박태현/Taehyun Park
박사후 연구원/Postdoctoral Researcher
한양대학교 융합전자공학부/
Department of Electronic Engineering, Hanyang University

# 광전자 난수 소자를 활용한 의공학 응용
# Optoelectronic Randomness for Biomedical Security

## Abstract

As healthcare devices and AI-assisted diagnostics become more common, secure authentication and reliable data handling are emerging as critical issues. A central requirement for these functions is unpredictability, or "true randomness," which conventional software-based systems cannot guarantee. In this talk, I will present two recent approaches that use light to generate such randomness through optoelectronic devices. The first is a photoacoustic physically unclonable function (PA-PUF), which produces device-specific digital keys from random acoustic signals inside nanomaterials. This allows each device to be uniquely identified, even when attached to flexible surfaces such as human skin. The second is a light-induced true random number generator (TRNG), which creates continuous random signals from competing photocurrents. These random numbers can be applied not only to secure communication but also to biomedical AI. In particular, we demonstrate their use in generating synthetic chest X-ray images for training diagnostic networks, addressing data shortage and privacy challenges in medical imaging. These results suggest that light-driven randomness can be a new resource for biomedical engineering, supporting both trustworthy wearable devices and reliable AI-assisted diagnosis.

## Brief Biosketch

Taehyun Park received his Ph.D. degree in Chemical and Biological Engineering from Gachon University in 2024. He is currently a postdoctoral researcher in the Department of Electronic Engineering at Hanyang University. His research interests include emerging optoelectronic devices, self-powered and low-power photodetectors, and hardware security devices such as physically unclonable functions and true random number generators.