Laura A. Hallock

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CURRENT APPOINTMENTS

1/2024 – Present **Assistant Professor of Mechanical Engineering**, *University of Utah*.
Principal Investigator, Human–Robot Empowerment Lab (HRELab)

8/2024 – Present **Adjunct Assistant Professor of Physical Medicine & Rehabilitation**, *University of Utah*.

PREVIOUS APPOINTMENTS

11/2021 – 9/2023 **Postdoctoral Researcher in Mechanical Engineering and Applied Mechanics (MEAM)**, *GRASP Laboratory, University of Pennsylvania*.
Advisors: Vijay Kumar, Michelle J. Johnson, & Nadia Figueroa
Topics: *Biomechanical sensing for rehabilitation robotics, physical human–robot collaboration*

EDUCATION

8/2021 **Ph.D. in Electrical Engineering and Computer Science (EECS)**, *University of California, Berkeley*.
Advisor: Ruzena Bajcsy
Cumulative GPA: **3.9** / 4.0
Thesis: *A Systematic Study of the Muscle Force–Deformation Relationship at the Human Elbow: Toward Physiology-Aware Assistive Device Control and Noninvasive Muscle Force Sensing*
Relevant Coursework: *Advanced Robotics, Convex Optimization, Random Processes, Hybrid Systems and Intelligent Control, Linear System Theory, Nonlinear Systems*

6/2015 **S.B. in Electrical Engineering and Computer Science (EECS)**, *Massachusetts Institute of Technology*.
Cumulative GPA: **4.9** / 5.0
Relevant Coursework: *Underactuated Robotics*, Robotics: Science and Systems, Machine Learning, Circuits and Electronics, Advances in Computer Vision*, Geometric Folding Algorithms*, Computer Systems Security** (*graduate-level course)

CURRENT RESEARCH

I am the PI of the Human–Robot Empowerment Lab (HRELab) at the University of Utah, where I work to build more effective assistive and rehabilitative robots. In particular, our work leverages multiple sensing modalities (including ultrasound, surface electromyography, and motion capture) to better evaluate human capability and intent, enabling safer, more intuitive, and more personalized physical human–robot interactions.

PUBLICATIONS

REFEREED JOURNAL / CONFERENCE PUBLICATIONS

[1] **Laura Hallock**, Bhavna Sud, Chris Mitchell, Eric Hu, Fayyaz Ahamed, Akash Velu, Amanda Schwartz, and Ruzena Bajcsy, "Toward real-time muscle force inference and device control via optical-flow-tracked muscle deformation," *IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE)*, pp. 2625–2634, 2021.

[2] **Laura Hallock**, Akash Velu, Amanda Schwartz, and Ruzena Bajcsy, "Muscle deformation correlates with output force during isometric contraction," in *IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)*. IEEE, 2020, pp. 1188–1195.

[3] Yonatan Nozik*, **Laura Hallock***, Daniel Ho, Sai Mandava, Chris Mitchell, Thomas Hui Li, and Ruzena Bajcsy, "OpenArm 2.0: Automated segmentation of 3D tissue structures for multi-subject study of muscle deformation dynamics," in *International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*. IEEE, 2019, pp. 982–988. *Equal contribution.

[4] Jeffrey Zhang, Sravani Gajjala, Pulkit Agrawal, Geoffrey H. Tison, **Laura Hallock**, Lauren Beussink-Nelson, Mats H. Lassen, Eugene Fan, Mandar A. Aras, ChaRandle Jordan, Kirsten E. Fleischmann, Michelle Melisko, Atif Qasim, Sanjiv J. Shah, Ruzena Bajcsy, and Rahul C. Deo, "Fully automated echocardiogram interpretation in clinical practice: Feasibility and diagnostic accuracy," *Circulation*, vol. 138, no. 16, pp. 1623–1635, 2018.

[5] **Laura Hallock**, Akira Kato, and Ruzena Bajcsy, "Empirical quantification and modeling of muscle deformation: Toward ultrasound-driven assistive device control," in *IEEE International Conference on Robotics and Automation (ICRA)*. IEEE, 2018, pp. 1825–1832.

WORKSHOPS / ABSTRACTS / POSTERS

[6] **Laura Hallock** and Ruzena Bajcsy, "The OpenArm Project: Exploring deformation as a measure of muscle force," in *Meeting of the American Society of Biomechanics (ASB)*. ASB, 2020.

[7] **Laura Hallock** and Ruzena Bajcsy, "A preliminary evaluation of acoustic myography for real-time muscle force inference," in *International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*. IEEE, 2018.

[8] **Laura Hallock** and Ruzena Bajcsy, "Beyond surface electromyography: Novel measures of muscle activation for high-degree-of-freedom assistive device control," in *PhD Student Forum, IEEE International Conference on Robotics and Automation (ICRA)*. IEEE, 2018.

[9] **Laura Hallock** and Ruzena Bajcsy, "Musculoskeletal modeling for physical HRI," in *Women in Robotics III Workshop, Robotics: Science and Systems (RSS)*, 2017.

[10] **Laura Hallock**, Robert Peter Matthew, Sarah Seko, and Ruzena Bajcsy, "Sensor-driven musculoskeletal dynamic modeling," in *International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*. IEEE, 2016.

[11] Emily Clements, Bruno Alvisio, Alessandra Babuscia, Zachary Casas, Brian Coffee, Sydney Giblin, **Laura Hallock**, Ryan Kingsbury, Michael Leaman, Naomi Lynch, Michael O'Connor,

Elizabeth Qian, Frank Hall Schmidt, Maria de Soria-Santacruz, Lionel Sotomayor, Christian Valledor, Megan Tadge, Leonard Tampkins, Evan Wise, Mary Zhuang, Manuel Martinez-Sanchez, and Kerri Cahoy, "TERSat: Trapped energetic radiation satellite," in *AIAA/USU Conference on Small Satellites*, 2012.

TECHNICAL REPORTS / THESES

[12] **Laura Hallock**, "A systematic study of the muscle force–deformation relationship at the human elbow: Toward physiology-aware assistive device control and noninvasive muscle force sensing," Ph.D. dissertation, EECS Department, University of California, Berkeley, Aug 2021.

[13] **Laura Hallock**, Robert Peter Matthew, Sarah Seko, and Ruzena Bajcsy, "Sensor-driven musculoskeletal dynamic modeling," University of California, Berkeley, Tech. Rep. UCB/EECS-2016-66, May 2016.

GRANTS / FELLOWSHIPS

AWARDED

2016–2021 **NSF Graduate Research Fellowship Program (GRFP)**, *Individualized Kinematic and Dynamic Modeling for Exoskeleton Control*, Laura Hallock.

IN PREPARATION

[in prep.] **NSF Mind, Machine and Motor Nexus (M3X)**, *Assistance as (actually) needed: Neuromusculoskeletal modeling of the joint human–robot system for improved patient engagement in robot-mediated therapy*, Laura Hallock and Daniel Brown.

HONORS / AWARDS

10/2022 **Rising Stars in Engineering in Health**, *Workshop Selectee*.

10/2020 **Rising Stars in Mechanical Engineering**, *Workshop Selectee*.

5/2019 **UC Berkeley EECS**, *Chair's Graduate Award*.

9/2018 **NextProf Nexus**, *Workshop Selectee*.

5/2018 **UC Berkeley Graduate Division**, *Outstanding Graduate Student Instructor*.

2/2016 **Innovation Competition, WearRAcon 2016**, *Winning Team Member*.

5/2015 **MIT Eta Kappa Nu Computer Science and Electrical Engineering Honor Society**, *Member*.

TALKS / PRESENTATIONS

EXTERNAL

11/14/2024 **Utah Life Sciences Summit**, *The Evolution of Robotics in Life Sciences*, Invited Panelist.

9/1/2024 **IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob), Workshop on Building Responsive Body-Machine Interfaces with Biosignals and Robotic Exoskeletons**, *Human–Robot Empowerment: Human Neuromusculoskeletal Modeling for Improved Assistive & Rehabilitative Robotics*, Invited Talk.

3/27/2023 **Electrical & Computer Engineering Seminar Series, Princeton University**, *(Re)building Human Dexterity: Modeling Neuromusculoskeletal Capability & Intent For Improved Collaborative & Rehabilitative Robots*, Invited Talk.

3/9/2023 **Electrical & Computer Engineering Rising Stars Seminar Series, University of Wisconsin–Madison**, *(Re)building Human Dexterity: Modeling Neuromusculoskeletal Capability & Intent For Improved Collaborative & Rehabilitative Robots*, Invited Talk.

2/22/2023 **Mechanical & Industrial Engineering Seminar Series, Northeastern University**, *(Re)building Human Dexterity: Modeling Neuromusculoskeletal Capability & Intent For Improved Collaborative & Rehabilitative Robots*, Invited Talk.

2/9/2023 **Mechanical Engineering Seminar Series, University of Utah**, *(Re)building Human Dexterity: Modeling Neuromusculoskeletal Capability & Intent For Improved Collaborative & Rehabilitative Robots*, Invited Talk.

5/28/2021 **AMBER Lab, California Institute of Technology**, *A Systematic Modeling Framework for Deformation-Based Muscle Force Inference: Toward Safe and Capable Assistive Device Control*, Talk.

3/25/2021 **The Future of Mechanical Engineering Seminar Series, Stanford University**, *(Re)building Human Dexterity: Inferring Musculoskeletal Dynamics for Next-Generation Assistive Devices & Diagnostics*, Invited Talk.

3/10/2021 **Mechanical Engineering Seminar Series, Massachusetts Institute of Technology**, *(Re)building Human Dexterity: Inferring Musculoskeletal Dynamics for Next-Generation Assistive Devices & Diagnostics*, Invited Talk.

3/1/2021 **AeroAstro Seminar Series, Massachusetts Institute of Technology**, *(Re)building Human Dexterity: Inferring Musculoskeletal Dynamics for Next-Generation Assistive Devices & Diagnostics*, Invited Talk.

2/24/2021 **Electrical & Computer Engineering Seminar Series, Princeton University**, *(Re)building Human Dexterity: Inferring Musculoskeletal Dynamics for Next-Generation Assistive Devices & Diagnostics*, Invited Talk.

2/19/2021 **Electrical & Systems Engineering Seminar Series, University of Pennsylvania**, *(Re)building Human Dexterity: Inferring Musculoskeletal Dynamics for Next-Generation Assistive Devices & Diagnostics*, Invited Talk.

1/22/2021 **3rd NorCal Control Workshop**, *Novel Muscle Force Inference Methods for Human Dexterity Modeling & Augmentation*, Invited Talk.

12/2/2020 **IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)**, *Muscle Deformation Correlates with Output Force During Isometric Contraction*, Oral Presentation.

11/18/2020 **GRASP SFI Seminar Series, University of Pennsylvania**, *A Systematic Modeling Framework for Deformation-Based Muscle Force Inference: Toward Safe and Capable Assistive Device Control*, Invited Talk.

11/10/2020 **Neuromuscular Biomechanics Lab, Stanford University**, *A Systematic Modeling Framework for Deformation-Based Muscle Force Inference*, Talk.

8/7/2020 **American Society of Biomechanics Annual Conference (ASB)**, *The OpenArm Project: Exploring Deformation as a Measure of Muscle Force*, Virtual Poster.

12/6/2019 **Action Lab, Northeastern University**, *A Systematic Modeling Framework for Deformation-Based Muscle Force Inference*, Talk.

9/25/2019 **Harvard Biodesign Lab**, *A Systematic Modeling Framework for Deformation-Based Muscle Force Inference*, Talk.

7/30/2019	**Slovenská technická univerzita v Bratislave (STU)**, *A Systematic Modeling Framework for Deformation-Based Muscle Force Inference*, Invited Talk.
7/29/2019	**University of Žilina (UNIZA)**, *A Systematic Modeling Framework for Deformation-Based Muscle Force Inference*, Invited Talk.
7/24/2019	**International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)**, *OpenArm 2.0: Automated Segmentation of 3D Tissue Structures for Multi-Subject Study of Muscle Deformation Dynamics*, Poster & Lightning Talk.
7/22/2019	**Czech Institute of Informatics, Robotics and Cybernetics (CIIRC CTU)**, *A Systematic Modeling Framework for Deformation-Based Muscle Force Inference*, Invited Talk.
4/26/2019	**CITRIS/CPAR Control Theory and Automation Symposium, 2nd NorCal Control Workshop**, *System Identification of Human Musculoskeletal Dynamics*, Invited Talk.
7/18/2018	**International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)**, *A Preliminary Evaluation of Acoustic Myography for Real-Time Muscle Force Inference*, Poster.
5/22/2018	**IEEE International Conference on Robotics and Automation (ICRA)**, *Empirical Quantification and Modeling of Muscle Deformation: Toward Ultrasound-Driven Assistive Device Control*, Poster.
12/7/2017	**Center for Neural Engineering & Prostheses Annual Retreat (CNEP)**, *Quantification and Modeling of Upper-Limb Muscle Deformation: Toward Ultrasound-Driven Assistive Device Control*, Invited Talk.
7/15/2017	**Women in Robotics III Workshop, Robotics: Science and Systems (RSS)**, *Musculoskeletal Modeling for Physical HRI*, Poster.
1/22/2017	**Center for American Education and Culture (CAEC)**, *Human Musculoskeletal Dynamic Modeling: Current Research and Objectives*, Invited Talk.
8/19/2016	**International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)**, *Sensor-Driven Musculoskeletal Dynamic Modeling*, Poster.

INTERNAL

1/23/2024	**UofU Robotics Seminar**, *Human–Robot Empowerment: Human Neuromusculoskeletal Modeling For Improved Collaborative & Rehabilitative Robots*, Talk.
10/26/2018	**BAIR/CPAR/BDD Internal Weekly Seminar**, *Human Muscle Force Modeling for Enhanced Assistive Device Control*, Talk.
2/5/2018	**Seminar in Physiological Energetics and Biomechanics, UCB Integrative Biology**, *Human Musculoskeletal Dynamics Modeling: Toward Biomimetic Assistive Device Control*, Talk.
8/25/2017	**Berkeley Semiautonomous Seminar**, *Human Musculoskeletal Dynamics Modeling: Current Research and Objectives*, Talk.
7/26/2017	**Berkeley Center for Computational Imaging Seminar (BCCI)**, *Sensor-Driven Musculoskeletal Dynamics Modeling*, Talk.

TEACHING EXPERIENCE

Spring 2025	**ME EN 2030 Dynamics**, *Instructor of Record*, University of Utah.

Spring 2024	**ME EN 2030 Dynamics**, *Instructor of Record*, University of Utah.
Spring 2020	**EECS 127/227A Optimization Models in Engineering**, *Graduate Student Instructor*, University of California, Berkeley.
Fall 2018 – Fall 2020	**Teaching Conference for Graduate Student Instructors**, *Computer Science Discipline Cluster Workshop Leader*, University of California, Berkeley.
Fall 2017	**EECS 106A/206A Introduction to Robotics**, *Head Graduate Student Instructor*, University of California, Berkeley.
Winter 2017	**Robotics & AI Lecture Series**, *Lecturer*, Center for American Education and Culture.
Fall 2012 – Fall 2014	**EC.A790 Engineering, Art, and Science**, *Associate Advisor*, Massachusetts Institute of Technology.
Winter 2014	**High School Physics, *Liceo Scientifico Sperimentale "Luigi Cremona"***, *Instructor*, MIT Global Teaching Labs, Milan, Italy.

PROFESSIONAL / DEPARTMENTAL SERVICE

EXTERNAL

12/2024	**NSF Panel**, *Reviewer/Panelist*.
12/2024	**Nature Scientific Reports**, *Paper Reviewer*.
10/2024	**Nature Communications**, *Paper Reviewer*.
9/2024	**IEEE Sensors Journal**, *Paper Reviewer*.
1–4/2024	**IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob), 2024**, *Associate Editor*.
4/2024	**IEEE Sensors Journal**, *Paper Reviewer*.
11/2023	**IEEE International Conference on Robotics and Automation (ICRA), 2024**, *Paper Reviewer*.
6/2023	**IEEE Sensors Journal**, *Paper Reviewer*.
6/2023	**IEEE Transactions on Biomedical Engineering (TBME)**, *Paper Reviewer*.
8/2022	**IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob), 2022**, *Workshop Co-Organizer*, "Closing the Loop on Upper-Limb Assistive Device Design, Sensing, Control, & Clinical Practice".
1–4/2022	**IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), 2022**, *Associate Editor*.
4/2020	**IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob), 2020**, *Paper Reviewer*.
10/2018	**IEEE Robotics and Automation Letters (RA-L), 2019**, *Paper Reviewer*.
5/2018	**IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob), 2018**, *Paper Reviewer*.
4/2017	**IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), 2017**, *Paper Reviewer*.

INTERNAL

7/2017 – 7/2021	**CITRIS People and Robots (CPAR) / Design of Robotics and Embedded Systems, Analysis, and Modeling (DREAM) Seminar, University of California, Berkeley**, *Organizer*.
2–3/2020	**EECS Faculty Search Committee, University of California, Berkeley**, *Student Interviewer*.
12/2017	**EE Graduate Admissions, University of California, Berkeley**, *Graduate Student Application Reviewer*.
8–12/2016	**UC Berkeley Disabled Students' Program**, *Note Taker, EE 227BT Convex Optimization*.

PROFESSIONAL AFFILIATIONS

6/2020 – Present	**American Society of Biomechanics (ASB)**, *Early Career Member (prev. Student Member)*.
2/2018 – Present	**IEEE Robotics and Automation Society (RAS)**, *Member (prev. Graduate Student Member)*.
8/2016 – Present	**IEEE Engineering in Medicine and Biology Society (EMBS)**, *Member (prev. Graduate Student Member)*.

RESEARCH MENTORING / ADVISING

CURRENT STUDENTS

PhD	Ajay Anand, Carson Wynn
master's	Tharnath Bagirathan, Jonathan Jenkens
undergraduate	Chad Berghoff, Ethan Berry, Gabriel Parra, Vikram Athithan, Evan Falconer, Gavin Sueltz, Maria Herrera

SELECT FORMER STUDENTS

undergrad	Chris Mitchell (now Software Engineer, Amazon), Akash Velu (now graduate student, Stanford), Bhavna Sud (now graduate student, Stanford), Fayyaz Ahamed (now medical student, UCSF), Eric Hu (now MD/PhD student, NYU), Amanda Schwartz (now PhD student, UMich mathematics), Varun Bhatia (now graduate student, CMU RI), Jaeyun Stella Seo (now graduate student, UCB), Yonatan Nozik (now PhD student, CMU ECE), Sachiko Matsumoto (now PhD student, UCSD robotics), Nandita Iyer (now Software Engineer, Twitter), David Wang (now Firmware Integration Engineer, Tesla), Sai Mandava (now Software Engineer, Intuit), Thomas Li (now Software Engineer, Lyft), Kireet Agrawal (now Software Engineer, ThoughtSpot), Michelle He (now Robotics & Controls Engineer, Johnson & Johnson), Ian McDonald (now Site Reliability Engineer, Atlassian), Daniel Ho (now Software Engineer, Mapbox), Aaron Sy (now Engineer, YouTube), Jason Xinyu Liu (now PhD student, Brown), Jeffrey Zhang (now PhD student, UIUC CS), Shivani Sharma (now Assistant Program Manager, GM)
high school	Ivan Zheng (now undergraduate, MIT), Tina Jiang (now undergraduate, Northeastern), Prerana Kiran (now undergraduate, UIUC)

ADDITIONAL RESEARCH / PROFESSIONAL EXPERIENCE

6/2017	**Siemens Healthineers**, *Intern*, Princeton, NJ.

1/2013 – 6/2015	**Biomechatronics Group, Media Lab, Massachusetts Institute of Technology**, *Undergraduate Researcher*, Cambridge, MA.
5–8/2014	**DRC Tartan Rescue, National Robotics Engineering Center**, *Intern*, Pittsburgh, PA.
2–5/2014	**Edgerton Center, Massachusetts Institute of Technology**, *Undergraduate Researcher*, Cambridge, MA.
6–8/2013	**Centro de Astro-Ingeniería (Astro-Engineering Center), Pontificia Universidad Católica de Chile**, *Intern*, Santiago, Chile.
6–8/2012	**Cirrus Logic, Energy, Exploration, and Lighting Division**, *Product Test Engineering Intern*, Austin, TX.
1–2/2012	**Space Systems Lab, Massachusetts Institute of Technology**, *Undergraduate Researcher*, Cambridge, MA.
7–8/2011	**Plasma Dynamics Lab, University of Texas at Austin**, *Research Assistant*, Austin, TX.
6–8/2010	**Center for Nonlinear Dynamics, University of Texas at Austin**, *Research Assistant*, Austin, TX.

OUTREACH / LEADERSHIP

6–8/2022	**Army Educational Outreach Program (AEOP)**, *Mentor*, University of Pennsylvania.
9/2017 – 8/2021	**EECS Peers**, *Peer Advisor*, University of California, Berkeley.
9/2017 – 5/2021	**BAIR Undergraduate Mentoring Program**, *Mentor*, University of California, Berkeley.
7/2020	**Awesome Girls: Family STEM Series**, *Webinar Co-Presenter*, Girl Scouts of Northern California.
9/2017 – 12/2019	**LAGSES Fellowship Mentoring Program**, *Mentor*, University of California, Berkeley.
8/2018 – 8/2019	**EECS Graduate Student Association**, *Visit Days Co-Chair*, University of California, Berkeley.
7/2019	**UC Berkeley Girls in Engineering (GiE)**, *Module Instructor*, University of California, Berkeley.
8/2018	**UC Berkeley AI4ALL**, *Camp Mentor*, University of California, Berkeley.
5/2017 – 5/2018	**Women in Computer Science and Engineering (WICSE)**, *Outreach Chair*, University of California, Berkeley.
2/2017 – 2/2018	**Next Scholars**, *Mentor*, New York Academy of Sciences.
11–12/2016	**Linear System Theory Tutoring Program**, *Tutor*, University of California, Berkeley.
9/2012 – 6/2015	**MIT Educational Studies Program (ESP)**, *Special Programs Instructor*, Massachusetts Institute of Technology.
5/2012 – 6/2015	**OrigaMIT**, *Office Manager / Instructor*, Massachusetts Institute of Technology.
5/2012 – 6/2015	**American Jiu-Jitsu @ MIT**, *President / Recruitment Chair*, Massachusetts Institute of Technology.

LANGUAGES

technical	Python, C/C++, MATLAB, Linux / bash, Robot Operating System (ROS)
spoken	English (native), Spanish (proficient)

ADDITIONAL CERTIFICATIONS

9/14/2020	**Adult, Child and Baby First Aid/CPR/AED Certified**, American Red Cross, *Valid through 9/14/2022.*
11/28/2020	**1st Dan / Black Belt**, Yongmudo Hapkido.