

JEONGHWAN 'JAY' LEE

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PROFESSIONAL SUMMARY

- PhD candidate trained in Mechanical Engineering, with 5+ years of experience in human subject research, medical robotics, and biomechanics.
- Proficient in scientific programming, such as machine learning, statistical analysis, kinematics/dynamics analysis, and numerical optimization, using Python, C/C++, R, and MATLAB.
- Skilled in processing and analyzing biomechanical, physiological signals (e.g., motion capture, electromyography, inertial measurement unit, indirect calorimetry).
- Experience in mechatronic system development and validation.
- Experience in leading early lab and start-up company development.

CORE COMPETENCIES

Machine Learning, Statistical Modelling, Data Mining

Experimental Design, Human Locomotion Biomechanics

Design Optimization, System Validation, Kinematics & Dynamics Analysis

PROFESSIONAL EXPERIENCE

The University of Texas at Austin

Austin, TX

Graduate Research Assistant, Walker Department of Mechanical Engineering

Sept 2017 – Present

- Identifying a set of predictors for quadriceps spasticity in post-stroke individuals with a powered knee orthosis through tree-based machine learning algorithms (i.e., Random Forest, Bayesian Additive Regression Trees).
- Discovering three gait phenotypes among 50 post-stroke individuals by time-series kernel k-means clustering.
- Examining the biomechanical effects of exoskeleton's weight distributions via 15 healthy individuals gait data to find optimal design parameters for lower extremity robotic exoskeletons.
- Found impact of using kinematic gait features on supervised machine learning classifications of 40 healthy participants' dual-task gait.
- Determined optimal 1-DOF linkage mechanism configuration to produce human-like end-effector motion trajectory by comparing numerically optimized designs based on gait datasets of 100+ individuals.
- Verified ability of motion capture systems based on inertial measurement units to track small changes in gait kinematics by a comparison of ground truth system, an optical motion capture system.
- Mentored 10+ freshman students to develop a semester-long mechanical engineering research project.

Harmonic Bionics, Inc.

Austin, TX

System Validation Engineer Intern

May 2018 – Aug 2018; May 2019 – Aug 2019

- Invented electronic hardware debugging platform, achieving zero defective rates before shipment.
- Built C/C++ source code library and tutorial applications for EtherCAT motion controller and sensor interfaces.
- Created haptic interface demonstration kits using dual motors to exhibit at a technical conference.

Korea Institute of Science and Technology (KIST)

Seoul, South Korea

Research Assistant, Center of Bionics

Mar 2017 – July 2017

- Tested a non-invasive, patient-specific surgical tool navigation method for an orbital reconstructive surgery that improved registration and tool tracking accuracy by up to 50% with 3D printed phantom model.

Seoul Nation University

Seoul, South Korea

Graduate Research Assistant, Department of Mechanical Engineering

Sept 2013 – Aug 2014; Mar 2016 – Feb 2017

- Devised a needle steering scheme with a pivoted super-elastic Nitinol for MR image-guided breast needle intervention robot, improving needle insertion angle and tip movement with no actuator addition in robot.
- Designed vehicle door and driver's seat mockup for ingress/egress experiment with ten adjustable parameters.

The University of Texas Health Science Center (UTHealth) at Houston

Houston, TX

Research Assistant, Vivian L Smith Department of Neurosurgery

Sept 2014 – Feb 2016

- Designed surgical graspers with an outer diameter of less than 5mm with a passive grasper opening using an elastic element.
- Examined hysteresis of 7-DOFs dual-segmented continuum robotic manipulator by motorized testbed.
- Prototyped 7-DOFs cable-driven continuum robotic manipulator for single-port surgery.

EXTRACURRICULAR EXPERIENCE

Korean Student Association at the University of Texas at Austin

Austin, TX

Graduate Student Representative of Department of Mechanical Engineering

Sept 2020 – Aug 2021

- Managed semi-annual events of Korean graduate student association
- Coordinated campus recruiting events served by industries headquartered in South Korea.

8th Fighter Wing, Republic of Korea Air Force

Wonju, South Korea

Executive Officer

Sept 2006 – Nov 2008

- Principally responsible for the crew's paychecks and the expenditure logs of the training.

EDUCATION

University of Texas at Austin

Austin, TX

PhD candidate, Mechanical Engineering

Expected Dec 2022

*Dissertation: Approaches in optimization and machine learning towards post-stroke gait***Seoul National University**

Seoul, South Korea

MS, Mechanical Engineering

Feb 2017

*Thesis: Needle steering scheme within limited DOFs for MR-guided breast needle intervention robot***Hanyang University**

Seoul, South Korea

BS, Mechanical Engineering

Feb 2013

TECHNICAL SKILLS

Programming: Proficient in Python, C/C++, R, MATLAB**CAD & EAD:** Proficient in Solidworks, Experience in CATIA, EAGLE**Simulation:** Proficient in OpenSim, Simulink real-time, Experience in Simscape, Labview, Multisim**Language:** English (Fluent), Korean (Native)**SELECTED PUBLICATION (3 OF 7)**

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.

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.

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.