

EDUCATION	<p><b>Seoul National University</b>, Seoul, Korea</p> <p>Ph. D., Department of Electrical and Computer Engineering, Mar. 2016 to Aug. 2023</p> <ul style="list-style-type: none"> <li>• Advisor: <b>Professor Saewoong Bahk</b> (Changed from <b>Sunghyun Choi</b> who is currently a Senior Vice President and Head of Advanced Communications Research Center at Samsung Research)</li> <li>• Ubiquitous Network Laboratory in Seoul National University (NETLAB)</li> </ul> <p><b>Pohang University of Science and Technology (POSTECH)</b>, Pohang, Korea</p> <p>B.S., Department of Electrical Engineering, in Feb. 2016</p>
RESEARCH INTERESTS	<p><b>3D object detection for autonomous vehicles:</b> Semi-supervised learning, distributed learning</p> <p><b>Protocol design for V2X communication and 5G New Radio (NR):</b> 3GPP LTE and NR standard for V2X communication systems, DSRC protocol design</p>
EXPERIENCE	<p><b>Panasonic USA</b>, Mountain View, CA.</p> <p>Internship, May 2019 – Oct. 2019.</p>
RESEARCH PROJECT	<ul style="list-style-type: none"> <li>• National Research Foundation grant funded by the Korea government (MSIT), “Research on distributed learning and extended-vision based 3D object detection model for autonomous driving in 5G networks,” 2020-2023.</li> <li>• 5G Unmanned Vehicle Research Center funded by the Institute for Information &amp; Communications Technology Promotion, “Research and Education for Integrated Technology of 5G/Autonomous Vehicles,” 2018-2019. - Create MATLAB system level simulator for IEEE 802.11p based on Simulator for Urban Mobility (SUMO) vehicle traffic</li> <li>• Institute for Information &amp; communications Technology Promotion grant funded by Ministry of Science, ICT and Future Planning (MSIP) of the Republic of Korea, “Spectrum Sensing and Future Radio Communication Platforms,” 2015–2017. - Implement the USRP LTE-LAA testbed for coexistence with Wi-Fi in 5 GHz</li> </ul>
AWARDS	<ul style="list-style-type: none"> <li>• <b>Second Prize from SNU ECE for graduate deeplearning project</b> “SmartSearch: AIBRIL conversation API &amp; facial keypoints detection for beauty items recommendation system”, Fall. 2017.</li> <li>• <b>First Prize from POSTECH EE for Undergraduate design project</b>, Apr. 2012.</li> </ul>
PAPERS	<p>[1] <b>[IEEE/CVF ICCV 2023]</b> UpCycling: Semi-supervised 3D Object Detection without Sharing Raw-level Unlabeled Scenes <b>Sunwook Hwang</b>, Youngseok Kim, Seongwon Kim, Saewoong Bahk, and Hyung-Sin Kim</p> <p>[2] <b>[IEEE TVT 2020]</b> Beyond Vision: Hidden Car Detector with On-demand Relaying in Vehicular Communications <b>Sunwook Hwang</b>, Seongwon Kim, Hoyoung Yoon, Byungjun Kim, Sunghyun Choi, and Saewoong Bahk</p>

- [3] Jin Mo Yang, Hoyoung Yoon, **Sunwook Hwang**, and Saewoong Bahk, "PRESS: Predictive Assessment of Resource Usage for C-V2V Mode 4," in *Proc. IEEE WCNC*, Mar. 2021.
- [4] Byungjun Kim, Seongwon Kim, Hoyoung Yoon, **Sunwook Hwang**, M. Xavier Punithan, Byeong Rim Jo, and Sunghyun Choi, "Nearest-First: Efficient Relaying Scheme in Heterogeneous V2V Communication Environments," *IEEE Access*, vol. 7, pp. 23615–23627, Feb. 2019.
- [5] **Sunwook Hwang**, Kanjin Yoon, and Sunghyun Choi, "Channel Switching Operation of LTE-LAA in Unlicensed Spectrum," in *Proc. ICTC 2017*, Jeju, South Korea, Oct. 18-20, 2017.
- [6] Kangjin Yoon, Taejun Park, Jihoon Kim, Weiping Sun, **Sunwook Hwang**, Ingab Kang, and Sunghyun Choi, "COTA: Channel Occupancy Time Adaptation for LTE in Unlicensed Spectrum," in *Proc. IEEE DySPAN 2017*, Baltimore, USA, Mar. 2017.

#### PATENTS

- [1] **Sunwook Hwang**, Youngseok Kim, Hyung-sin Kim, and Saewoong Bahk, "Semi-supervised learning method for object detection in autonomous vehicle and server for performing semi-supervised learning for object detection in autonomous vehicle,"  
**US 11,495,012**, Nov. 2022.  
**Korean Patent 10-23-4024**, Apr. 2022.
- [2] **Sunwook Hwang**, Seongwon Kim, Hoyoung Yoon, Byungjun Kim, and Sunghyun Choi, "Method and apparatus for communication between vehicles and apparatus for using the same,"  
**US 11,032,682**, June, 2021.  
**Korean Patent 10-1975759**, Apr. 2019.
- [3] Byounghoon Jung , Jihoon Kim , Sunghyun Choi , Seung-Hoon Park , Jungsoo Jung , Taejun Park , Kangjin Yoon , Jaehong Yi , **Sunwook Hwang**, "Apparatus and Method for using Multiple Carriers in Wireless Communication System ,"  
**US 11,330,585**, May, 2022.
- [4] Kangjin Yoon, **Sunwook Hwang**, and Sunghyun Choi, "Method, apparatus and computer readable record media for collision-aware link adaptation through clustering,"  
**Korean Patent 10-2099376**, Apr. 2020.
- [5] Seungil Park, **Sunwook Hwang**, Hoyoung Yoon, Byungjun Kim, and Sunghyun Choi, "Method and apparatus for message relaying,"  
**Korean Patent 10-1935230**, Dec. 2018.  
**PCT/KR2019/008328**, July 2019.
- [6] Kangjin Yoon, **Sunwook Hwang**, Taejun Park, Jihoon Kim, and Sunghyun Choi, "Method, apparatus and computer readable record media for sharing radio resource on unlicensed band,"  
**Korean Patent 10-1865390**, May 2018.
- [7] Byounghoon Jung, Jihoon Kim, Sunghyun Choi, Seunghoon Park, Jungsoo Jung, Jaehong Yi, Kangjin Yoon, and **Sunwook Hwang**, "Apparatus and method for operating a plurality of carriers in wireless communication system,"  
**Korean Patents Application 10-2017-0111389**, filed Aug. 2017, Patent Pending.

#### SOFTWARE INTELLECTUAL PROPERTIES

- [1] Kangjin Yoon, **Sunwook Hwang**, Taejun Park, Jihoon Kim, and Sunghyun Choi, "LAA Channal Occupancy Time Adaptation Algorithm for fair coexistence with WLAN," Korea Copyright Commission C-2017-024231, Oct. 2017.

- [2] Kangjin Yoon, **Sunwook Hwang**, Taejun Park, Jihoon Kim, and Sunghyun Choi, “WLAN Saturation Detection Algorithm,” Korea Copyright Commission C-2017-000564, Jan. 2017.

**SOFTWARE  
SKILLS**

Computer Programming Languages and Frameworks:

- C, C++, Python, PyTorch, TensorFlow, UNIX shell scripting

Prototyping Tools:

- LabVIEW FPGA, LabVIEW Communications System Design Suite (CSDS)

Simulation Tools:

- Network Simulator 3 (ns-3)
- MATLAB

Desktop Editing and Productivity Software:

- Git, Docker

**TEACHING  
EXPERIENCES**

**Instructor**

Department of Electrical and Computer Engineering, Seoul National University

- 400.019A Introduction to Electrical Engineering, Spring 2016.
- 430.469 Networking Protocol Design, Fall 2017.

**KICS Invited Instructor**

Korean Institute of Communications and Information Sciences (KICS),

- Basic Course for Network Simulation using ns-3. Feb. 2019.
- Basic Course for Network Simulation using ns-3. Feb. 2018.