

Henry M. Clever

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RESEARCH INTERESTS

I am interested in modeling and enhancing physical interactions between robots, humans, and the real world. My work has explored how modern fast physics simulation can be used to generate data that robots can learn from and efficiently boost autonomous robot capabilities. I have sought to understand and condition robot interactions using multimodal sensing information and embedded mechanical models within deep networks that constrain inference and improve human interpretability. My research crosses the fields of haptics, computer vision, machine learning, optimization, control, biomechanics, physics simulation, multi-robot systems and robot perception, to improve how robots behave in complex dynamic environments.

EDUCATION

Georgia Institute of Technology, Atlanta, GA Ph.D. Candidate – Robotics, Advisor: Charles C. Kemp	2016 - Present
New York University Tandon School of Engineering, Brooklyn, NY M.S. Mechanical Engineering, Advisor: Joo H. Kim	2014 - 2016
The University of Kansas, Lawrence, KS B.S. Mechanical Engineering, Advisor: Sarah L. Kieweg	2009 - 2014

PUBLICATIONS

Clever, H.M., P. Grady, G. Turk, and C.C. Kemp. “Inferring Body Pose and Contact Pressure from a Depth Image.” *Submitted to IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2021.

Clever, H.M.*, T. Bhattacharjee*, J. Wade, and C.C. Kemp. “Material Recognition via Heat Transfer Given Ambiguous Initial Conditions.” *Accepted to IEEE Transactions on Haptics*, 2021.

Clever, H.M., Z. Erickson, A. Kapusta, G. Turk, C.K. Liu, and C.C. Kemp. "Bodies at Rest: 3D Human Pose and Shape Estimation from a Pressure Image using Synthetic Data." *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2020. **Accepted for oral presentation (5%).**

Erickson, Z., **H.M. Clever**, V. Gangaram, G. Turk, C.K. Liu, and C.C. Kemp. "Multidimensional capacitive sensing for robot-assisted dressing and bathing." *IEEE International Conference on Rehabilitation Robotics (ICORR)*, 2019. **Best Student Paper Award.**

Kapusta, A., Z. Erickson, **H.M. Clever**, W. Yu, C.K. Liu, G. Turk, and C.C. Kemp. "Personalized collaborative plans for robot-assisted dressing via optimization and simulation. *Autonomous Robots*, 2019.

Kapusta, A., P.M. Grice, **H.M. Clever**, Y. Chitalia, D. Park, and C.C. Kemp. "A system for bedside assistance that integrates a robotic bed and a mobile manipulator." *PLOS ONE*, 2019.

Clever, H. M., A. Kapusta, D. Park, Z. Erickson, Y. Chitalia, C.C. Kemp. "Estimating 3D Human Pose on a Configurable Bed from a Single Pressure Image," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2018.

Erickson, Z., **H. M. Clever**, G. Turk, C. K. Liu, C. C. Kemp, "Deep Haptic Model Predictive Control for Robot-Assisted Dressing," *IEEE International Conference on Robotics and Automation (ICRA)*, 2018.

Bhattacharjee, T., **H. M. Clever**, J. Wade, C. C. Kemp. "Multimodal Tactile Perception of Objects in a Real Home." *IEEE Robotics and Automation Letters (RAL)*, 2018.

Grice, P.M., Y. Chitalia, M. Rich, **H.M. Clever**, C.C. Kemp. "Autobed: Open hardware for accessible web-based control of an electric bed." *Rehabilitation Engineering and Assistive Technology Society of North America (RESNA)*, 2016.

Clever, H.M., Brown, A., Kapila, V. "Using an AR Drone Lab in a High School Classroom to Promote Quantitative Research." *The 123rd Annual American Society of Engineering Education Conference and Exposition (ASEE)*, 2016.

Anwar, R., **H.M. Clever**, J. Fleenor, B. Hu, V. Kheyfets, H. Sis, S.L. Kieweg. "Thin Film Coating Flows in Vaginal Drug Delivery." *7th World Congress of Biomechanics*, 2014.

Hu, B., **H.M. Clever** and Kieweg, S.L. "Contact Line Instability of Gravity-driven Flow of Powerlaw Fluids: Comparison of Experiments and Simulations", *The 66th Annual Meeting of the American Physical Society's Division of Fluid Dynamics (APS-DFD)*, 2013.

Clever, H.M., H. Evans, S.L. Kieweg. "Ultramouse: A communicative device which allows those with disabilities to operate a computer using head movement." *ASME International Mechanical Engineering Congress and Exposition Undergraduate Poster Presentation*, 2013.

PATENTS

Kemp, C.C., **H.M. Clever**. "A Low-Cost General-Purpose Mobile Manipulator for Indoor Use", U.S. Patent Application No. 15/924,052. Provisional Filing Date: March 20, 2017. Patent application submitted to USPTO March 2018.

- Technology licensed by Hello Robot, Inc. Company link: www.hello-robot.com
- Stretch RE-1 commercial robot unveiled in 2020, currently available for \$17,950
- Many top research labs in industry and academic have purchased a Stretch RE-1
- Called a "Beautifully simple, clever robot design" by IEEE Spectrum

Kemp, C.C., **H.M. Clever**. "Additional Hardware and Software for a Low-Cost General-Purpose Mobile Manipulator for Indoor Use", U.S. Patent Application No. 15/924,088. Provisional Filing Date: February 5, 2018. Patent application submitted to USPTO March 2018.

AWARDS AND HONORS

NSF Graduate Research Fellowship (GRF)	2015 – 2020
President's Fellowship – Georgia Tech	2016 – 2020
NRT – NSF Research Traineeship – Georgia Tech	2016 – 2018
Selected speaker – New York University President's Global Council	2015
NSF G-K12 Fellowship: Applying Mechatronics to Promote Science – NYU	2014 – 2015
3rd place, University of Kansas Innovation and Collaboration Fair	2014
Wesley G. Kramer Scholar Award – University of Kansas	2014
2nd place, ASME IMECE Undergraduate Poster Competition	2013
3rd place, Sigma Xi Undergraduate Research Symposium – University of Kansas	2013
Undergraduate Research Award – University of Kansas	2013
Eagle Scout – Scouts of America	2006

WORK EXPERIENCE

NVIDIA Robotics Research Lab: Intern, Seattle, WA Summer 2021
Robot manipulation, physics-based simulation, and robot perception

Robots for Humanity: Design Engineer, Menlo Park, CA 2012 – 2017
Collaboration between Willow Garage, Inc., Healthcare Robotics Lab, and Henry and Jane Evans

Project #1: The WOUSE: PR2 robot safety stop device

Set of customized safety goggles to detect a wince on the user

See www.ros.org/wiki/wouse for videos and further documentation

Project #2: The Ultramouse: A device to control a computer cursor with head movement

Watch the Ultramouse in action: www.youtube.com/watch?v=2kRi1g88mWI

Featured on the evening news in Kansas City (KCTV5), Topeka–Capital Journal and used by a person with quadriplegic on TED Mid-Atlantic

Project #3: The AutoBed: A device enabling control of a hospital bed via computer interface

Watch the QuadRock, where the AutoBed enables a person with quadriplegia to dance:
www.youtube.com/watch?v=-t5U4LzEz0Y

Project #4: The Whiskey-bot: Assistive EEG-based drinking system

Whiskey-bot in action: www.youtube.com/watch?v=D9E8Q1PQ9Mw

Featured and described in TEDx Sonoma: www.youtube.com/watch?v=Tg7EHj74AKk

Briem Engineering: Intern, St. Louis, MO 2011 – 2012
Materials science, metallurgy, failure analysis
Develop testing methods, operate precision testing equipment

Frontenac Bank: Teller, St. Louis, MO 2009 – 2010
Customer service, account management, telephone reception, executive assistance

OUTREACH

Undergraduate Research Mentor – Healthcare Robotics Lab, Georgia Tech 2021 –
Mentor highly motivated 2nd year biomedical engineering student
Research project: modeling quasi-static human pose at rest

Vice President of Outreach – Robograds, Georgia Tech 2019 – 2020
Organize tours at Georgia Tech robotics labs for K-12 students
Give robotics demonstrations at local libraries, schools, and community centers

Teaching Assistant – Introduction to Biomechanics, Georgia Tech 2017, 2020

Sophomore level course in the Biomedical Engineering Department
Lesson plan preparation, test preparation, recitation instructor

NSF Summer Undergraduate Research in Engineering Robotics Program mentor 2019

Summer research immersion program for undergraduate students
Mentored one student for a summer of research
Taught programming in ROS and Unity for the Microsoft HoloLens

Applied Research Innovations in Science and Engineering program mentor, NYU 2014 – 2016

Research immersion program for 10th and 11th grade high school students
Mentored five students throughout two summers of research
Taught computer programming, circuits, basic control systems

FIRST Robotics Club Leader – Millennium Brooklyn High School, Brooklyn, NY 2014 – 2015

Started robotics club and led weekly meetings, recruiting twenty students
Taught students programming and hardware development
Led students to build working robot and compete in First Tech Challenge (FTC) of NYC

Teaching Assistant – Millennium Brooklyn High School, Brooklyn, NY 2014 – 2015

Ninth grade quantitative research class, co-instructor
Mentor students with special needs, particularly Autism Spectrum Disorders (ASD)

SKILLS

Programming Languages – Python, C++, HTML, Javascript, CSS, MATLAB, Simulink, LabVIEW, PBASIC, Unity, C-Sharp

Software – PyTorch, Keras, NVIDIA FleX, NVIDIA PhysX, Dynamic Animation and Robotics Toolkit (DART) simulator, ROS, Gazebo, Patran/Nastran Finite Element Analysis, Solidworks, Autodesk, Visual 3D

Hardware – Robot building, soldering, electronic troubleshooting, machining, wood working, automotive repair