Minsung Kim

Princeton, NJ, USA
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RESEARCH INTERESTS

Wireless Systems and Networks
Quantum Computing (Quantum Annealing/Gate Model)
Network Architecture/Protocols
Distributed Systems and Artificial Intelligence

EDUCATION

Princeton University, NJ Sep. 2017 - Present
Ph.D. Student in the Department of Computer Science
Advisor: Prof. Kyle Jamieson (kylej@cs.princeton.edu)

Korea University, Seoul August. 2016
B.E. in Electrical Engineering, *Graduation with Great Honor & Presidential Research Award*
Advisor: Prof. Sangheon Pack (shpack@korea.ac.kr)

Stanford University, CA Summer. 2016
Visiting Student, Electrical Engineering

WORK EXPERIENCES

Research Intern, InterDigital Communications, Inc., PA Summer. 2021
Advisor: John Kaewell, Senior Principal - Advisor to CTO (John.Kaewell@InterDigital.com)

The National Aeronautics and Space Administration (NASA) – Ames Research Center in Silicon Valley, CA
Advisor: Dr. Davide Venturelli (davide.venturelli@nasa.gov)
- Affiliated Researcher, *Quantum Artificial Intelligence Laboratory (QuAIL)* Apr. 2018 – Feb. 2021
- Research Intern, *Quantum Artificial Intelligence Laboratory (QuAIL)* Summer. 2020
- Research Intern, *Quantum Artificial Intelligence Laboratory (QuAIL)* Summer. 2019
- Visiting Scholar, *Universities Space Research Association (USRA)* Summer. 2018

PUBLICATIONS

(+: co-first author)

M. Kim, D. Venturelli, J. Kaewell, and K. Jamieson, "On Flexible and Scalable Parallelization in Quantum Sphere Decoders," under submission.

M. Kim, D. Venturelli, J. Kaewell, and K. Jamieson, "QuAMax 2.0: Enabling Hybrid Classical-Quantum Massive MIMO Processing via Reverse Quantum Annealing," under submission.

M. Kim+, S. Kasi+, A. Lott, D. Venturelli, J. Kaewell, and K. Jamieson, "Heuristic Quantum Optimization for 6G Wireless Communications," In IEEE **Network Magazine 2021**, IF:8.808 (**Invited Paper**).

M. Kim, S. Mandra, D. Venturelli, and K. Jamieson, "Physics-Inspired Heuristics for Soft MIMO Detection in 5G New Radio and Beyond," In ACM **MobiCom 2021**, acceptance rate: 16.8% (19/113, summer deadline).

M. Kim, D. Venturelli, and K. Jamieson, "Towards Hybrid Classical-Quantum Computation Structures in Wirelessly-Networked Systems," In ACM **SIGCOMM HotNets 2020**, acceptance rate: 24.8% (30/121).

M. Kim, D. Venturelli, and K. Jamieson, "Leveraging Quantum Annealing for Large MIMO Processing in Centralized Radio Access Networks," In ACM **SIGCOMM 2019**, acceptance rate:14.5% (32/221).

ACADEMIC HONORS AND AWARDS

Qualcomm Innovation Fellowship Finalist (in progress), Qualcomm, CA March. 2021
Finalist (in progress) in 2021 QIF (North America)

Alumni Scholarship, Korea University Alumni Association (NY) March. 2021
Scholarship for Exceptional KU Alumni in New York Metropolitan Area

Nomination for an Honorific Fellow, Princeton Computer Science Dept. February. 2021
Selected Doctoral Student (4 in CS Dept.) with the Outstanding Performance and Professional Promise

Student Spotlight, NASA Ames Research Center August. 2020
Outstanding 2020 Research Intern introduced in summer Newsletter from NASA Ames Research Center

Graduate School Fellowship, Princeton University 2017-2018 Academic year
Full Fellowship awarded to Princeton Doctoral Students

Great Honor, Korea University August. 2016
Graduation with Great Honor at Korea University

Korea University Presidential Best Research Award March. 2016
Best Undergraduate Research at Creative Challenger Program

Semester High Honors, Korea University 8 Times
Exceptional Grades during All Semesters

Qualcomm IT Tour supported by Qualcomm, CA July. 2015
Selected Excellent EE/CS Student and Invited Small Conference with Executive Chairman

Korea Telecom (KT) Excellence Award February. 2016
Best Project & Outstanding Intern at KT

Creative Challenger Scholarships, Korea University Jun. 2015 - Mar. 2016
Research Funding for Creative Independent Research & Scholarships for Best Research

National Science and Engineering Scholarship, Korea Student Aid Foundation 5 Times
Full Scholarships for Academic Honors – Fall'10, Spring'14, Fall'14, Fall'15, Spring'16

Best Honors Scholarship, LOTTE Foundation 2 Times
Full Scholarships for Academic Honors – Spring'11, Fall'11

Family Scholarships, Korea University 1 Times
Korea University Entrance Scholarship – Spring'10

PATENTS

Provisional US Patent Application 62/845,642 filed May 9, 2019. PCT application PCT/US2020/032398. Leveraging Quantum Annealing for Large MIMO Processing in Cloud-Based Radio Access Networks. **Minsung Kim**, Davide Venturelli, Kyle Jamieson. Assignee: Princeton University.

OTHER RESEARCH OUTPUTS

M. Kim, K. Jamieson, "Transforming MIMO BPSK Maximum Likelihood Detection into QUBO Form," Department of Computer Science Technical Report TR-010-17, Princeton University 2017.

M. Kim, J. Y. Lee, and H. Kim, "Warning and Detection System for Epidemic Disease," In International Conference on ICT Convergence, IEEE **ICTC 2016**, (undergraduate publication and talk).

GRANTS AND FUNDING

National Science Foundation (NSF) Award #1824357 ($372,667) and Award #1824470 ($277,206)
"SpecEES: Collaborative Research: Advancing the Wireless Spectral Frontier with Quantum-Enabled Computational Techniques (QENeTs)", Oct. 2018–Jul. 2022.
- Conducted experiments and prepared the proposal with (PIs) Prof. Kyle Jamieson and Dr. Davide Ventruelli.

Princeton University SEAS Project X Innovation Fund ($150,000), Feb. 2018–Jan. 2020.

- Conducted experiments and prepared the proposal with (PI) Prof. Kyle Jamieson.

USRA Cycle 3 and Cycle 4 Awards
Proposal selected for research time on a D-Wave Quantum Computer in the USRA-NASA-Google Quantum Artificial Intelligence Laboratory at NASA Ames Research Center, Feb. 2018 (Cycle 3) & Nov. 2020 (Cycle 4).
- Conducted experiments and prepared the proposal with (PI) Prof. Kyle Jamieson.

TALKS

Conference Talks

- ACM MobiCom 21, New Orleans (planned) Oct. 2021
"Physics-Inspired Heuristics for Soft MIMO Detection in 5G New Radio and Beyond"

- ACM HotNets 20, Chicago, IL (virtual due to COVID-19) Nov. 2020
"Towards Hybrid Classical-Quantum Computation Structures in Wirelessly-Networked Systems"

- NASA Symposium 20, NASA Ames Research Center, CA (virtual due to COVID-19) Aug. 2020
"Quantum-Inspired Heuristics for Wireless Networks"

- ACM SIGCOMM 19, Beijing, China Aug. 2019
"Leveraging Quantum Annealing for Large MIMO Processing in Centralized Radio Access Networks"

- IEEE ICTC 16, Jeju, Korea Oct. 2016
"Warning and Detection System for Epidemic Disease"

Invited Talks

- Princeton University, NJ Nov. 2020
"Quantum Annealing for MIMO Processing", host: Princeton Quantum Science and Engineering Group

- Pusan National University, Pusan, Korea May. 2019
"Wireless Systems and Quantum Computing", host: Prof. Wonjae Shin

- Korea University, Seoul, Korea Feb. 2016
"CCP Winner: Smart Public Transportation", host: Korea University Center for Teaching and Learning

Special Lectures

- Ajou University, Suwon, Korea May. 2021
"Wireless Communications and MIMO Techniques", Mobile Communications (ECE 432)

RESEARCH EXPERIENCES

Research on Wireless Communication Systems leveraging Quantum Computing July. 2017 - Present
Princeton Advanced Wireless Systems (PAWS) Group, Princeton University – Joint Research with NASA
- Transforming the Sphere Decoder for 5G Massive MIMO Communication with Quantum Computation.
- Led to NSF $372,667 and $277,206 Awards (#1824357, #1824470), USRA Cycle 3 and 4 Award, Princeton University SEAS Innovation Fund, and the first paper on Quantum Computing in SIGCOMM.

Performance Analysis on LTE Networks based on NS-3 Dec. 2014 - Jun. 2016
Mobile Network & Communications (MNC) Lab, Korea University – Undergraduate Research Student
- Analyzed performance of LTE X2 handover in ultra-small cell networks using NS-3 and Wireshark.

Development on Cloud CDN system and Enterprise Storage using OpenStack Apr. 2016 - Dec. 2016
Hanium ICT Project, National IT Industry Promotion Agency – Joint Project with KT Cloud Team
- Constructed a global cloud CDN system and Zadara cloud enterprise storage using OpenStack Cinder.

System Design Research and Development on Android App for Evaluation Feb. 2016 - Oct. 2016
Wireless & Wired Inter-Networking and Evaluation (WINE) Lab, Korea University – ICTC Publication
- Designed a GPS-based warning and detection system to prevent the spread of epidemic diseases.

Independent Research Project 'Smart Public Transportation' using RFID Jun. 2015 - Mar. 2016
7th Creative Challenger Program, Korea University – KU Presidential Best Research Award
- As a research team leader, led a study on service to provide comfort-level in vehicles for public transportation.
- The proposed concept is currently applied to public bus stations in Seoul, Korea.

Survey of Tactile Internet Application & Connected Car Auto-Driving System Apr. 2015 - July. 2015
13th Qualcomm IT Tour supported by Qualcomm Korea and Qualcomm, San Diego, CA
- Presented Tactile Internet-based 3D hologram service and design of VANET-based highway infrastructure.
- Had a lively discussion with Executive Chairman of Qualcomm (Dr. Paul Jacobs) on wireless technologies.

TEACHING EXPERIENCES

Teaching Assistant, Department of Computer Science, Princeton University
- Wireless Networks Spring. 2019
- Mobile Computing Design for Assistive Technology Fall. 2018
- Network Measurement, Sensing, and Visualization Across the Princeton Campus Fall. 2018

SERVICE

Reviewer
- IEEE Transactions on Communications (TCOM)

External Reviewer
- USENIX NSDI 2020
- ACM SIGCOMM 2019

OTHER EXPERIENCES

Undergraduate Internship, Department of Wireless Engineering, Korea Telecom Dec. 2015 - Feb. 2016
Optimized KT's communication systems using wireless network guard system (WING) & antenna tilting.

Intelligence Agent & Translator (Eng), Foreign Affairs Division, National Police Jun. 2012 - Mar. 2014
Covered special requirement intelligence (SRI) and foreign affairs in Korea. (Military Service in Korea)

End of CV ***(latest update: 06/2021)***

References:
Prof. Kyle Jamieson, Computer Science Dept, Princeton University (kylej@cs.princeton.edu)
Dr. Davide Venturelli, NASA ARC & USRA RIACS (DVenturelli@usra.edu)
John Kaewell, InterDigital (John.Kaewell@InterDigital.com)
Prof. Sangheon Pack, Electrical Engineering Dept, Korea University (shpack@korea.ac.kr)

Links

Personal Website: https://www.cs.princeton.edu/~minsungk

PAWS Research Group: https://paws.cs.princeton.edu/

QENeTs Project: https://qenets.cs.princeton.edu/index.html

LinkedIn: linkedin.com/in/minsung-kim-093407132