Haena-Young Lee

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EDUCATION

Cornell University, Ithaca, NY
Master of Engineering, Dept of Mechanical Engineering (early admit) May 2021
Coursework: Fluid Mechanics, Computational Fluid Dynamics, Machine Learning, Product Design, Management
Research project title: Developing a long short-term memory algorithm to predict simulated thrombosis behavior

Cornell University, Ithaca, NY
Bachelor of Science, Dept of Mechanical Engineering May 2020

RESEARCH & WORK EXPERIENCE

Research Engineer II Apr 2021 - Jun 2024
Dept of Biomechanics, Hospital for Special Surgery | New York City, NY

- Supervisors: Timothy Wright, Ph.D., Peter Sculco, M.D.
- **Managed 6 innovative research projects** totaling over $273k in funding, collaborating closely with physicians and industry experts to translate clinical problems into engineering solutions.
- **Developed the first computational finite element model** of patient-specific flanged acetabular components (i.e., hip implants) to guide optimal treatment and classification of complex bone defects in revision total hip arthroplasties.
    - Performed retrieval analysis, CT image reconstructions, highly complex CAD modeling, finite element analysis, post-processing with scripts, technical writing, and presentations.
- Designed and executed **4 cadaveric studies** investigating treatment of periprosthetic femoral fractures.
    - Performed specimen preparation, additive and subtractive manufacturing, mechanical design and testing, motion capture, data analysis, technical writing, and presentations.
- Assisted with protocol development, data collection, and data analysis of colleagues' projects.

Graduate Student Researcher Jun 2020 - Apr 2021
Micro/Nanofluidics Laboratory, Cornell University | Ithaca, NY

- Advisor: Brian Kirby, Ph.D.
- Conducted in-depth literature review of popular deep learning frameworks for time series analyses in biomedical problems (e.g., DFFNN, CNN, RNN, hybrid) and, as the sole student researcher in ML, presented at didactic lab meetings to enhance team understanding of ML fundamentals.
- Developed a **deep learning neural network** with TensorFlow in Python and Jupyter Notebook for particle tracking of blood clots (i.e., ellipses) in MATLAB videos of simulated thrombosis.
    - Trained the LSTM RNN on a self-built computer with an NVIDIA RTX 2070 GPU.
    - Achieved root mean squared percentage errors < 10%.

Software Electronics Engineering Summer Games Intern (Accepted)
Booz Allen Hamilton | Westborough, MA Jun 2020 - Aug 2020

- Internship offer accepted. Program cancelled due to COVID-19.

Engineering and Project Management Intern Jun 2019 - Aug 2019
HNTB Corporation | Washington, D.C.

- Supported task order management for a $10 billion contract by maintaining project documentation and assisting the creation of data visualization dashboards presented at executive briefings.
- Improved project management efficiency by developing detailed Standard Operating Procedures and redesigning project management forms with colleague feedback for enhanced usability.

Online Tutor Dec 2018 - 2019
MAST Education | Hong Kong

- Tutored students in AP CS A/AP CS Principles.

Private Tutor Jun 2015 - Apr 2021
Freelance

- Tutored students in mathematics, physics, English, reading/writing, history, SAT, CS, CAD, violin. Ran book clubs, "journal" clubs, and group coding classes for middle school students.

REFEREED JOURNAL PUBLICATIONS

Lee H-Y, Boettner F, Blevins JL, et al. Hip joint center lateralization minimally affects the biomechanics of patient-specific flanged acetabular components: a computational model. *J Orthop Res*. 2024;1-9. doi: 10.1002/jor.25864.

Xiang W, Tarity TD, Gkiatas I, **Lee H-Y**, et al. Prophylactic cable prevents tapered titanium stem subsidence with 2 cm of stem-cortical engagement in a cadaveric model. *Bone Jt Open*. 2023;4(7):472-477. doi: 10.1302/2633-1462.47.BJO-2023-0041.R1. *Was also an e-poster at the American Association of Hip and Knee Surgeons 2021 Annual Meeting.*

PAPERS IN PROGRESS

Lee H-Y, Boettner F, Blevins JL, et al. Finite element model of patient-specific flanged acetabular components highlights biomechanical effects of bone density and cortical shell thickness. *Revision submitted 11/7/24, currently under review at the Journal of Orthopaedic Research.*

Bornes T, Anatone AJ, **Lee H-Y**, et al. Number of Cerclage Cables Matters: Stability of Titanium Tapered Stems in a Biomechanical Model of Peri-Isthmic Periprosthetic Femoral Fractures. *With PI for revision.*

Flevas D, Anatone AJ, Sokrab R, **Lee H-Y**, et al. Polymer-Based Cerclage Cables are Equivalent to Stainless Steel Cables in the Management of Peri-isthmic Periprosthetic Femur Fracture: A Biomechanical Comparison. *With PI for revision.*

CONFERENCE PROCEEDINGS & PRESENTATIONS

Lee H-Y, Boettner F, Blevins JL, et al. Finite element model of patient-specific flanged acetabular components highlights biomechanical effects of bone density and cortical shell thickness. Paper presented at: ISTA. Proceedings of the 35th International Society for Technology in Arthroplasty; 2024 Aug 28-31; Nashville, TN. *Abstract found here, pg. 117.*

Zigan C, Helbock R, **Lee H-Y**, et al. The Location of Periprosthetic Femoral Fracture Corresponds to Areas of High Strain: A Finite Element and Cadaveric Experimental Study. Paper presented at: ISTA. Proceedings of the 35th International Society for Technology in Arthroplasty; 2024 Aug 28-31; Nashville, TN. *Abstract found here, pg. 110.*

Lee H-Y, Hughes AJ, Driscoll DA, et al. Lateralization of Custom Flanged Acetabular Component Does Not Negatively Impact Implant Survivorship. Poster session presented at: ORS. 70th Orthopaedic Research Society; 2024 Feb 2-6; Long Beach, CA. *Twitter (X) post here.*

Lee H-Y, Boettner F, Blevins JL, et al. Finite element model of custom flange acetabular components provides biomechanical insight into the risks of hip joint center lateralization. Paper presented at: ISTA. Proceedings of the 33rd International Society for Technology in Arthroplasty; 2022 Aug 31-Sept 3; Maui, HI. *Abstract found here, #7779.*

Bornes T, **Lee H-Y**, Anderson C, et al. How Does Number of Cerclage Cables Impact Titanium Tapered Stem Stability in Periprosthetic Femoral Fracture: A Biomechanical Cadaveric Study. Paper presented at: ISTA. Proceedings of the 33rd International Society for Technology in Arthroplasty; 2022 Aug 31-Sept 3; Maui, HI. *Abstract found here, #7708.* Poster session presented at: AAOS. 90th American Academy of Orthopaedic Surgeons; 2023 Mar 7-11; Las Vegas, NV. *Poster and abstract are here.*

CERTIFICATES

Machine Learning Stanford University & Coursera
Andrew Ng, Ph.D., Computer Science Department at Stanford University

Introduction to TensorFlow for AI, ML, and DL DeepLearning.AI & Coursera
Laurence Moroney, AI Lead at Google

Convolutional Neural Networks in TensorFlow DeepLearning.AI & Coursera
Laurence Moroney, AI Lead at Google

Sequences, Time Series and Prediction DeepLearning.AI & Coursera
Laurence Moroney, AI Lead at Google

SKILLS & HONORS

Technical:

- CAD (Geomagic Design X, Autodesk Fusion 360, Creo, SolidWorks)
- FEA, CFD (Abaqus, ANSYS)
- Computational modeling
- Machine learning frameworks (TensorFlow, PyTorch) and CUDA programming
- Data analysis & visualization
- Mechanical design and testing (Cortex motion capture, Digital Image Correlation system (DICS), Materials Test Systems (MTS) machines. Basic machine shop and manufacturing knowledge.)
- Medical imaging & processing (Materialise Mimics, PACS (Sectra IDS7), ImageJ)
- Programming (C/C++, Java, Linux/Unix, MATLAB, Python. Basic HTML/CSS, Xcode and Swift for iOS, shell scripting in Linux.)
- Computer hardware assembly and software installation (Windows, Linux (Ubuntu))
- Project management (ClickUp, Monday.com, MS Office Suite)

Languages: English (fluent), Korean (fluent)

Honors:

- Fall 2019 Dean's List, Cornell University
- 2017 Susan H. Murphy Sorority & Fraternity Life Awards: Outstanding New Member, Cornell University
- 2017 Kappa Phi Lambda Iota Chapter Sister of the Year, Cornell University

EXTRACURRICULARS & SERVICE

Author Jun 2016 - Jul 2018

- Wrote and published *The Blair Book: An insider's guide to Montgomery Blair High School's Magnet program and the college application process*, a 92-page narrative about the education system and

experience in Maryland and the college admissions process. Available as an Apple iBook, Amazon Kindle, and Amazon paperback.

- Wrote, edited, published, and printed several editions of *ASME Mechanicus* as Newsletter Editor of the Cornell chapter of the American Society of Mechanical Engineers.

Tutor, Mentor, & Teacher Jun 2015 - Aug 2021

- Tutored ~20 students throughout ~6 years in CS, mathematics, English, reading/writing, history, SAT, and violin.
- Mentored a student on her data science project for 2 months with Data Science for Social Good.
- Won a $3000 National Center for Women and Information Technology (NCWIT) grant to develop my 2 week summer program, Girls Got IT!, to teach and mentor 16 girls (grades 3-8) in an underserved community about coding with Scratch and women in technology.
- Created a peer tutoring music program, Project TEMP[O], to direct resources (i.e., peer tutors and supply donations) to help students practice music; recognized by the National Association for Music Education as an official service project idea.

Student Activist & Volunteer

- Attended the Northeast Greek Leadership Association (NGLA) conference and afterwards, created and executed initiatives within my sorority to strengthen morale. Also attended the Korean American Grassroots Conference, University (KAGC U) two times.
- Collaborated with two students to plan and execute “Greeks Give Back,” a full day of 781 students engaging in service for the local Ithaca community. Created a new tier system of points and “menus” of upcoming service events to encourage philanthropy across all Greek organizations as the VP of University & Community Relations on the Cornell Multicultural Greek Letter Council.
- Planned and executed large events to bring together multicultural Greek organizations to discuss culture and diversity as a Co-Cultural Chair of Kappa Phi Lambda at Cornell.
- Volunteered for child care (3-5 years) for 3 months at The Arc Montgomery County.
- Performed violin solo and in a quartet for the Springhouse of Bethesda senior living community.
- Helped an acquaintance prepare and distribute bags of various food items in Baltimore City.