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EDUCATION / TRAINING

Sep. 2003 – Mar. 2010	Stanford University • Ph.D. in Aeronautics and Astronautics	Stanford,CA
Aug. 2001 - May 2003	University of California, Berkeley • M.S. in Mechanical Engineering	Berkeley,CA
Mar. 1998 - Jun. 1998	Korea Navy Officer Candidate School • Naval Officer Commissioned	Jinhae,Korea
Mar. 1996 - Feb. 1998	Seoul National University • M.S. in Naval Architecture and Ocean Engineering	Seoul,Korea
Mar. 1992 - Feb. 1996	Seoul National University • B.S. in Naval Architecture and Ocean Engineering	Seoul,Korea

WORK EXPERIENCE

Mar. 2026 - Present	KAERI School, University of Science and Technology (UST)	Daejeon,Korea
	• Associate Professor, Artificial Intelligence Major	Mar. 2026 - Present
Mar. 2015 - Present	Korea Atomic Energy Research Institute (KAERI)	Daejeon,Korea
	• Principal researcher	Sep. 2019 - Present
	• Senior researcher	Mar. 2015 - Aug. 2019
	• Principal Investigator	
	- IL-based robot motion policies for precision assembly	Apr. 2024 - Present
	- Space Challenge: Mars exploration system	Apr. 2023 - Mar.2025
	- LiDAR-only semantic SLAM for nuclear application	Apr. 2022 - Dec.2023
	- Object classification & pose estimation using scan data	Apr. 2019 - Mar.2022
	• Co-Investigator	
	- Physics-aware AI and XR-based teleop. for extreme env.	May 2026 - Present
	- Robotic manipulator for space operations	Jul. 2024 - Present
	- Emergency response robots for operating nuclear power plants	May 2022 - Present
	- Robotic digital twin for nuclear decommissioning	Apr. 2022 - Dec. 2024
	- Robotic cutting system for nuclear decommissioning	Mar. 2017 - Dec. 2021
	- Small reactor for marine applications	Mar. 2017 - Present
	- Jordan Research Reactor, Kijang Research Reactor	Mar. 2015 - Feb. 2017
Jan. 2013 - Feb. 2015	Georgia Institute of Technology (GIT)	Atlanta,GA
	• Research scientist II of School of Interactive Computing, College of Computing	
	• Lecturer	
	- CS4649/7649 Robot Intelligence – Planning	Fall 2014
	• Project team member and project facilitator	
	- Object-level communication for robot motion generation	Oct. 2013 - Feb. 2015

- DARPA Robotics Challenge — Jan. 2013 - Dec. 2013

Jul. 2009 - Jan. 2013 — Samsung Heavy Industries, Co. Ltd. (SHI) — Daejeon,Korea
- Principal research engineer — Mar. 2012 - Jan. 2013
- Senior research engineer — Jul. 2009 - Feb. 2012
- Principal Investigator
  - Distributed embedded robot controller — Dec. 2011 - Oct. 2012
- Principal Investigator
  - Teleoperation robot for offshore platform O&M — Aug. 2011- Oct. 2012
- Co-Investigator
  - Wire-driven parallel robot mechanism — Jul. 2009 - Jul. 2011

Jun. 2007 - Sep. 2007 — Carnegie Mellon University at Silicon Valley (CMU@SV) — Moffett Field,CA
- Summer research assistant
- Project team member
  - Vision-aided autonomous unmanned aerial vehicle landing — Jun. 2007 - Sep. 2007

Jul. 1998 - Jun. 2001 — Korea Naval Academy — Jinhae,Korea
- Teaching instructor of the Department of Naval Architecture and Mechanical Engineering
- Taught undergraduate-level engineering courses.

RESEARCH EXPERIENCE

Mar. 2015 – Present — KAERI
- Physics-aware AI and XR-based teleoperation for extreme env. — May 2026 - Present
  - Role: Co-Investigator
  - Technical contribution as a team member: Technical support for vibration analysis of robotic manipulator in space applications
- Robotic manipulator for space operations — Jul. 2024 - Present
  - Role: Co-Investigator
  - Technical contribution as a team member: Technical support for vibration analysis of robotic manipulator in space applications
- IL-based robot motion policies for precision assembly — Apr. 2024 - Present
  - Role: Principal Investigator
  - Technical contribution as a team member: Developed teaching interface, robot skill refinement framework using numerical optimization, natural language interface for agentic AI system
- SPACE Challenge: Mars exploration system — Apr. 2023 - Mar. 2025
  - Role: Principal Investigator
  - Technical contribution as a team member: Developed vision-based drone detection and Tracking system
- LiDAR-only semantic SLAM for nuclear application — Apr. 2022 - Dec. 2023
  - Role: Principal Investigator
  - Technical contribution as a team member: Developed LiDAR only SLAM, object classification & pose estimation AI models
- Robotic digital twin for nuclear decommissioning — Apr. 2022 - Dec. 2024
  - Role: Co-Investigator
  - Technical contribution as a team member: Developed AI models for anomaly detection in underwater laser cutting
- Emergency response robots for operating nuclear power plants — Mar. 2022 - Present
  - Role: Co-Investigator
  - Technical contribution as a team member: Developed the stairway detection and parameter estimation algorithm, using point cloud.
- Object classification & pose estimation using scan data — Apr. 2019 - Mar.2022
  - Role: Principal Investigator

- Technical contribution as a team member: Defined & formulated deep learning problems for object classification, segmentation and pose estimation using partial view scan data. Developed the scanner simulator for synthetic laser scan data generation. Developed the adaptive ICP-based matching algorithm for object pose fine-tuning.

• Robotic cutting system for nuclear decommissioning Mar. 2017 - Dec. 2021
- Role: Co-Investigator
- Technical contribution as a team member: Developed the deep-learning-based object classification and segmentation system using underwater scan data. Developed the deep-learning-based underwater scan data distortion correction system. Developed the deep-learning-based kinematic calibration system for hydraulic multi-joint serial link robot.

• Small reactor for marine applications Apr. 2017 - Dec. 2023
- Role: Co-Investigator
- Technical contribution as a team member: Developed simulators for testing advanced reactor power control logics. Performed controller parameter tuning.

• Jordan Research Reactor(JRR), Kijang Research Reactor(KJRR) Mar. 2017 - Dec. 2021
- Role: Co-Investigator
- Technical contribution as a team member: Wrote design specifications and documents for JRR/KJRR nuclear measurement systems. Performed factory acceptance tests for JRR nuclear measurement systems. Performed nuclear power calibration tests for JRR.

Jan. 2013 – Feb. 2015 Humanoid Robotics Laboratory, GIT

• Object-level communication for robot motion generation Oct. 2013 - Feb. 2015
- Role: Co-Investigator
- Technical contribution as a team member: Designed the combinatory categorial grammar and corpus for human-robot interaction in object manipulation scenarios.
- Contribution as a project facilitator: Helped PI to achieve interim milestones and deliver deliverables on time and to proper specification. Participated progress review meetings on behalf of PI.

• DARPA Robotics Challenge Jan. 2013 - Dec. 2013
- Role: Co-Investigator and project facilitator
- Technical contribution as a team member: Designed and tested impedance controllers for object manipulation
- Contribution as a project facilitator: Helped the GIT team working on DRC project to achieve interim milestones and deliver deliverables on time and to proper specification, handling logistics and staffing issues.

Jul. 2009 - Jan. 2013 Center for Mechatronics, SHI

• Distributed embedded robot controller Dec. 2011 - Oct. 2012
- Role: Principal Investigator
- Technical contribution as a team member: Designed the combinatory categorial grammar and corpus for human-robot interaction in object manipulation scenarios.

Sep. 2003 – Jun. 2009 Aerospace Robotics Laboratory, Stanford University

• Research topic: Stochastic nonlinear optimal control approach to navigation and mapping for unmanned vehicles with vision aided inertial navigation system.
• Contribution: Nonlinear stochastic optimal control, Simultaneous localization and Mapping with on-line filtering approaches.
• Acquired experience in building unmanned aerial vehicles and rovers.

Jun. 2007 – Sep. 2007 Carnegie Mellon Innovations Laboratory, CMU@SV

• Research topic: Autonomous landing using vision-aided inertial navigation system.
• Contribution: Sensor fusion algorithm using extended Kalman Filtering, vision system for object detection using optical flow.

- Acquired experience in inertial navigation system, GPS, and vision system.

Aug. 2001 - May 2003 Vehicle Dynamics Laboratory, University of California, Berkeley
- Research topic: Coordination layer design and implementation for automatic highway system.
- Contribution: Optimal truck merging algorithm using mathematical programming.

Jan. 2000 - Dec. 2000 Naval Institute for Ocean Research Korea Naval Academy
- Research topic: Motion characteristic analysis and maximum hitting probability of underwater guidance weapons.
- Contribution: Analysis on equations of motion of underwater guidance weapons.

Mar. 1996 - Feb. 1998 Ocean Engineering Lab Seoul National University
- Research topic: Dynamic positioning system of floating offshore vessels.
- Contribution: Design linear optimal controllers for dynamic positioning systems.

PROFESSIONAL ACTIVITIES/SERVICES

2023 - 2024	IAEA Decommissioning Technical Meetings Committee (NET4D Project)
2022 - Present	NVIDIA Deep Learning Institute (DLI), Jetson AI Ambassador
2021 - Present	Member of Korea Robotics Society
2021 - 2023	Executive Committee, Robotics and Remote Systems Division, American Nuclear Society
2017 - Present	Member of American Nuclear Society
2017 - Present	Member of Korean Radioactive Waste Society
2015 - Present	Member of Korean Nuclear Society
2013 - 2014	Program Committee/Associate Editor, IEEE/RAS Humanoids 2014 Conference
2009 - Present	Member of Institute of Control, Robotics and Systems
2002 - Present	Member of Institute of Electrical and Electronics Engineers

JOURNAL PUBLICATIONS (Recent work only)

[1] Ikjune Kim, Jonhwan Lee, Dongjun Hyun, Sungmoon Joo, S. and Jaehyun Ha, "Error detection in underwater laser cutting for nuclear facility dismantlement using hydrophone and AI techniques," *Annals of Nuclear Energy*, Vol. 222, 111590, 2025

[2] Sungmoon Joo, "Toward Robotic Nuclear Decommissioning: Deep Learning-based Object Classification and Pose Estimation from Partial-View Scans," *Nuclear Science and Engineering,* Vol. 199. pp.1325-1336, Aug. 2025.

[3] Dongjun Hyun, Ikjune Kim, Sungmoon Joo, Jaehyun Ha, and Jongwhan Lee, "Remote Dismantling System using a Digital Manufacturing System and Workpiece Localization for Nuclear Facility Decommissioning," *Annals of Nuclear Energy*, Vol. 195, 110182, 2024.

[4] Sungmoon Joo, Hogeon Seo, and Yonggyun Yu, "Unsupervised Domain Adaptation for Classification of Imbalanced Time Series Data," *Journal of the Korean Society for Nondestructive Testing*, Vol. 43 (6), pp. 458-467, 2023.

[5] Dongjun Hyun, Ikjune Kim, Sungmoon Joo, and Jongwhan Lee, "3D Point Cloud Acquisition and Correction in Radioactive and Underwater Environments using Industrial 3D scanners," *Sensors*, Vol. 22 (23), 9053, 2022.

[6] Hogeon Seo, Sungmoon Joo, "Characteristic Analysis of Data Preprocessing for 3D Point Cloud Classification based on a Deep Neural Network: PointNet," *Journal of the Korean Society for Nondestructive Testing*, Vol. 41 (1), pp. 19-24, 2021.

CONFERENCE & WORKSHOP PRESENTATIONS (Recent work only)

[1] Sungmoon Joo and Ikjune Kim, "Hybrid Agentic AI Framework for Reliable Execution of Instruction-based Assembly Tasks," 21st Korea Robotics Society Annual Conference, Feb. 2026.

[2] Sungmoon Joo et al., "Learning Precise Robot Assembly Tasks from Human Demonstrations," 25th International Conference on Control, Automation and Systems, Nov. 2025.

[3] Sungmoon Joo and Dongseok Ryu, "Robust and Accurate Stair Geometry Extraction Using Point Cloud," Transactions of the Korean Nuclear Society Autumn Meeting, Oct. 2025.

[4] Sungmoo Joo et al., "Acoustic Representation Learning: A β-VAE Approach for Anomaly Detection in Underwater Robotic Laser Cutting," ICRA 2025 Workshop on Acoustic Sensing and Representations for Robotics, May 2025.

[5] Sungmoon Joo et al., "Learning Precise Robot Motion from Demonstration with Constraint-aware Refinement," 2025 IEEE International Conference on Robotics and Automation (Poster Session), May 2025.

[6] Sungmoon Joo et al., "Robot Motion Generation based on Motion and Vision Data for Precision Assembly Task," Spring Meeting of Korea Society of Mechanical Engineers on Dynamics, Controls, and Robotics, Apr. 2025.

[7] Sungmoon Joo and Dongseok Ryu, "LiDAR-based Staircase Detection for Autonomous Nuclear Emergency Response Robots," International Symposium on Future I&C for Nuclear Power Plants, Dec. 2024.

[8] Sungmoon Joo et al., "Conceptual Design of a Rover for a Multi-Vehicle Wide Area Mars Exploration System," International Symposium on Artificial Intelligence, Robotics and Automation in Space, Nov. 2024.

[9] Sungmoon Joo et al., "Underwater Cutting Status Monitoring for Robotic Nuclear Decommissioning System," American Nuclear Society Meeting on Decommissioning, Environmental Science and Remote Technology 2024, Nov. 2024.

[10] Lee Jongwhan et al., "Underwater Laser Cutting Process Monitoring Method," Korea Society of Radioactive Waste Autumn Meeting, Oct. 2024.

[11] Kim Ikjune et al., "Remote Monitoring Methodology for Underwater Laser Cutting in Nuclear Facility Dismantlement," Korea Society of Radioactive Waste Autumn Meeting, Oct. 2024.

[12] Sungmoon Joo et al., "Application of Unsupervised Domain Adaptation to Underwater Cutting Status Monitoring for Nuclear Decommissioning," International Topical Workshop on Fukushima-Daiichi Decommissioning Research 2024, Oct. 2024.

[13] Kim Ikjune et al., "Gazebo Physical Simulation of a Track based Multi-Purpose Rover," 39th Annual Meeting of Institute of Control, Robotics and Systems, Jul. 2024.

[14] Sungmoo Joo et al., "Robotic Dismantling for Nuclear Decommissioning," ICRA 2024 Workshop on Robotics for Nuclear Environments, May 2024.

[15] Sungmoon Joo and Ikjune Kim, “Analysis of Laser Scanning to 3D Mesh Conversion Methods for Digital Modelling of Nuclear Decommissioning Site,” Korea Society of Radioactive Waste Autumn Meeting, Nov. 2023.

[16] Sungmoon Joo et al., “β-VAE-LSTM Model for Realtime Condition Monitoring with Time Series Data,” 38th Annual Meeting of Institute of Control, Robotics and Systems, Jun. 2023.

[17] Sungmoon Joo et al., “Application of Unsupervised Domain Adaptation for Time Series Data Classification Model Training with Data Imbalance,” 38th Annual Meeting of Institute of Control, Robotics and Systems, Jun. 2023.

[18] Sungmoo Joo, “Telerobotic Manipulation Framework for Hazardous Material Handling in Nuclear Decommissioning,” ICRA 2023 Workshop on Robot Assisted Safe Manipulation of Hazardous Materials, Jun. 2023.

[19] Sungmoon Joo and Dongseok Ryu, “Stairway Detection from Point Cloud Data for Robot Operation in Nuclear Facilities,” Transactions of the Korean Nuclear Society Spring Meeting, May 2023.