# Minsung Kim

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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)

- ***Selected Courses:*** Advanced Computer Networks, Advanced Computer Systems, Wireless Networks

**Korea University, Seoul** Mar. 2010 - Aug. 2016
B.E. in Electrical Engineering, *Graduation with Great Honor & Presidential Research Award*
GPA : 3.97 / 4.0 (Original Scale 4.34 / 4.5 & 98.2 / 100)
*Advisor:* Prof. Sangheon Pack (shpack@korea.ac.kr)

- ***Selected Courses:*** Wireless Networks, Communications Network Design, Mobile Communication Engineering, Communication Theory, Data Communications, Digital Signal Processing, Digital Communications

**Stanford University, CA** Jun. 2016 - Aug. 2016
Visiting Student, Electrical Engineering

- ***Selected Courses:*** Convex Optimization, Statistical Signal Processing, Colloquium on Computer System

## WORK EXPERIENCES

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

## ACADEMIC HONORS AND AWARDS

**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

## PUBLICATIONS

(+: co-first author)

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

**M. Kim**+, S. Kasi+, A. Lott, D. Venturelli, J. Kaewell, and K. Jamieson, "Heuristic Quantum Optimization for 6G Wireless Communications," Submitted to 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 **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).

## 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**, (undergrad 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
- ACM HotNets 20, Chicago, IL (virtual due to COVID-19) Nov. 2020
- NASA Symposium 20, NASA Ames Research Center, CA (virtual due to COVID-19) Aug. 2020
- ACM SIGCOMM 19, Beijing, China Aug. 2019
- IEEE ICTC 16, Jeju, Korea Oct. 2016

**Invited Talks**

- Quantum Annealing for MIMO Processing, Princeton University Nov. 2020
(host: Princeton Quantum Science and Engineering Group)
- Wireless Systems and Quantum Computing, Pusan National University, Korea May. 2019
(host: Prof. Wonjae Shin)
- Smart Public Transportation, Korea University, Seoul Feb. 2016
(host: Korea University Center for Teaching and Learning)

## 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 Dr. Paul Jacobs, (ex) Executive Chairman of Qualcomm, 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

## OTHER EXPERIENCES

**Undergrad 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)

## SERVICE

**Reviewer**
- IEEE Transactions on Communications (TCOM) 2021

***End of CV*** ***(latest update: 01/2021)***
***References, Prof. Kyle Jamieson, Computer Science Dept, Princeton University (kylej@cs.princeton.edu)***
***References, Dr. Davide Venturelli, NASA ARC & USRA RIACS (DVenturelli@usra.edu)***
***References, 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**: https://www.linkedin.com/in/minsung-kim-093407132?trk=nav_responsive_tab_profile_pic