Kyoungmo Koo

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Summary

I am a first-year Ph.D. student in Biomedical Engineering at the University of Michigan. I conduct research in the Optical Imaging Laboratory (Prof. Xueding Wang) and the Image-Guided Medical Robotics Laboratory (Prof. Mark Draelos).

My work focuses on developing affordable, automated, and standardized medical imaging devices by integrating robotics technology with advanced digital interfaces. I believe robotics-applied medical imaging can be a game-changer in healthcare, helping reduce delays and diagnostic errors while expanding access to underserved populations worldwide.

Education

Ph.D. **University of Michigan**, Ph.D. Student in Biomedical Engineering — Aug 2025 – May 2029 (Expected)
- GPA: N/D

M.S. **University of Michigan**, M.S. in Electrical & Computer Engineering — Aug 2023 – May 2025
- GPA: 4.0/4.0

BS **Seoul National University (SNU)**, B.S. in Electrical & Computer Engineering — Mar 2017 - Aug 2023
- GPA: 3.87/4.3 (Cumulative), 3.92/4.3 (Major)
- 2 years military leave of absence

Research Experience

Image-Guided Medical Robotics Lab, Graduate Student Research Assistant — Ann Arbor, MI
(Advisor: Xueding Wang) — Aug 2024 – Present

- Designed a medical robotic system integrating ultrasound (US) and photoacoustic (PA) imaging to scan the proximal interphalangeal (PIP) joint for rheumatoid arthritis (RA) detection using an arc-shaped trajectory.
- Developed real-time firmware enabling frame acquisition, robotic control, calibration, and 3D image reconstruction.
- Demonstrated functional imaging (Doppler US, PA) equivalence of arc scanning to conventional linear scanning, with enhanced boundary sharpness of bone and skin structures at oblique angles (t-test, $p < 0.001$).

Image-Guided Medical Robotics Lab, Research Assistant — Ann Arbor, MI
(Advisor: Mark Draelos) — Aug 2023 – Present

- Developed a digital interface for a galvanometer controller to enhance optical coherence tomography (OCT) scan quality.
- Implemented real-time bidirectional communication via SPI, SAI, UART, and TIM interfaces of the STM32 evaluation boards.
- Verified resolution equivalence with conventional analog interfaces and demonstrated a twofold improvement in SNR.
- Released software, hardware configurations, and PCB schematics as open-source resources for the research community. **GitHub**

Applied Superconductivity Lab, Research Assistant — Seoul, KR
(Advisor: Seungyong Hahn) — Jun 2021 – Aug 2023

- Designed internal circuitry and mechanical architecture of superconductivity-based electromechanical devices.
- Performed simulations and experimental validation of a no-insulation high-temperature superconductor (NI-HTS)–based magnetohydrodynamic (MHD) ship, the first of its kind worldwide, which achieved a measured propulsion speed of 4 cm/s.
- Proposed and validated use cases for a 10 kW-scale wave energy converter integrating NI-HTS technology, demonstrating mechanical, thermal, and electromagnetic stability through finite element simulations.

Journals

- **Volumetric ultrasound and photoacoustic imaging of inflammatory arthritis in human finger joints via robotic arm powered arc scan,** Kyoungmo Koo*, Xiaorui Peng*, Guangshen Ma, Nada Abdulaziz, David Mills, Aaron Dentinger, Girish Gandikota, Mark Draelos, and Xueding Wang. Under review at *Biomedical Optics Express*, 2025.
- **Photoacoustic Imaging Combined with Robotics: A Review of Current Works,** Xiaorui Peng, Kyoungmo Koo, Guangshen Ma, Mark Draelos, and Xueding Wang. Under review at *Biomedical Optics Express*, 2025.
- **Cost reduction and quality preservation with digital scanner interfaces for optical coherence tomography,** Kyoungmo Koo, Lucia Lee, Morgan McCloud, and Mark Draelos. Under review at *Journal of Biomedical Optics*, 2025.
- **Design, Construction, and Operation of Liquid Nitrogen Cooled MHD Miniature Ship with No-Insulation High Temperature Superconductor Magnet**, Kyoungmo Koo*, Chaemin Im*, Geonyoung Kim, Jaemin Kim, Seungyong Hahn, and Sangjin Lee. Published in *IEEE Transactions on Transportation Electrification*, May 2024. **Paper**

Conferences

- **Enhanced Diagnostic Imaging for Rheumatoid Arthritis in the Finger via Robotic Arc Ultrasound Scanning and 3D Reconstruction,** Kyoungmo Koo*, Xiaorui Peng, Guangshen Ma, Mark Draelos, and Xueding Wang. Under review at *SPIE Photons Plus Ultrasound: Imaging and Sensing 2026*.
- **High-speed Robotic Ultrasound Scanning for Finger Joint Examination,** Guangshen Ma, Kyoungmo Koo, Xiaorui Peng, Mark Draelos, and Xueding Wang. Under review at *SPIE Photons Plus Ultrasound: Imaging and Sensing 2026*.
- **Reducing cost but not quality with digital scanner interfaces for optical coherence tomography,** Kyoungmo Koo, Lucia Lee, Morgan McCloud, and Mark Draelos. Published in *SPIE Proceedings Volume 13305, Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XXIX*, 2025. **Paper & Presentation**

Work Experiences

BorgWarner Inc. Kokomo, IN
Embedded System Intern, e-Hardware Architecture Team May 2024 - Aug 2024

- Developed user interfaces (UIs) utilizing a keypad and OLED display connected to an FPGA board via the SPI bus.
- Integrated functional blocks and enabled digital signal processing using Verilog / VHDL in the Vivado environment.
- Designed a circuit prototype and PCB to optimize signal performance for users.

Nrise Inc. Seoul, KR
Data Analyst Intern, Project Manager Jan 2021 - Feb 2021

- Optimized push message notifications by conducting user segmentation and customizing tailored messages.
- Identified effective buzzwords on notifications by analyzing user click-rate using SQL and Python.

Diveroid Inc. Seoul, KR
Data Analyst Intern Oct 2020 - Jan 2021

- Developed a data-driven marketing strategy to optimize targeted advertising across various social media platforms
- Analyzed ad click-through rates to identify patterns of users and evaluated the marketing strategy's effectiveness

Leadership Experiences

Korean Student Association - Graduate (KSAG) Ann Arbor, MI
President (May 2024 - Aug 2025), Board Member (Aug 2023 - May 2024) Aug 2023 - Aug 2025

- Led an official student-run group under the University of Michigan of 10 board members to organize networking events.
- Assisted 150+ incoming graduate students in adapting to a new environment and fostering socialization.
- Organized career events connecting Korean tech companies with Korean graduate students at the University of Michigan.

Republic of Korea Army (ROKA), Missile Strategic Command Yangpyeong, KR
Sergeant, Satellite Operation Specialist, Communications Squad Leader Aug 2018 - Mar 2020

- Connected the satellite communication systems between front-line missile battalions and the ROK Joint Chiefs of Staff
- Awarded the excellence of leadership for leading a squad to complete a battalion-wide combat training successfully

Teaching Experiences

Growth Hackers Seoul, KR
Fellowship Workshop Head Sep 2020 - Jun 2021

- Conducted an educational program in Seoul National University (SNU) for over 20 selected underclassmen covering fundamental Python concepts and practical data analysis techniques.

Extra-Curricular Experiences

Michigan Autonomous Aerial Vehicles (MAAV) Ann Arbor, MI
Embedded System Team Aug 2023 - Oct 2023

- Participated in the design of an autonomous aerial vehicle for the International Aerial Robotics Competition (IARC)
- Acquired proficiency in microprocessor GPIOs and communication protocols (SPI, UART) utilized in drone

SNU: Silicon Valley Entrepreneurship Fellowship Team Stanford, CA
Fellow Jun 2018 - Aug 2018

- Selected out of 100+ competitive SNU applicant pools to participate in an entrepreneurial fellowship program
- Presented a business model with deep-learning-based automated advertisement design at Stanford University

Technical Skills

Languages: English (Proficient), Korean (Native), Chinese (Limited)

Programming Languages: C, C++, Python, Verilog, VHDL, Java, SQL, HTML/CSS/JavaScript

Used Tools: MATLAB, LTSPICE, COMSOL Multiphysics, HSPICE, PLECS, Simulink, Altium, KiCad, SolidWorks, Amira Avizo

Basic Tools: Microsoft Excel, Microsoft PowerPoint, Microsoft Word, LaTeX