

PROFESSIONAL SUMMARY

5+ years of experience in human subject researches. Proven collaborator in inter- and multidisciplinary projects, led to 5+ peer-reviewed publications in engineering and clinical journals. Experience leading early lab and start-up company development, and mentoring professional growth of undergraduate students.

KEY SKILLS

- Human Subject Research • Experimental Design • Biomechanical, Physiological Data Collection & Processing
- Human Motion Analysis • Statistical Modeling • Clustering & Classification • Data Mining • Design Optimization

TECHNICAL SKILLS

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| Programming | C/C++, Python, R, MATLAB |
| Design Tools | Solidworks, CATIA, Solid Edge, EAGLE |
| Engineering Tools | OpenSim, Simulink (real-time), Simscape, Labview, Multisim |
| Experimental Tools | Motion capture, EMG, IMUs, Pressure mats, Loadcells, Force plates, Indirect calorimetry |

EDUCATION

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| PhD in Mechanical Engineering , University of Texas at Austin, Austin, TX | Expected Dec 2022 |
| • Area of Expertise: Post-stroke gait rehabilitation, Motion analysis, Locomotion biomechanics | |
| MS in Mechanical Engineering , Seoul National University, Seoul, KR | 2017 |
| BS in Mechanical Engineering , Hanyang University, Seoul, KR | 2013 |

RESEARCH EXPERIENCE

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|------------------------------------|----------------------------|
| Graduate Research Assistant | Sept 2017 — Present |
| University of Texas at Austin | Austin, TX |

The effects of exoskeletal assistance on human locomotion

- Analyze 10 post-stroke gaits with knee exoskeleton assistance and its simulated muscle mechanics by OpenSim to determine the predictor of a reflex response
- Examine biomechanical effects of exoskeleton's weight distributions by collecting & analyzing 20+ healthy individuals walking data with 10 different conditions mimicking hip exoskeleton

Characterization of post-stroke stiff-knee gait

- Processed 50 post-stroke & 15 healthy individuals' treadmill walking data (e.g., kinematics, kinetics, EMG, GRF)
- Performed feature selection for 35+ gait parameters by applying a generalized linear mixed-effects Lasso regression
- Clustered post-stroke gait by using a multivariate time-series kernel k-means resulting in 3 different phenotypes

Impact of kinematics and kinetics on classification of dual-task gait

- Developed experimental protocol for simulation study with 40 healthy participants, using cognitive-motor dual-task to test the primary hypothesis
- Implemented machine learning classification to differentiate between different gait conditions with above-chance performance

Kinematic comparison of single degree-of-freedom robotic gait trainers

- Optimized designs of 1-DOF mechanisms (e.g., 4-, 6-, and 8-bar) to produce human-like end-effector motion trajectory
- Evaluated optimal linkage configurations for motion trajectory accuracy by a comparison of 100+ healthy individuals gait

Research Assistant**Mar 2017 — July 2017**

Korea Institute of Science and Technology (KIST)

Seoul, KR

Development of a surgical simulator for cranio-maxillofacial reconstructive surgery

- Researched a non-invasive, patient-specific surgical navigation method for an orbital reconstructive surgery, improving registration and tool tracking accuracy by up to 50%

Graduate Research Assistant**Sept 2013 — Aug 2014; Mar 2016 — Feb 2017**

Seoul National University

Seoul, KR

Needle steering scheme within limited DOFs for MR-guided breast needle intervention robot

- Devised a needle steering scheme with a pivoted super-elastic needle made of Nitinol for MR image-guided breast needle intervention robot, improving needle insertion angle and tip movement with zero actuator addition in robot

Prediction of human motion in vehicle ingress/egress using an artificial neural network

- Designed a low-cost (< \$1K) vehicle mock-up with four adjustable parameters for the research to predict human motion in ingress/egress movement
- Recruited & processed 10 healthy subjects of vehicle ingress/egress trials

Research Assistant**Sept 2014 — Feb 2016**

The University of Texas Health Science Center (UTHealth)

Houston, TX

Development of a minimally invasive surgical robot with a continuum manipulator

- Designed a surgical grasper with an outer diameter of less than 3mm using an elastic element
- Developed & prototyped a cable-driven continuum robotic manipulator for a minimally invasive single-port surgery

INTERNSHIPS

System Validation Engineer Intern**May 2019 — Aug 2019**

Harmonic Bionics, Inc.

Austin, TX

- Devised hardware debugging & quality control frameworks for EtherCAT motion controller and sensor interface
- Documented a quality control & experimental log for a design iteration

System Validation Engineer Intern**May 2018 — Aug 2018**

Harmonic Bionics, Inc.

Austin, TX

- Built a C/C++ source code library and tutorials for EtherCAT motion controller and sensor interface to allow users to create their own application solutions
- Designed demonstration kits (e.g., haptics interface) to exhibit at a tech conference

TEACHING EXPERIENCE

Graduate Teaching Assistant**Feb 2018 — May 2021**

University of Texas at Austin

Austin, TX

- Led 21-hours weekly mechatronics laboratory sections and instructed a circuit theory and hands-on circuit building
- Created and graded robot modeling, mechatronics assignments
- Mentored 10+ freshman students to develop a semester-long mechanical engineering research project

SELECTED PUBLICATIONS (3 OF 7)

- [1] **J. Lee**, L. Li, S. Y. Shin, A. D. Deshpande, and J. Sulzer, "Kinematic comparison of single degree-of-freedom robotic gait trainers," *Mechanism and Machine Theory*, vol. 159, p. 104 258, 2021.
- [2] **J. Lee**, S. Y. Shin, G. Ghorpade, T. Akbas, and J. Sulzer, "Sensitivity comparison of inertial to optical motion capture during gait: Implications for tracking recovery," in *2019 IEEE 16th International Conference on Rehabilitation Robotics (ICORR)*, 2019, pp. 139–144.
- [3] **J. Lee**, K. Mekuria, T. G. Son, W. S. Jeong, J. W. Choi, and Y. Kim, "A novel noninvasive patient-specific navigation method for orbital reconstructive surgery: A phantom study using patient data," *Plastic and reconstructive surgery*, vol. 143, no. 3, 602e–612e, Mar. 2019.