

Jaeyoun Choi

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Research Interests

Reinforcement Learning, Soft Robotics, Robot Learning, Locomotion

Education

Massachusetts Institute of Technology

Ph.D. in Mechanical Engineering

Advisor: Professor Pulkit Agrawal & Professor Kevin Chen

Sep. 2024 –

MA, United States

Seoul National University

M.S. in Mechanical Engineering

Advisor: Professor Yong-Lae Park

Mar. 2021 – Feb. 2023

Seoul, Republic of Korea

Seoul National University

B.S. in Mechanical Engineering

Summa Cum Laude

Leave of absence for military service (Dec. 2014 – Nov. 2016)

Mar. 2014 – Aug. 2020

Seoul, Republic of Korea

Publications

- **Choi, J.**, Kim, J., Kim, H., Choi, Y. Y., Kim, J. & Ahn, J. Estimation of Pulmonary Oxygen Uptake (VO₂) and Carbon Dioxide Production (VCO₂) via Deep Learning based on Transfer Learning (In preparation)
- **Choi, J.**, Choi, I., Yoon, S. J., & Park, Y. L. Inertia-Driven Swimming Robot with Agile Maneuvers Inspired by the C-start Motion (In preparation)
- Kim, J. I., **Choi, J. (co-first author)**, Kim, J., Song, J., Park, J., & Park, Y. L. Bilateral Back Extensor Exosuit for multidimensional assistance and prevention of spinal injuries, *Science Robotics*, 9.
- Kim, J. I., **Choi, J. (co-first author)**, Kim, J., & Park, Y. L. (2021). A Twisted Elastic Rotary-Rail Actuator (TERRA) Using a Double-Stranded Helix Structure. *IEEE Robotics and Automation Letters*, 6(4), 7381-7388. **The contents of this paper were also selected by the IROS'21 Program Committee for presentation at the Conference**
- Kwon, J., Park, M., **Choi, J.**, & Park, Y. L. (2021). Pop-up cookie molds: self-folding elastomer sheets using thermal expansion of embedded air chambers. *Smart Materials and Structures*, 30(11), 115013

Presentation

- **Choi, J.**, Kim, J. I., Kim, J., & Park, Y. L. Design and Modeling of a Twisted Elastic Rotary-Rail Actuator (TERRA), IROS 2022, Workshop: Assistive robots in the real world
- **Choi, J.**, Lee, T., Kim, Y., Yun, S. S., Jung, B. K., & Cho, K. J. Development of Soft Wearable Robot for Rehabilitation after Rotator Cuff Reconstruction Surgery, Undergraduate Design Competition, Rehabilitation Engineering and Assistive Technology Society of Korea, November 8, 2019

Research Experience

Improbable AI Lab, Massachusetts Institute of Technology

Sep. 2024 - Present

Advisor: Professor Pulkit Agrawal & Professor Kevin Chen

Development of dielectric elastomer actuator for legged robot.

- Design an cm scale dielectric elastomer actuator suitable for legged robot.
- Simulate and Control the actuator based on reinforcement learning.

Soft Robotics & Bionics Laboratory, Seoul National University

Sep. 2018 – Feb. 2023

Advisor: Professor Yong-Lae Park

Inertia-Driven Swimming Robot with Agile Maneuvers Inspired by the C-start Motion

- Designed an inertia-driven swimming robot mimicking the C-start maneuvers of fish.
- Integrated a LiDAR sensor into the swimming robot, enabling it to recognize and rapidly avoid approaching obstacles.

Soft Ankle Exoskeleton for Multi-Functional Gait Rehabilitation

- Verified the effect of the proposed exoskeleton using the musculoskeletal predictive simulation (SCONE).

Design and Validation of a Spinal Lifting Device: Bilateral Back Extensors Exosuit (BBEX).

- Collaborated with Biomechanics Laboratory (P.I.: Prof. Jaebum Park) at Seoul National University
- Developed a wearable robot that assists various lifting tasks and enhances spinal safety
- Verified the BBEX with human subject experiment and musculoskeletal analysis using OpenSim
- Theoretically analyzed that the BBEX has the potential to reduce risk factors of back injuries.

A Twisted Elastic Rotary-Rail Actuator (TERRA) Using a Double-Stranded Helix Structure

- Designed a linear actuator that has inherent compliance.
- Derived the theoretical model of the developed actuator and analyzed the characteristics of the actuator.

Pop-up cookie molds: self-folding elastomer sheets using thermal expansion of embedded air chambers

- Manufactured the self-folding elastomer sheets by using polymer molding and CNC machining
- Conducted tensile tests and baking experiments to analyze the repeatability of the polymer

Biorobotics Laboratory, Seoul National University

May. 2019 – Jan.2020

Advisor: Professor Kyu-Jin Cho

Development of a Wearable CPM Device for Rehabilitation after Rotator-Cuff Repair Surgery

- Designed a rehabilitation robot consisting of a foldable pneumatic actuator and its anchoring mechanism
- Verified that the robot can conduct shoulder flexion without discomfort

Work Experience

Neumafit Corporation

Mar. 2023 - Present

Chief Technical Officer

Estimation of Pulmonary Oxygen Uptake (VO₂) and Carbon Dioxide Production (VCO₂) via Deep Learning based on Transfer Learning

- Collaborating with Sports Engineering Lab (P.I.: Prof. Joeeun Ahn) at Seoul National University
- Developed deep-learning algorithm based on gated recurrent unit (GRU) for VO₂ and VCO₂ estimation

Patents

- . K.R. 10-2022-0083838, “MULTI-DOF WEARABLE ASSISTANCE DEVICE”, Korea, Patent Pending
- . K.R. 10-2021-0111235, “FORMING MOLD”, Korea, Patent Pending
- . K.R. 1026146220000, “AN ELECTRONIC DEVICE FOR ANALYZING ATHLETIC PERFORMANCE, A METHOD OF OPERATING THE ELECTRONIC DEVICE, AND AN ATHLETIC ANALYSIS SYSTEM INCLUDING THE ELECTRONIC DEVICE”, Korea, Patent Granted
- . K.R. 1024827300000, “Twisted Elastic Rotary-Rail Actuator”, Korea, Patent Granted
- . K.R. 1022234590000, “APPARATUS FOR REHABILITATION”, Korea, Patent Granted

Honors & Awards

- . **Outstanding MS Thesis Paper Award**, Seoul National University Feb. 2023
- . **Outstanding MS Thesis Presentation Award**, Seoul National University Dec. 2022
- . **Summa Cum Laude**, Seoul National University Aug. 2020
- . **Grand Prize**, Undergraduate Design Competition, Rehabilitation Engineering and Assistive Technology Society of Korea Nov. 2019

Scholarships

- . **Kwanjeong Educational Fellowship**, Kwanjeong Educational Foundation 2024 – 2028
- . **Human Resources Development Program Fellowship**, Korea Institute for Advancement of Technology 2021 – 2023
- . **Kwanjeong Educational Fellowship**, Kwanjeong Educational Foundation 2018 – 2020
- . **Merit-based Scholarship**, Seoul National University Spring, 2015
- . **Eminence Scholarship**, Seoul National University Fall, 2014
Fall, 2017

Teaching Experience

- . Teaching Assistant, **Mechanical Product Design**, Seoul National University Spring, 2021
- . Tutor, **Fundamental of Physics 2**, Seoul National University Fall, 2019
- . Tutor, **Fundamental of Physics 1**, Seoul National University Spring, 2019
- . Tutor, **Solid Mechanics**, Seoul National University Spring, 2019

Skills

- . **CAD Design** SolidWorks, Fusion 360
- . **Statistics** R, SPSS
- . **Analysis & Simulation Software** OpenSim, SCONE, Ansys Fluent
- . **Programming Languages** Python, MATLAB, C/C++
- . **Software Libraries** PyTorch, ROS
- . **Laboratory Tools** EMG (Delsys), Laser Cutting, 3D Printing, Motion Capture (Vicon)