

# JEONGHWAN 'JAY' LEE

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## PROFESSIONAL SUMMARY

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- PhD candidate trained in Mechanical Engineering, with 5+ years of experience in medical robotics, biomechanics, and human subject research.
- 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

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**Machine Learning, Statistical Modelling, Data Mining**

**Wearable Robotics, Experimental Design, Human Locomotion Biomechanics**

**Design Optimization, System Validation, Kinematics & Dynamics Analysis**

## PROFESSIONAL EXPERIENCE

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### The University of Texas at Austin

Austin, TX

Graduate Research Assistant, Walker Department of Mechanical Engineering

Sept 2017 – Present

- Identified kinematic predictors for post-stroke quadriceps spasticity as control parameters of wearable exoskeleton robots by machine learning regression techniques (i.e., LASSO, Bayesian Additive Regression Trees).
- Differentiated and characterized three distinct post-stroke gait patterns among 50 post-stroke individuals by time-series kernel k-means clustering.
- Examined 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**

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**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.

**8<sup>th</sup> 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**

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**University of Texas at Austin**

Austin, TX

PhD candidate, Mechanical Engineering

**Expected graduation: Aug 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**

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**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)**

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**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.