

# Hun Chan (Bryan) Lee

Boston, MA | [hunchanl.github.io](https://hunchanl.github.io) | [Google Scholar](#) | [hclee94@bu.edu](mailto:hclee94@bu.edu)

## RESEARCH INTEREST

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- Design, fabrication, and optimization of soft actuators and sensors for advanced soft robotic systems.
- System modeling and control for soft robotic systems
- Developing and integrating soft optics / visual sensors into the soft robotic platforms

## EDUCATION

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### Boston University

Ph.D. Candidate, Mechanical Engineering

*Advisor: Prof. Sheila Russo*

**Boston, MA**

Sept. 2021 ~ Present

### Purdue University

Master of Science, Mechanical Engineering

*Advisor: Prof. Raymond Cipra*

**West Lafayette, IN**

Aug. 2016 ~ Aug. 2018

*GPA: 3.81 / 4.00*

### Purdue University

Bachelor of Science, Mechanical Engineering

*(Highest Distinction)*

**West Lafayette, IN**

Aug. 2012 ~ May. 2016

*GPA: 3.96 / 4.00*

## RESEARCH EXPERIENCE

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### Material Robotics Lab, Boston University

*Advisor: Prof. Sheila Russo*

*Sept. 2021 – Present*

- Developed and optimized a monolithic layer-by-layer fabrication process for soft-rigid hybrid robots, achieving seamless system integration of a soft actuator, an ionic resistive sensor, and a rigid-flexible mechanical controller. [J1]
- Designed and prototyped an innovative Miura-ori pattern-inspired soft retractor with capacitive sensor for neurosurgical applications, enhancing precision and adaptability in surgical procedures. [C1, C2]
- Leading a team of four people to develop an autonomous soft-rigid hybrid robotic system for laser-assisted surgery, incorporating optical proprioceptive sensors interpreted using machine learning. [Work in progress]

### Cipra Lab, Purdue University

*Advisor: Prof. Raymond Cipra*

*Aug. 2016 – Aug. 2018*

- Developed and optimized the design of a wearable, 3-D printed prosthetic hand with compliant joints, leveraging rapid prototyping techniques. [J5]
- Utilized MATLAB image processing techniques to analyze the motion of the prosthetic hand [J5]

### Vlachos Research Group, Purdue University

*Advisor: Prof. Pavlos Vlachos*

*Jan. 2015 – May. 2016*

- Constructed and optimized a realistic circulation loop and compliance chamber model, accurately replicating the intricate blood flow patterns in cerebral aneurysms

## WORK EXPERIENCE

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### IntheSmart Co., Ltd.

*Research and Design Team Member*

**Seoul, South Korea**

*Aug. 2018 – Aug. 2021*

- Shadowed over 150 preclinical and clinical trial cases across various general surgery divisions and directly worked with clinicians to gather and incorporate their feedback to refine surgical imaging systems.
- Developed and integrated a YOLOv5 object detection machine learning model into a handheld RGB and NIR dual-imaging system, enhancing parathyroid gland (PG) identification rates and viability diagnostic accuracy. [J3, J4]
- Led the research and development of hardware for the Laser Speckle Contrast Imaging (LSCI) system, a laser-based blood flow meter and acquired Korean Good Manufacturing Practice (K-GMP) certification for the system. [P1, J4, C3]
- Developed and implemented over 20 experimental protocols and designed electro-mechanical testing system instruments to improve the functionality of fluorescence laparoscopy systems that integrate RGB and NIR imaging.

## PUBLICATIONS (J: Journal Article, C: Conference Proceeding, P: Patent, \*Equally Contributed)

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### JOURNAL ARTICLES

- J1. Lee, H.C.,** Elder, N., Leal, M., Stantial, S., Vergara Martinez, E., Jos, S., Cho, H. and Russo, S., 2024. A fabrication strategy for millimeter-scale, self-sensing soft-rigid hybrid robots. *Nature Communications*, 15(1), p.8456.

- J2. Lee, H.C.,** Pacheco, N.E., Fichera, L. and Russo, S., 2022. When the end effector is a laser: A review of robotics in laser surgery. *Advanced Intelligent Systems*, 4(10), p.2200130.
- J3. Kim, Y., Lee\*, H.C., Kim\*, J., Oh\*, E., Yoo, J., Ning, B., Lee, S.Y., Ali, K.M., Tufano, R.P., Russell, J.O. and Cha, J.,** 2022. A coaxial excitation, dual-red-green-blue/near-infrared paired imaging system toward computer-aided detection of parathyroid glands in situ and ex vivo. *Journal of Biophotonics*, 15(8), p.e202200008.
- J4. Oh, E., Lee, H.C., Kim, Y., Ning, B., Lee, S.Y., Cha, J. and Kim, W.W.,** 2022. A pilot feasibility study to assess vascularity and perfusion of parathyroid glands using a portable hand-held imager. *Lasers in Surgery and Medicine*, 54(3), pp.399-406. **\*Cover Article\***
- J5. Lee, H.C. and Cipra, R.,** 2020. Design of a Novel Locking Ratcheting Mechanism for a Body-Powered Underactuated Hand. *Journal of Medical Devices*, 14(1), p.011101.

#### CONFERENCE PROCEEDINGS

- C1. Van Lewen D., Wang C., Lee H.C., Devaiah A., Upadhyay U., and Russo S.,** 2024. Monitoring Forces in Soft Robotic Brain Retraction via Origami Sensing Modules. *The Hamlyn Symposium on Medical Robotics*
- C2. Van Lewen, D., Wang, C., Lee, H.C., Devaiah, A., Upadhyay, U. and Russo, S.,** 2024, May. Capacitive Origami Sensing Modules for Measuring Force in a Neurosurgical, Soft Robotic Retractor. In *2024 IEEE International Conference on Robotics and Automation (ICRA)* (pp. 5302-5308). IEEE.
- C3. Bhrugubanda, S., Lee, H.C., Kifle, N., Kim, Y. and Cha, J.,** 2023, March. Multi-directional adjustable two-camera housing module for medical applications. In *Design and Quality for Biomedical Technologies XVI* (Vol. 12370, p. 1237002). SPIE.

#### PATENT

- PI. Jaepyeong, Cha. and Lee, H.C.,** Optosurgical LLC, 2023. Method and apparatus for biometric tissue imaging. **U.S. Patent Application** 17/854,084.

#### TEACHING EXPERIENCE

##### *Teaching Assistant*

##### **Electromechanical Design**

*Sept. 2022 -Dec. 2022*

- Assisted the electromechanical system design lab sessions (Topics: Arduino, electromechanical system design)

##### **Machine Design**

*Jan. – May 2017 & Jan. – May 2018*

- Instructed the machine design lab sessions (Topics: the kinetics and kinematics of machine, the stress analysis of machine components)

##### **Mechanical Engineering Design, Innovation, and Entrepreneurship**

*Aug. – Dec. 2016 & Aug. – Dec. 2017*

- Instructed the design lab session and guided in applying engineering principles to open-ended problems.

##### **Conference Presentations**

- A Monolithic Fabrication Strategy for Millimeter-Scale, Self-Sensing Actuators, Oral Presentation at *Materials Research Society (MRS)*, San Francisco, CA, April 25-27, 2023
- A Monolithic Fabrication Method for Proprioceptive Soft-Foldable Robots, Oral Presentation at *Society of Engineering Science (SES)*, Minneapolis, MN, October 8-11, 2023

##### **Honors and Awards**

- Distinguished Mechanical Engineering Fellowship *2021*
- Dean's List *2012-2016*
- Semester Honor *2012-2016*
- EPICS AMD Design Award *2014*
- School of Mechanical Engineering Scholarship *2013*

##### **Technical Skills**

- 3D Modeling:** SOLIDWORKS, CATIA
- Simulation:** Abaqus
- PCB Designing:** Altium
- Programming:** Python, MATLAB, C, ROS / MicroROS, TensorFlow