Feb 2012
 - Thesis: A New Young Wall Realization of the Kirillov-Reshetikhin Crystal $\mathbf{B}(\omega_2)$ for $U_q(D_3^{(2)})$
 - Advisor: Prof. Seok Jin Kang
- B.S. in Mathematical Education Mar 2006 – Feb 2010

WORK EXPERIENCE

Ulsan National Institute of Science and Technology, Ulsan, South Korea

Aug 2020 – Present

- Assistant Professor, Department of Computer Science and Engineering
- Affiliate Assistant Professor, Artificial Intelligence Graduate School

University of Texas, Health Science Center at Houston, TX, United States

May 2018 – Jul 2020

- Assistant Professor, School of Biomedical Informatics

University of California, San Diego, CA, United States

Mar 2017 – Apr 2018

- Postdoctoral Researcher, Division of Biomedical Informatics, School of Medicine
- Supervisor: Dr. Xiaoqian Jiang

Microsoft Research, WA, United States

Jan 2015 – Apr 2015

- Research Intern in the Cryptography and Privacy Research Group
- Mentor: Dr. Kristin Lauter

Seoul National University, Seoul, South Korea

Jan 2013 – Feb 2017

- Research assistant, Department of Mathematical Sciences

REFEREED CONFERENCE PUBLICATIONS

- H. Chen, W. Dai, **M. Kim**, and Y. Song. “Efficient homomorphic conversion between (ring) LWE ciphertexts”. *Proceedings of International Conference on Applied Cryptography and Network Security (ACNS)*, 2021.
- M. Bataa, S. Song, K. Park, **M. Kim**, J. H. Cheon, and S. Kim. “Homomorphic computation of local alignment”. *International Workshop on High Performance Computing on Bioinformatics (HPCB 2020)*, 2020.
- H. Chen, **M. Kim**, I. Razenshteyn, D. Rotaru, Y. Song, and S. Wagh. “Maliciously secure matrix multiplication with applications to private deep learning”. *Proceedings of the International Conference on the Theory and Application of Cryptology and Information Security (ASIACRYPT)*, 2020.
- H. Chen, W. Dai, **M. Kim**, and Y. Song. “Efficient multi-key homomorphic encryption with packed ciphertexts with application to oblivious neural network inference”. *Proceedings of the ACM SIGSAC Conference on Computer and Communications Security (CCS)*, pp.395-412, 2019.
- X. Jiang, **M. Kim**, K. Lauter, and Y. Song. “Secure outsourced matrix computation and application to neural networks”. *Proceedings of the ACM SIGSAC Conference on Computer and Communications Security (CCS)*, pp.1209-1222, 2018.
- J. H. Cheon, K. Han, A. Kim, **M. Kim**, and Y. Song. “A full RNS variant of approximate homomorphic encryption”. *Proceedings of the International Conference on Selected Areas in Cryptography (SAC)*, LNCS, vol:11349, pp.347-368, 2018.
- J. H. Cheon, K. Han, A. Kim, **M. Kim**, and Y. Song. “Bootstrapping for approximate homomorphic encryption”. *Proceedings of the Annual International Conference on the Theory and Applications of Cryptographic Techniques (EUROCRYPT)*, LNCS, vol:10820, pp.360-384, 2018.
- J. H. Cheon, A. Kim, **M. Kim**, and Y. Song. “Homomorphic encryption for arithmetic of approximate numbers.” *Proceedings of the International Conference on the Theory and Application of Cryptology and Information Security (ASIACRYPT)*, LNCS, vol:10624, pp.409-437, 2017.

- J. Kim, C. Lee, H. Shim, J. H. Cheon, A. Kim, **M. Kim**, and Y. Song. "Encrypting controller using fully homomorphic encryption for security of cyber-physical systems". *Proceedings of the IFAC Workshop on Distributed Estimation and Control in Networked Systems (NECSYS)*, 49(22):175-180, 2016.
- J.H. Cheon, **M. Kim**, and K. Lauter. "Homomorphic computation of edit distance". *Proceedings of the Financial Cryptography and Data Security (FC)*, LNCS, vol:8976, pp.194-212, 2015.
- J.H. Cheon, **M. Kim**, and M. Kim. "Search-and-compute on encrypted data". *Proceedings of the Financial Cryptography and Data Security (FC)*, LNCS, vol:8976, pp.142-159, 2015.

REFEREED JOURNAL PUBLICATIONS

- S. Karimi, X. Jiang, R. Dolin, **M. Kim**, and Aziz Boxwala. "A secure system for genomics clinical decision support". *Journal of Biomedical Informatics*; 112, 2020.
- JL Raisaro, F. Marino, J. Troncoso-Pastoriza, R. Beau-Lejdstrom, R. Bellazz, E. V. Bernstam, M. Bucalo, Yong Chen, A. Gottlieb, A. Harmanci, **M. Kim**, Y. Kim, J. Klann, C. Klersy, B. A. Malin, M. Méan, F. Prasser, L. Scudeller, A. Torkamani, J. Vaucher, M. Puppala, S. T.C. Wong, M. Frenkel-Morgenstern, H. Xu, B. M. Musa, A. G. Habib, A. Wilcox, H. M. Salihu, H. Sofia, X. Jiang, JP Hubaux. "SCOR: A secure international informatics infrastructure to investigate COVID-19". *Journal of the American Medical Informatics Association*; ocaa172, 2020.
- M. Kim**, Y. Song, B. Li, and D. Micciancio. "Semi-parallel logistic regression for GWAS on encrypted data". *BMC Medical Genomics*; 13(99), 2020.
- M. Kim**, J. Lee, L. Ohno-Machado, and X. Jiang. "Secure and differentially private logistic regression for horizontally distributed data". *IEEE Transactions on Information Forensics and Security*; 15(1):695-710, 2019.
- Y. Jiang, J. Hamer, C. Wang, X. Jiang, **M. Kim**, Y. Song, Y. Xia, N. Mohammed, M. N. Sadat, and S. Wang. "SecureLR: Secure Logistic Regression model via a hybrid cryptographic protocol". *IEEE/ACM Transactions on Computational Biology and Bioinformatics*; 16(1):113-123, 2019
- A. Kim, Y. Song, **M. Kim**, K. Lee, and J. H. Cheon. "Logistic regression model training based on the approximate homomorphic encryption". *BMC Medical Genomics*; 11:S4, 2018.
- M. Kim**, Y. Song, S. Wang, Y. Xia, and X. Jiang. "Secure logistic regression based on homomorphic encryption: design and evaluation". *JMIR Med Inform*; 6(2):e19, 2018.
- M. Kim**, Y. Song, and J. H. Cheon. "Secure searching of biomarkers using hybrid homomorphic encryption scheme". *BMC Medical Genomics*; 10:42, 2017.
- J.H. Cheon, **M. Kim**, and M. Kim. "Optimized search-and-compute circuits and their application to query evaluation on encrypted data". *IEEE Transactions on Information Forensics and Security*; 11(1):188-199, 2016.
- S. Wang, Y. Zhang, W. Dai, K. Lauter, **M. Kim**, Y. Tang, H. Xiong, and X. Jiang. "HEALER: Homomorphic computation of ExAct Logistic rEgRession for secure rare disease variants analysis in GWAS". *Bioinformatics*; 32(2):211-218, 2016.
- M. Kim** and K. Lauter. "Private genome analysis through homomorphic encryption". *BMC Medical Informatics and Decision Making*; 15(Suppl 5):S3, 2015.

TECHNICAL REPORTS

- J.H. Cheon, A. Costache, R.C. Moreno, W. Dai, N. Gama, M. Georgieva, S. Halevi, **M. Kim**, S. Kim, K. Laine, Y. Polyakov, Y. Song. "Introduction to Homomorphic Encryption". To be available at HomomorphicEncryption.org. 2020.
- M. Brenner, W. Dai, S. Halevi, K. Han, A. Jalali, **M. Kim**, K. Laine, A. Malozemoff, P. Paillier, Y. Polyakov, K. Rohloff, E. Savaş, and B. Sunar. "A standard API FOR RLWE-based homomorphic encryption". Available at HomomorphicEncryption.org. 2017

ABSTRACTS

- M. Kim**. "Homomorphic encryption for protecting genome privacy". *Proceedings of IEEE EMBS International Conference on Biomedical and Health Informatics-BHI 2019*. 2019.
- Y. Zhang, W. Dai, S. Wang, **M. Kim**, K. Lauter, J. Sakuma, H. Xiong, and X. Jiang. "SECRET: Secure Edit distance Computation over homomoRphic EncrypTed data". *Proceedings of the 5th Annual Translational Bioinformatics Conference (TBC)*, 2015.

PATENTS	[P06] Apparatus for approximately processing encrypted messages and methods thereof, US Patent App. US 20200036511A1, Jan 2020.	
	[P05] Apparatus for processing approximate encrypted messages and methods thereof, KR-102040120-B1, application date: Nov 2019.	
	[P04] Method and system for communicating homomorphically encrypted data, US Patent App. US10198592B2, publication date: Feb 2019.	
	[P03] Method for Processing Dynamic Data by Homomorphic Encryption, KR-101919940-B1, publication date: Nov 2018.	
	[P02] Method for Calculating Edit Distance Between DNA Genomic Sequence through Homomorphic Encryption, KR-101817087-B1, publication date: Jan 2018.	
	[P01] A Method for Managing Data and Apparatuses therefor, KR-20170004456-A, publication date: Jan 2017.	
PROJECTS	<ul style="list-style-type: none"> ▪ <i>PI</i> in a Seed grant by UNIST (1.200109): “Secure genomic analysis on encrypted data” (10/1/2020-present) ▪ <i>Co-I</i> in an Institute of Information & communications Technology Planning & Evaluation (IITP) by the Korea government (MSIT) (2020-0-01336): “Artificial intelligence graduate school support” (9/1/2020-present) ▪ Microsoft Research Award - 2019 Dr. Kim’s Research Collaboration (\$55,000) ▪ <i>Co-PI</i> in NIH R41 grant (R41HG010978): “Secure Outsourced computation of genomic data” (\$344,948, 9/9/2019-8/31/2020, PI: Karimi) ▪ <i>Co-I</i> in Cancer Prevention Research Institute of Texas (CPRIT) Rising Stars Award (CPRIT RR180012): “Cancer Phenotyping for personalized combinatorial drug therapy” (\$939,405, 5/1/2018-4/30/2023, PI: Jiang) ▪ <i>Co-I</i> in an NIH R01 grant (R01GM124111): “Privacy-preserving methods and tools for handling missing data in distributed health data networks” (\$475,135, 09/08/2017-06/30/2021, PI: Qi) ▪ <i>Co-I</i> in an NIH U01 grant (U01EB023685): “Encryption methods and software for privacy-preserving analysis of biomedical data” (10/01/16 - 04/30/18, PI: Tang) ▪ <i>Co-I</i> in Samsung grant: “Development of homomorphic encryption for data analysis” (2015 - 2016, PI: Cheon) ▪ <i>Co-I</i> in Samsung grant: “Fusion-based next generation privacy/sw security technology” (2014 - 2015, PI: Cheon) ▪ <i>Co-I</i> in Samsung grant: “A development of public key encryption for the hybrid scheme which combines public key” (2013 - 2014, PI: Cheon) 	
PROFESSIONAL SERVICE	Organizer of the iDASH Privacy Workshop	2019-Present
	Program committee for Genome Privacy and Security (GenoPri)	2019-Present
	Program committee for Mathcrypt	2019
	Member for the Global Alliance for Genomics and Health (GA4GH) Data Security	2019
HONORS & AWARDS	First Prize, iDASH Genomic Data Privacy and Security Protection Competition 2018 Organized by NIH, http://www.humangenomeprivacy.org/2018/	Oct 2018
	Awards for Young Korean Female Mathematicians Organized by Korean Women in Mathematics Sciences, http://www.kwms.or.kr/index.php?mp=5_4 .	Jun 2018
	First Prize, iDASH Genomic Data Privacy and Security Protection Competition 2017 Organized by NIH, http://www.humangenomeprivacy.org/2017/	Oct 2017
	Excellence Award, Crypto Contest Korea Cryptography Forum.	Oct 2017
	Second Prize, iDASH Genomic Data Privacy and Security Protection Competition 2016 Organized by NIH, http://www.humangenomeprivacy.org/2016/	Nov 2016
	Grand Prize Crypto Contest Korea Cryptography Forum.	Oct 2016

- Special Prize Crypto Contest Nov 2015
Korea Cryptography Forum.
- First Prize, iDASH Genomic Data Privacy and Security Protection Competition 2015 Mar 2015
Organized by NIH, <http://www.humangenomeprivacy.org/2015/>
- BK 21+ Scholarship 2013 – 2015
Ministry of Education of Korea.
- Outstanding Teaching Assistant Awards Feb 2011
Seoul National University.
- BK 21 Scholarship 2010 – 2012
Ministry of Education of Korea.
- Korea Student Aid Foundation – National Science and Engineering Scholarship 2006 – 2009

PRESENTATIONS

- Homomorphic encryption: from theory to practice Oct 2020
Women Committee Workshop in Korean Institute of Information Scientists and Engineers, Republic of Korea.
- Homomorphic encryption and its application to Private AI Sep 2020
UNIST AIGS Workshop, Ulsan, Republic of Korea.
- The iDASH Competition: Progress of homomorphic encryption for genomic privacy Apr 2020
Simons Workshop: From theory to practice, The Simons Institute for the Theory of Computing, Berkeley, CA, USA.
- Practical applications of homomorphic encryption Dec 2019
Guest seminar, Department of Mathematics, Hanyang University, Seoul, Republic of Korea.
- Practical applications of homomorphic encryption Dec 2019
Samsung Advanced Institute of Technology Seminar, Seoul, Republic of Korea.
- Practical applications of homomorphic encryption Dec 2019
International Conference on Information Security and Cryptology (ICISC) 2019, Seoul, Republic of Korea.
- Efficient multi-key homomorphic encryption and application to neural network inference Oct 2019
Genome Privacy and Security (GenoPri) 2019, Boston, USA.
- Introduction to homomorphic encryption May 2019
Guest seminar, Department of Electrical and Computer Engineering, Rice University, Houston, TX, USA.
- Homomorphic encryption for protecting genome privacy May 2019
IEEE EMBS International Conference on Biomedical and Health Informatics 2019, Chicago, IL, USA.
- Practical applications of homomorphic encryption Jan 2019
The workshop of The rising of biomedical informatics: hammers and nails, University of Texas, Health Science Center at Houston, Houston, TX, USA.
- Secure outsourced matrix computation and application to neural networks Oct 2018
ACM SIGSAC Conference on Computer and Communications Security 2018, Toronto, ON, Canada.
- Semi-parallel logistic regression based on RNS-CKKS Oct 2018
iDASH Genomic Data Privacy and Security Protection Workshop 2018, San Diego, CA, USA.
- Homomorphic encryption for protecting genomic privacy Oct 2018
Guest seminar, University of Texas, Health Science Center at Houston, Houston, TX, USA.
- Progress on genome privacy and security Jul 2018
Seoul National University Bundang Hospital - Big Data Center Seminar, Bundang, Republic of Korea.
- Secure logistic regression model training based on homomorphic encryption Jun 2018
The 2018 KWMS International Conference, Seoul, Republic of Korea.
- Secure logistic regression based on homomorphic encryption Nov 2017
Guest seminar, Department of Computer Science, UCSD, San Diego, CA, USA
- Homomorphic encryption for arithmetic of approximate Numbers Oct 2017
iDASH Genomic Data Privacy and Security Protection Competition 2017, Orlando, FL, USA.
- Secure Searching of biomarkers using hybrid GSW encryption scheme Jan 2017
Women in Mathematics Workshop, Seoul, Republic of Korea.
- Homomorphic encryption and its applications Dec 2016
Korea Internet Security Agency, Seoul, Republic of Korea.
- Secure searching of biomarkers using Hybrid GSW Encryption Scheme Nov 2016
iDASH Genomic Data Privacy and Security Protection Workshop 2016, Chicago, IL, USA.
- Guide to applications of homomorphic encryption Feb 2016
Microsoft Research Seminar, Redmond, WA, USA.

	<ul style="list-style-type: none"> ▪ Private genome analysis through Homomorphic Encryption Mathematics of Lattices and Cybersecurity, Providence, RI, USA. 	Apr 2015
	<ul style="list-style-type: none"> ▪ Private genome analysis through homomorphic encryption Microsoft Research Seminar, San Diego, CA, USA. 	Apr 2015
	<ul style="list-style-type: none"> ▪ Private genome analysis through homomorphic encryption iDASH Genomic Data Privacy and Security Protection Workshop 2015, San Diego, CA, USA. 	Mar 2015
	<ul style="list-style-type: none"> ▪ Homomorphic computation of Edit distance WAHC'15 : 3rd Financial Cryptography Workshop on Applied Homomorphic Cryptography, San Juan, PR, USA. 	Jan 2015
	<ul style="list-style-type: none"> ▪ Search-and-compute on encrypted data WAHC'15 : 3rd Financial Cryptography Workshop on Applied Homomorphic Cryptography, San Juan, PR, USA. 	Jan 2015
	<ul style="list-style-type: none"> ▪ Search-and-compute on encrypted data The 2014 Global KMS International Conference, Gangneung, Republic of Korea. 	Apr 2014
TEACHING	<ul style="list-style-type: none"> ▪ Discrete mathematics 	Fall 2020
MEDIA MENTIONS	<ul style="list-style-type: none"> ▪ Awards for Young Korean Female Mathematics Knowledge@yonhapnews,etnews,hankyung,seouldaily,insight,asiatimes,etoday,fomos ▪ Vanderbilt-, IBM-, Microsoft-Led Teams Named Winners of Recent iDASH Genomic Privacy Competition Dec 2016 Knowledge@GenomeWeb. ▪ The 10th Crypto Contest http://www.etnews.com/20161123000272. ▪ Extreme cryptography paves way to personalized medicine Knowledge@NatureNews. ▪ Cryptographer's Challenge: Keeping Genetic Secrets While Advancing Genetic Research Knowledge@Microsoft Research. ▪ Hot Global Mathematicians of Cryptography Knowledge@Donga. ▪ New Community Challenge Seeks to Evaluate Methods of Computing on Encrypted Genomic Data Knowledge@GenomeWeb. 	<p>Jul 2018</p> <p>Nov 2016</p> <p>Mar 2015</p> <p>Mar 2015</p> <p>Mar 2015</p> <p>Nov 2014</p>
LANGUAGES	<ul style="list-style-type: none"> ▪ Korean: Native language ▪ English: Fluent 	
SKILLS	<ul style="list-style-type: none"> ▪ Basic: Matlab, R, Sage ▪ Intermediate: Python ▪ Advanced: C/C++ 	

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