Thomas R Groechel

CONTACT INFORMATION

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RESEARCH INTERESTS

Virtual and Augmented Reality for Human-Robot Interaction (VAM-HRI), Socially Assistive Robotics, Computer Science Education, Computational Modeling for HRI

TECHNICAL

Languages: C#, C++, Python, Javascript, R, Bash
Tools: Unity, Robot Operating System (ROS), RosSharp (ROS#), Mixed Reality Toolkit (MRTK), Jupyterlab (pandas, seaborn, sklearn)

EDUCATION

University of Southern California, Los Angeles, CA *July 2018 - Present*
– Ph.D. Computer Science: *Expected Dec 2022*
– Master's Computer Science: *Completed Aug 2021*
– Research Advisor: Professor Maja J. Matarić

University of Michigan, Ann Arbor, MI *Sep 2014 - May 2018*
– B.S.E. Computer Science: *Completed May 2018*
– Undergraduate Research Advisor: Professor Odest C. Jenkins

EXPERIENCE

Ph.D. Researcher, USC Interaction Lab, Los Angeles, CA *July 2018 - Present*
– Created mixed reality robot tutor aiming to teach K-12 students coding through modeling student kinesthetic learning processes
– Developed and deployed telepresence robots in schools for home-bound students
– Supported month-long in-home deployments of robot tutor for students with Autism Spectrum Disorder

Robotics Software Intern, iRobot, Pasadena, CA *May 2021 - Aug 2021*
– Worked on robot behaviors framework
– Virtual internship

UG Researcher, UofM 4Progress Lab, Ann Arbor, MI *May 2016 - May 2018*
– Developed 2D SLAM algorithm using Iterative Closest Point visualization
– Implemented Stochastic Gradient Descent for loop closure based on *Fast Iterative Alignment of Pose Graphs with Poor Initial Estimates* (Olson et al.) using the Fetch

Staff Development Czar and TA, UofM, Ann Arbor, MI *Sep 2016 - May 2018*
– Created Staff Development program for teaching staff of 30 graduate and undergraduate TAs to improve teaching skills of new and returning staff members
– Structured 35-student lab session to review and teach concepts in a specialized alternative to traditional lecture, tailoring for active learning
– Produced class-specific help and tip videos to give students an extra resource to common issues in a newer format

Robotics Software Intern at TRACLabs, Houston, TX *Summer 2017*
– Adapted local mapping and navigation to move TRACBot, a mobile-manipulator, to maneuver dynamically through obstacles such as doors and people in order to reach/use items in Affordance Template library

– Refitted and rebuilt action server nodes into custom system to perform dynamic re-planning based on real time observations

Student Research Mentoring

Current Students

– İpek Göktan	Viterbi Fellow, USC SHINE Program, USC Computer Science
– Karen Ly	Merit Research Fellow, USC Computer Science
– Massimiliano Nigro	Politecnico di Milano Computer Science (MS)

Previous Students

– Chloe Kuo	Merit Research Fellow, USC Computer Science
– Julia Cordero	Merit Research Fellow, USC Computer Science
– Nisha Chatwani	Merit Research Fellow, USC Computer Science
– Adam Wathieu	Northwestern University Computer Science
– Karen Berba	Cal State LA Computer Science (MS)
– Daniel Ramirez	Cal State LA Computer Science
– Jenny Haemin Lee	USC Computer Science
– Radhika Agrawal	Merit Research Fellow, USC Computer Science
– Kartik Mahajan	Merit Research Fellow, USC Computer Science
– Roddur Dasgupta	USC Computer Science
– Annika Modi	USC SHINE Program, High School Student
– Jacob Zhi	USC SHINE Program, High School Student
– Roxanna Pakkar	Merit Research Fellow, USC Electrical Engineering
– Zhonghao Shi	USC Computer Science
– Mena Hassan	USC SHINE Program, High School Student
– Adnan Karim	SURE Student, University of Calgary Computer Science
– Ryan Stevenson	USC Computer Science Games
– Ashley Perez	USC SHINE Program, High School Student
– Bryan Pyo	USC SHINE Program, High School Student

Contributions to Grant Proposals

Amazon Research Awards - Learning User Preferences for In-Home Robots Through In Situ Augmented Reality

– Contributed significant ideas and content to proposal based upon ongoing Ph.D. work in learning SAR preferences using Mixed Reality
– Research grant awarded in Spring 2022

NSF NRI 2.0 - Communicate, Share, Adapt: A Mixed Reality Framework for Facilitating Robot Integration and Customization

– Contributed significant ideas and content to proposal based upon ongoing Ph.D. work in Mixed Reality SAR
– Research grant awarded in Fall 2019

K-12 Educational Outreach

MoveToCode: Pair Programming a Robot in Augmented Reality
John Mack Elementary *29 Apr 2022*

From High School to Robotics Research at USC Panel
USC Robotics Ed Week via Zoom *6 Apr 2022*

PoseToCode: Embodied Learning for Coding
USC CS Ed Week via Zoom *7 Dec 2021*

Virtual, Augmented, and Mixed Reality for Human-Robot Interaction
USC Robotics Ed Week via Zoom *10 Apr 2021*

What is a Socially Assistive Robotics Ph.D.?
Temple City High School Robotics Team Talk via Zoom *15 Nov 2020*

Microsoft TEALS Teaching Volunteer
Los Angeles Center for Enriched Studies, Los Angeles, CA *July 2019 - June 2020*

Live Mixed Reality Demo and How it Applies to Socially Assistive Robotics
USC Remote Robotics Open House via Zoom *19 May 2020*

USC Robotics Academy Judge
University of Southern California, Los Angeles, CA *Dec 2018 & 2019, Apr 2019*

Robotics Family Night
Monterey Hills Elementary, Los Angeles, CA *May 2019, Nov 2019*

The Help Group STEM^3 Academy Visit
STEM^3 Academy, Los Angeles, CA *June 2019*

Mixed Reality and the Kuri Robot
USC Robotics Open House *10 Apr 2019*

VEX Robotics Team Leader
Clifford Street Elementary, Los Angeles, CA *Oct 2018 - Feb 2019*

Honors and Awards

USC Computer Science Best Research Assistant *May 2022*
Finalist of the ASEE PSW Section Graduate Student Award *May 2022*
National Science Foundation Travel Fellowship *Nov 2021*
USC Viterbi Undergraduate Research Mentoring Award *May 2021*
USC Viterbi Undergraduate Research Mentoring Award *May 2020*
USC Computer Science Best Research Assistant *May 2020*
USC Robotics George Bekey Service Award *May 2019*

Publications and Abstracts

* Indicates Co-first Author

[1] Nisha Chatwani*, Chloe Kuo*, **Thomas R. Groechel*** and Maja J. Matarić. "PoseToCode: Exploring Design Considerations toward a Usable Block-Based Programming and Embodied Learning System", Accepted in the Fifteenth International Conference on Advances in Computer-Human Interactions (ACHI 2022), Porto, Portugal, Jun-2022.

[2] Adam Wathieu*, **Thomas R. Groechel***, Haemin Jenny Lee, Chloe Kuo, and Maja J. Matarić. "RE:BT-Espresso: Improving Interpretability and Expressivity ofBehavior Trees Learned from Robot Demonstrations", Accepted in *2022 IEEE International Conference on Robotics and Automation (ICRA 2022)*, Philadelphia, PA, May-2022.

[3] İpek Göktan*, Karen Ly*, **Thomas R. Groechel***, and Maja J. Matarić "Augmented Reality Appendages for Robots: Design Considerations and Recommendations for Maximizing Social and Functional Perception" In *Refereed ACM/IEEE International Conference on Human Robot Interaction (HRI) Workshop on Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI 2022)*, Virtual, Mar-2022.

[4] Julia R. Cordero*, **Thomas R. Groechel***, and Maja J. Matarić "What and How Are We Reporting in HRI? A Review and Recommendations for Reporting Recruitment, Compensation, and Gender" In *Refereed ACM/IEEE International Conference on Human Robot Interaction (HRI) Workshop on Fairness and Transparency in HRI: Algorithms, Methods, and Metrics*, Jan 2022

[5] Zhonghao Shi, **Thomas R. Groechel**, Shomik Jain, Kourtney Chima, Ognjen Rudovic, and Maja J. Matarić. "Toward Personalized Affect-Aware Socially Assistive Robot Tutors in Long-Term Interventions for Children with Autism." Accepted in *Transactions on Human-Robot Interaction* (THRI 2022).

[6] **Thomas R. Groechel***, Michael E. Walker*, Christine T. Chang, Eric Rosen, and Jessica Zosa Forde. "A Tool for Organizing Key Characteristics of Virtual, Augmented, and Mixed Reality for Human-Robot Interaction Systems: Synthesizing VAM-HRI Trends and Takeaways." Accepted in *IEEE Robotics and Automation Magazine* (2022).

[7] **Thomas R. Groechel** and Maja J. Matarić "Abstract: Improving Bidirectional Communication in Human-Robot Interaction Through Mixed Reality Modalities", Accepted in Robotics Gordon Research Seminar (Jan 2022)

[8] Christine T. Chang, Eric Rosen, **Thomas R. Groechel**, Michael Walker, Jessica Zosa Forde "Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", Accepted in *Companion of the 2022 ACM/IEEE International Conference on Human-Robot Interaction (Companion-HRI '21)*, Virtual, Mar-2022.

[9] Matthew Rueben, Mohammad Syed, Emily London, Mark Camarena, Eunsook Shin, Yulun Zhang, Timothy S. Wang, **Thomas R. Groechel**, Rhianna Lee, and Maja J. Matarić. "Long-Term, In-the-Wild Study of Feedback About Speech Intelligibility for K-12 Students Attending Class via a Telepresence Robot", In *23rd International Conference on Multimodal Interaction (ICMI)*, Montreal, Canada, Oct-2021.

[10] Zhonghao Shi, Manwei Cao, Sophia Pei, Xiaoyang Qiao, **Thomas R. Groechel** and Maja J. Matarić. "Personalized Affect-Aware Socially Assistive Robot Tutors Aimed at Fostering Social Grit in Children with Autism", In *Refereed Workshop ACM/IEEE International Conference on Human Robot Interaction (HRI) Workshop on Child-Robot Interaction and Child's Fundamental Rights.*, Mar-2021.

[11] **Thomas R. Groechel**, Roxanna Pakkar, Roddur Dasgupta, Chloe Kuo, Haemin Lee, Julia Cordero, Kartik Mahajan, and Maja J. Matarić "Kinesthetic Curiosity: Towards Personalized Embodied Learning with a Robot Tutor Teaching Programming in Mixed Reality", In *17th International Symposium on Experimental Robotics (ISER)*, Virtual, Mar-2021.

[12] Eric Rosen, **Thomas R. Groechel**, Micahel Walker, Christine T. Chang, Jessica Zosa Forde "Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", In *Companion of the 2021 ACM/IEEE International Conference on Human-Robot Interaction (Companion-HRI '21)*, Virtual, Mar-2021.

[13] Kartik Mahajan*, **Thomas R. Groechel***, Roxanna Pakkar, Julia Cordero, Haemin Lee, Maja J. Matarić "Adapting Usability Metrics for a Socially Assistive, Kinesthetic, Mixed Reality Robot Tutoring Environment", In *Proceedings of 2020 International Conference on Social Robotics (ICSR '20)*, Colorado, USA, Nov-2020. *Best Paper Award Finalist (5 nominated out of 113)*

[14] Naomi T. Fitter, Luke M. Rush, Elizabeth Cha, **Thomas R. Groechel**, Maja J. Matarić, and Leila Takayama "Closeness is Key over Long Distances: Effects of Interpersonal Closeness on Telepresence Experience", In *Proceedings of 2020 ACM/IEEE International Conference on Human Robot Interaction (HRI '20)*, Cambridge, UK, Mar-2020.

[15] Tom Williams, Daniel Szafir, Tathagata Chakraborti, Ong Soh Khim, Eric Rosen, Serena Booth, **Thomas R. Groechel**, "Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", In *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction (Companion-HRI '20)*, Cambridge, UK, Mar-2020.

[16] Matthew Rueben, **Thomas R. Groechel**, Yulun Zhang, Gisele Ragusa, Maja J. Matarić "Increasing Telepresence Robot Operator Awareness of Speaking Volume Appropriateness: Initial Model Development", In *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction (Companion-HRI '20)*, Cambridge, UK, Mar-2020.

[17] **Thomas R. Groechel**, Zhonghao Shi, Roxanna Pakkar, and Maja J. Matarić "Using Socially Expressive Mixed Reality Arms for Enhancing Low-Expressivity Robots", In *2019 IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN '19)*, New Delhi, India, Oct-2019.
Robotics Society of Japan and Korean Robotics Society Distinguished Interdisciplinary Research Award Finalist (3 nominated out of 206)

Talks, Demos, and Presentations

Overview of Computer Science Capstone Course: Design and Construction of Large Software Systems
USC Viterbi Corporate Advisory Board Meeting *3 May 2022*

Visualizing Robot Capabilities using Augmented Reality: Designing with Co-Dependent Factors Poster
USC Viterbi Ph.D. Visit Day *3 Mar 2022*

Communicate, Share, Adapt: A Mixed Reality Framework for Facilitation Robot Integration and Customization Virtual Poster Presentation
NSF NRI 2.0 PI Meeting via Hopin *10 Mar 2021*

Guest Lecture: Online Features and Measures for K-12 Robot Computer Science Tutoring Through Mixed Reality Modalities
CSCI 699: Computational Human-Robot Interaction via Zoom *8 Mar 2021*

Robot Operating System (ROS) Tutorial and Demo
USC Makers Club via Zoom *4 Mar 2021*

Planning A Successful Summer Research Experience
USC Summer Research Program Talks via Zoom *1 June 2020*

Communicate, Share, Adapt: A Mixed Reality Framework for Facilitation Robot Integration and Customization Poster Presentation
NSF NRI 2.0 PI Meeting, Arlington, VA *27 Feb 2020*

Human-Robot Interaction & Socially Assistive Robots
Laguna Woods Village, Laguna Woods, CA *19 Feb 2020*

USC Robotics Visions & Voices: Emotionally Intelligent Robots Demo
University of Southern California, Los Angeles, CA *24 Oct 2019*

SAR Through Augmented Reality Extensions Demo and Discussion
Public Affairs Council, Laguna Beach, CA *8-9 Jan 2019*

Professional Service

Workshop Organizer

- "The Fifth International Workshop on Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", In *2022 ACM/IEEE International Conference on Human Robot Interaction (HRI '22)*
- "The Fourth International Workshop on Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", In *2021 ACM/IEEE International Conference on Human Robot Interaction (HRI '21)*
- "The Third International Workshop on Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (VAM-HRI)", In *2020 ACM/IEEE International Conference on Human Robot Interaction (HRI '20)*

Reviewer

- International Conference on Robot Human Interactive Communication 2022
- Robotics: Science and Systems 2022
- Virtual, Augmented, and Mixed Reality for Human-Robot Interaction Workshop at HRI 2020, 2021, & 2022
- Transactions on Human-Robot Interaction 2021 & 2022
- International Conference on Human Robot Interaction 2021 & 2022
- Frontiers in Robotics and AI 2021
- International Conference on Development and Learning 2021
- International Conference on Intelligent Robots and Systems 2021

– International Conference on Robotics and Automation 2021
– International Conference on Social Robotics 2020
– Applied Sciences 2020
– Science Robotics 2018

Women in US Academic Research in Robotics Website *July 2019 - Present*
– Designed and implemented, under Prof. Matarić's supervision, an actively curated and monitored list of current women in US academic robotics research
– Link: us-women-in-robotics-research.github.io

MEDIA COVERAGE **Letting Robots Guide The Learning Experience** *Spring 21*
Daniel Druhora, Viterbi Magazine https://magazine.viterbi.usc.edu/spring-2021/

CERTIFICATION **USC Center for Excellence in Teaching's Future Faculty Teaching Institute**
USC, Los Angeles, CA *Jan 2020 - May 2020*