CAITLYN CLABAUGH

Curriculum Vitæ

Ph.D. Candidate
Computer Science
University of Southern California

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My research applies Machine Learning and Artificial Intelligence to automate long-term adaptation and interactive personalization of real-world Human-Machine Interaction and Human-Computer Interaction.

EDUCATION

2013-Aug 2018	**University of Southern California**	Ph.D. Candidate in *Computer Science*	Los Angeles, CA
2013-2016	**University of Southern California**	Masters of Science in *Computer Science*	Los Angeles, CA
2009-2013	**Bryn Mawr College**	B.A. in *Computer Science*, *Magna Cum Laude*	Bryn Mawr, PA

EXPERIENCE

May 2013-Present **Graduate Research Assistant – University of Southern California** Los Angeles, CA

- Apply and develop Machine Learning (ML) methods to enable long-term adaptation and interactive personalization of autonomous Human-Robot Interaction (HRI).
- Designed and developed a fully autonomous Socially Assistive Robotic (SAR) system for personalized tutoring of concepts in early childhood mathematics, collaborating with an interdisciplinary research team of experts in ML, SAR and HRI, and STEM education and early childhood development.
- Deployed the SAR tutor in a real-world general education classroom with over 50 children aged 3-6.
- Deployed the SAR in 5 family homes of children with Autism Spectrum Disorder (ASD) for 30 days.
- Applied Reinforcement Learning (RL) and Interactive Machine Learning (IML) to adapt the difficulty of the interaction to the aptitudes of individual children over multiple, repeated interactions.
- Leveraged domain knowledge, specifically educational and developmental standards, as well as human user input, such as parent feedback, to alleviate the computational complexities of personalization.

Oct 2016-Present **Human-Robot Learning Scientist – Embodied, Inc.** Los Angeles, CA

- Responsible for Human-Robot Interaction and Machine Learning R & D for a novel Socially Assistive Robot (SAR), directly under Chief Science Officer and Chief Technology Officer.
- Designed and implemented socially assistive interactions of the SAR with users of diverse needs.
- Designed a personalizable, mulitmodal model for detecting and responding to users' emotional states.

Jun-Aug 2013 **Summer Web Developer – NetApp, Inc.** Sunnyvale, CA

- Created a code generation engine and metaprogramming schema to simplify the development of a Representational State Transfer (REST) web API for the Mars all-flash data storage.
- Designed a sparse and functional YAML schema for developers to design high-level web APIs.
- Given developer's high-level API design in YAML, the Java code auto-generator implements the RESTful API using internal logic and Velocity Template Language, exposing Mars API to the web.

Jun-Aug 2012 **Summer Technology Analyst – Barclays Investment Bank** New York, NY

- Supported the business by developing real-world, financial tools in a face-paced environment.
- Gained a working knowledge of investment banking, specifically in equities and risk management.
- Independently restructured, expanded, and integrated Apache Camel with TIBCO Rendezvous into the system flow testing suite for Barlcays's trader-facing profit and loss risk viewer.
- Implemented in Java with focus on scalability using Aspect-Oriented Programming practices.

Jun-Aug 2011 **Summer Research Scientist – MIT Lincoln Laboratory** Lexington, MA

- Tasked to create solutions for spatiotemporal classification and anomaly detection for the DoD.
- Developed and implemented an emergent curvilinear clustering algorithm in MATLAB to detect road-like networks in geotagged data acquired from social networks (e.g. Flickr).
- The algorithm performed the best in cases with highly variable densities and tight waffle-like patterns.
- Gave technical presentations about research throughout the summer to experts and non-experts.

HONORS & AWARDS

May 2018 **Viterbi Undergraduate Research Mentoring Award** Los Angeles, CA
- Awarded to an outstanding Viterbi School of Engineering Ph.D. student who has been actively engaged in mentoring undergraduate student researchers.
- Mentored over 40 undergraduate students, 95% of whom were underrepresented minorities or women, and 40% of graduates are pursuing graduate-level degrees in computer science.

May 2018 **The Order of Areté – University of Southern California** Los Angeles, CA
- All-university award for outstanding graduate students who have demonstrated significant depth and scope of responsibility in leadership roles benefiting peers and the broader communities.

Aug 2016 **Best Empirical Paper – RO-MAN** New York, NY
- Awarded "Best Empirical Paper" at the Twenty-Fifth IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN).

May 2016 **Third Place Startup at MEPC – University of Southern California** New York, NY
- Co-founder and Chief Technology Officer (CTO) of small companion robot startup, Botkins Robotics, that placed third at USC's Fifth Annual Maseeh Entrepreneurship Prize Competition (MEPC).

Mar 2015 **Honorable Mention – NSF Graduate Research Fellowship Program** Los Angeles, CA
- Accorded an Honorable Mention, a significant national academic achievement.

Mar 2013 **Merit Top-off Fellowship – University of Southern California** Los Angeles, CA
- Awarded Viterbi School of Engineering Ph.D. Merit Top-off Fellowship.

Aug 2011-2013 **Fellowship – Center of Science of Information (CSOI)** Bryn Mawr, PA
- Awarded fellowship for senior research and thesis with focus on computational creativity.
- Created automated A vs B music mashup system.

Aug 2011-2012 **Fellowship – Partnership for International Research and Education (PIRE)** Bryn Mawr, PA
- Awarded fellowship for research in humanoid robotics and development of RoboCup team.
- Invited to SIGCSE conference as a student ambassador to Nao robot and Bryn Mawr College.

May 2011 & 2013 **MIT Lincoln Laboratories Research Award in Computer Science** Bryn Mawr, PA
- Awarded for work and research in gesture recognition for the American Sign Language-to-Text project (2011), and senior thesis (2013).

PUBLICATIONS

UNDER PREPARATION

Caitlyn Clabaugh, David Becerra, Gisele Ragusa, and Maja Matarić, "A Personalized Socially Assistive Robot for Long-term, In-home Interventions with Children with Autism Spectrum Disorder," in *the Fourteenth ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Daegu, South Korea, March 11-14, 2019.

Caitlyn Clabaugh and Maja Matarić, "Transferable Knowledge Tracing with a Socially Assistive Robot for Children with Diverse Needs," in *the Fourteenth ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Daegu, South Korea, March 11-14, 2019.

Caitlyn Clabaugh and Maja Matarić, "Robot vs. Wild: Autonomous Human-Robot Interaction in the Home," in *Companion of the Fourteenth ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Daegu, South Korea, March 11-14, 2019.

Roxanna Pakkar, Radhika Agrawal, **Caitlyn Clabaugh**, Eric Deng, Gisele Ragusa, and Maja Matarić, "Designing a Socially Assistive Robotic System for Long-term, In-home Interventions with Children with Autism Spectrum Disorder," in *ACM Interaction Design and Children (IDC) Conference*, Boise, Idaho, June 12-15, 2019.

BOOK CHAPTERS

Caitlyn Clabaugh, "Robot Learning," Chapter in *The Robotics Primer (2nd Edition)*, Maja Matarić, MIT Press, 2019.

JOURNAL ARTICLES

Caitlyn Clabaugh and Maja Matarić, "Can Technology Save Children from Itself?," in *Topical Issue on Roboethics in Paladyn. Journal of Behavioral Robotics*, Journal Article, 2018.

Caitlyn Clabaugh and Maja Matarić, "Robots for the People, by the People: Machine Learning Paradigms for Personalized Human-Machine Interaction," in *Science Robotics*, Focus Article, 2018.

Caitlyn Clabaugh and Maja Matarić, "Human-Robot Learning: A Survey of Machine Learning in Socially Assistive Robotics," in *Annual Review on Control, Robotics, and Autonomous Systems*, Journal Article, 2018.

PEER-REVIEWED CONFERENCE PAPERS

Caitlyn Clabaugh, Shomik Jain, Balasubramanian Thiagarajan, Zhonghao Shi, Leena Mathur, David Becerra, Eric Deng, Gisele Ragusa, and Maja Matarić, "Long-term Socially Assistive Robotic Interventions in the Homes of Children with Autism Spectrum Disorder," in *International Symposium on Experimental Robotics (ISER)*, Buenos Aires, Argentina, November 5-8, 2018.

Caitlyn Clabaugh, David Becerra, Eric Deng, Gisele Ragusa, and Maja Matarić, "Month-long, In-home Case Study of a Socially Assistive Robot for Children with Autism Spectrum Disorder," in *Companion of the Thirteenth ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Chicago, IL, March 5-8, 2018.

Caitlyn Clabaugh and Maja Matarić, "Exploring Elicitation Frequency of Learning-Sensitive Information by a Robotic Tutor for Interactive Personalization," in *Twenty-Fifth ACM/IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN)*, New York, NY, August 26-31, 2016. **Awarded Best Empirical Paper**

Caitlyn Clabaugh, Gisele Ragusa, Fei Sha, and Maja Matarić, "Designing a Socially Assistive Robot for Personalized Number Concepts Learning in Preschool Children," in *Fifth International Conference on Development and Learning and on Epigenetic Robotics (ICDL-EPIROB)*, Providence, RI, August 13-16, 2015.

PEER-REVIEWED WORKSHOP PAPERS

Caitlyn Clabaugh, Konstantinos Tsiakas, and Maja Matarić, "Predicting Preschool Mathematics Performance of Children with a Socially Assistive Robot Tutor," in *Workshop on Synergies Between Learning and Interaction at the 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2017)*, Vancouver, Canada, September 28, 2017.

Caitlyn Clabaugh, "Interactive Personalization for Socially Assistive Robotics," in *HRI-Pioneers Workshop at the Twenty-First ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Vienna, Austria, March 6-9, 2017.

Braden McDorman, **Caitlyn Clabaugh**, and Maja Matarić, "Attachment Theory in Long-Term Human-Robot Interaction," in *Workshop on Long-Term Child-Robot Interaction held at the Twenty-Fifth ACM/IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN)*, New York, NY, August 31, 2016.

Caitlyn Clabaugh, Teja Ram, and Maja Matarić, "Estimating Visual Focus of Attention in Dyadic Human-Robot Interaction for Planar Tasks," in *First International Workshop on Educational Robots (WONDER) at the Seventh International Conference on Social Robotics (ICSR)*, Paris, France, October 26, 2015.

Caitlyn Clabaugh, Fei Sha, Gisele Ragusa, and Maja Matarić, "Towards a Personalized Model of Number Concepts Learning in Preschool Children," in *Workshop on Machine Learning for Social Robotics at ICRA*, Seattle, WA, May 26, 2015.

Jillian Greczek, Elaine Short, **Caitlyn Clabaugh**, Katelyn Swift-Spong, and Maja Matarić, "Socially Assistive Robotics for Personalized Education for Children," in *AAAI Fall Symposium Series*, Washington, DC, November 13-15, 2014.

Ross Mead, Amin Atrash, Edward Kaszubski, Aaron St Clair, Jillian Greczel, **Caitlyn Clabaugh**, Brian Kohan, and Maja Matarić, "Building Blocks of Social Intelligence: Enabling Autonomy for Socially Intelligent and Assistive Robots," in *AAAI Fall Symposium Series*, Washington, DC, November 13-15, 2014.

WORKSHOP ORGANIZATION

HRI 2018 **Program Chair – 13th Human-Robot Interaction Pioneers Workshop** Chicago, IL
2018 ACM/IEEE International Conference on Human-Robot Interaction (HRI), March 2018
An annual workshop held in conjunction with the larger HRI conference to bring together the world's top student researchers in HRI, early in their academic careers, to foster collaboration and facilitate discussion of their work with peers and senior scholars in the field.
Co-organizers: Austin Whitesell (Oregon State University), Cristina Zaga (University of Twente), Brittany Noah (Georgia Institute of Technology), Felix Gervits (Tufts University), Nik Martelaro (Stanford University), Zhi Tan (Carnegie Mellon University), Ali Raza (University of Technology Sydney)

RO-MAN 2016 **Co-Organizer – First Workshop on Long-Term Child-Robot Interaction** New York, NY
IEEE International Symposium on Robot and Human Interactive Communication, August 2016
Co-organizers: Jacqueline Kory Westlund (MIT Media Lab), Hae Won Park (MIT Media Lab), Iolanda Leite (Disney Research), Chien-Ming Huang (Yale University), James Kennedy (Plymouth University), Elaine Short (University of Southern California)

LEADERSHIP

May 2014-2016 **Co-Founder & Chief Technology Officer of Botkins Robotics** Los Angeles, CA

- Co-founder and CTO of personalized companion robotics startup for young children.
- Learned about many parts of the startup process through the USC Incubator, including hardware and software prototyping, market and UX research, business modeling, legal processes, and pitching.
- Attended the annual New York Toy Fair and Maker Faire Bay Area as part of our market research and connected with many other companies and startups in the space.
- Placed 3rd out of 18 teams at the Fifth Annual Maseeh Entrepreneurship Prize Competition (MEPC).

Aug 2011-2013 **RoboCup Robotic Soccer Team Founder & Captain** Bryn Mawr, PA

- Founded and led Bryn Mawr and Haverford team for robot soccer platform on five Aldebaran NAOs.
- Placed fifth at the 2012 U.S. Open national RoboCup Standard Platform League competition.
- Qualified to compete in the international RoboCup competition.
- Led weekly meetings and trained team with various levels of robotics and programming experience.
- Developed semester-long goals and long-term team strategies, and fostered future team leadership.

K-12 STEM OUTREACH & MENTORING

2015-present **SHINE High School Research Mentor – University of Southern California** Los Angeles, CA

- Mentored and led a total of 8 high school students in Computer Science and Robotics research through USC's Summer High School Intensive in Next-Generation Engineering (SHINE) program.
- Designed research project to introduce student to the field of Socially Assistive Robotics.
- Every student now studies Computer Science or related STEM field at major research universities.

Aug 2015-2016 **Robotics & Coding Academy – University of Southern California** Los Angeles, CA

- Pioneered the University of Southern California Robotics & Coding Academy, an after-school program that reaches 70 students, annually, from three middle schools surrounding USC.
- Developed open source robotics curriculum aligned to Common Core Standards for elementary school.
- Hired and trained over 20 USC undergraduate and graduate mentors to lead after-school classes.

Jan 2016 **"Design a Start Up in a Day" Workshop – All Star Code** Los Angeles, CA

- Co-led workshop on tech and entrepreneurship for All Star Code, a non-profit founded in 2013 and dedicated to closing the opportunity gap between young men of color and the tech industry.

Jul 2014 & 2015 **Expressive Robotics Workshop at Global Conference on Educational Robotics** Los Angeles, CA

- Presented core concepts in expressive robotics including: emotion theory, tweening, principles of animation, and character/story design.
- Contributed new aesthetics component to workshop with professional puppeteer-led costume design.
- Led small teams in creating expressive robots through keyframing in C and aesthetic character design.

2014-present **Annual USC Viterbi Robotics Open House** Los Angeles, CA

- Conducted interactive demos of the Interaction Lab's Stewart Platform Robot for Interactive Tabletop Engagement (SPRITE) robot to thousands of visitors, especially K-12 students, annually.

2014-present **Invited Speaker on Robotics & Machine Learning at Girls Who Code** San Jose & Los Angeles, CA

- Give annual presentations on Robotics, Machine Learning, and women empowerment in Computer Science research to diverse classrooms of high school females.

SKILLS

Computer Languages:	C#, Python, JavaScript, C/C++, Java, Lua, Logo, Scheme, Processing, Scratch, Blockly
Natural Languages:	French (limited working proficiency), Spanish (elementary proficiency)
Applications:	Unity, Vim, Emacs, MATLAB, R, Visual Studios, .NET Framework, Eclipse, NetBeans, OpenGL, MS Office, LaTeX, Adobe Photoshop, Adobe Illustrator, Maya, Mudbox, Final Cut Pro
Operating Systems:	OSX, Linux, Unix, ROS, ArdOS, Windows 7, Vista, and XP
Robotic Platforms:	USC's SPRITE robot, Aldebaran NAO, MIT Media Lab's DragonBot, Wonder Workshop Dot & Dash, Sphero