

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

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

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

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 weight distribution 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 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.