MARIAH SCHRUM

Berkeley Artificial Intelligence Research (BAIR)
2121 Berkeley Way, Berkeley CA
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I work on deep learning algorithms for personalizing autonomous systems to account for heterogeneity in human-machine interaction. I believe that robots and AI systems must not only be designed to effectively perform the tasks for which they were intended, but they must also be optimized to work alongside humans.

EDUCATION

MAY 2023
PHD IN ROBOTICS, GEORGIA INSTITUTE OF TECHNOLOGY – GPA 4.0
ARMS Fellow
CORE Robotics Lab
Dissertation: "Data-Driven Personalization Techniques to Account for Heterogeneity in Human-Machine Interaction."

DEC 2020
MASTER'S IN COMPUTER SCIENCE, GEORGIA INSTITUTE OF TECHNOLOGY – GPA 4.0

MAY 2018
BIOMEDICAL ENGINEERING, JOHNS HOPKINS UNIVERSITY – GPA 3.7
B.S. in Biomedical Engineering, Minor in Mathematics & Robotics
Computer Integrated Interventional Systems Lab

AWARDS AND HONORS

Accessibility, Rehabilitation and Movement Science Fellowship, Recipient
Interdisciplinary traineeship program for integrating healthcare and engineering

Best Technical Paper Award – Conference On Human-Robot Interaction '22, Recipient
Awarded to paper for best technical advancement

Best Student Paper Award Finalist – Robotics: Science and Systems Conference '23, Recipient

College Of Engineering Travel Award – CRIDC 2023, Recipient

Awarded to best engineering poster at graduate poster competition

Best Poster Award – Institute for Robotics And Intelligent Machines Poster Competition 2022, Recipient
Awarded to best poster at robotics graduate poster competition

Executive Vice Provost Research Award – CRIDC 2022, Recipient

Awarded to best poster at graduate poster competition

Executive Vice Provost Research Award – CRIDC 2021, Recipient
Awarded to best poster at graduate poster competition

College Of Engineering Travel Award – CRIDC 2019, Recipient
Awarded to best engineering poster at graduate poster competition

Best Paper Award For Late-Breaking Reports, Conference On Human-Robot Interaction '19
Awarded to best and most promising, cutting-edge, early-stage research

Top Reviewer – International Conference On Artificial Intelligence And Statistics, Recipient
Selected as one of the top 10% of reviewers

HIP Grant: "Effects of The Addition Of A Single Bout Of Whole-Body Vibration To A Single Bout Of Treadmill Training On Gait And Spasticity In Ambulatory Children With Cerebral Palsy," Investigator
Awarded for work that aims to create, disseminate and apply knowledge in healthcare to benefit society

Pistritto Fellowship Grant, PURA Fellowship, STAR Grant, Recipient
Awarded to undergraduates to pursue cutting-edge research

RESEARCH EXPERIENCE

InterACT Lab, UC Berkeley **Berkeley, CA**
Postdoctoral Scholar with Anca Dragan 08/2023 to present

- Investigate reinforcement learning approaches for real world applications
- Focus on reinforcement learning for Deep Brain Stimulation

CORE Robotics Lab, Georgia Institute of Technology **Atlanta, GA**
Graduate Research Assistance with Professor Matthew Gombolay 01/2019 to present

- Developed a novel deep-learning approach in collaboration with Toyota Research Institute called MAVERIC for optimizing the driving style of autonomous vehicles to fit end-user preferences.
    - Demonstrated that MAVERIC can effectively mimic an end-user's driving style as well as modulate the level of aggression based upon end-user preferences
    - Conducted human subject study with 52 participants
- Developed MIND MELD, a personalized deep-learning framework for learning from suboptimal, heterogeneous demonstrators in learning from demonstration paradigms.
    - Demonstrated that MIND MELD outperforms baselines in human-centric and robot-centric LfD
    - Conducted human subject study with over 100 participants
- Created Reciprocal MIND MELD, a deep-learning based teaching framework for providing personalized robotic feedback to suboptimal humans.
    - Demonstrated that Reciprocal MIND MELD can effectively correct for end-user suboptimality.
    - Conducted human subject study with over 100 participants

- Developed safe meta-active learning algorithm to determine personalized parameter for asynchronous distributed microelectrode theta stimulation to reduce seizures in a rat's brain
- Developed safe meta-active learning algorithm for UAV damage recovery
- Designed safe active learning framework for aircraft control under failure
- Developed deep learning architectures for diagnosing lumbar spine disorders

Human Automation Systems Lab, Georgia Institute of Technology **Atlanta, GA**
Graduate Research Assistance with Professor Ayanna Howard 08/2018 to 01/2019

- Conducted human-robot interaction study investigating the effects of different forms of robot communication on trust
- Conducted preliminary work for a humanoid therapy robot for dementia patients
- Focused on healthcare applications and human-robot interaction

Computer-Integrated Interventional Systems Lab, Johns Hopkins University **Baltimore, MD**
Research Assistant with Professor Russell Taylor 09/2015 to 05/2018

- Designed and developed phantoms and tool interfaces for REMS surgical robot
- Worked as member of RoboELF surgical robot team in performing clinical trials
- Developed system to increase efficiency of malaria vaccine production
    - Used SolidWorks to design components which are 3D printed for testing
    - Built microprocessor controlled turn-table to automate vaccine production
    - Independently developed computer vision algorithm which was successful in automatically locating mosquito bodies and body features. This work was instrumental in receiving a 3 million dollar NSF research grant to fully automate the malaria vaccine production.
- Aided in design of pick and place robot and development of control and path planning algorithms

Neuroengineering and Biomedical Instrumentation Lab, Johns Hopkins University
Baltimore, MD
Research Assistant with Professor Nitish Thakor 01/2016 to 5/2016

- Aided in development and testing of electrodes for use in active actuator flexible socket

Member of Biomedical Engineering Design Team 01/2014 to 05/2014

- Developed automated oxygen regulation system for premature infants
- Developed specialized housing using SolidWorks and rapid prototyping techniques

PEER REVIEWED CONFERENCE AND JOURNAL PAPERS

[1] **M. Schrum,** E. Hedlund, and M. Gombolay. (2022). "Reciprocal MIND MELD: Improving Learning from Demonstration via Personalized, Reciprocal Teaching." In *Proceedings of the Conference on Robot Learning* [**39% Acceptance Rate**].

[2] **M. Schrum,** E. Sumner, M. Gombolay, and A. Best. (2023). "MAVERIC: A Data-Driven Approach to Personalized Autonomous Driving." arXiv:2301.08595.

[3] **M. Schrum*,** E. Hedlund*, N. Moorman, and M. Gombolay. (2022). "MIND MELD: Personalized Meta-Learning For Robot-Centric Imitation Learning." In *Proceedings of the International Conference on Human-Robot Interaction*. [**Best Paper Award, 25% Acceptance Rate**]

[4] **M. Schrum**, M. Connolly, E. Cole, M. Ghetiya, R. Gross, M. Gombolay. (2022). "Meta-active Learning in Probabilistically-Safe Optimization." In *IEEE Robotics and Automation Letters* with *International Conference on Intelligent Robots and Systems.*

[5] A. Silva, **M. Schrum,** E. Hedlund, N. Gopalan, and Matthew Gombolay. (2022). "xAI for Robotics: Evaluating Explainability and Developing Metrics via a Large-Scale User Study." In *International Journal of Human-Computer Interaction*.

[6] E. Seraj, J. Xiong, **M. Schrum,** and Matthew Gombolay. (2023). "Mixed-Initiative Multi-Agent Apprenticeship Learning for Human Training of Robot Team." Conference on Neural Information Processing Systems **[26% Acceptance Rate]**.

[7] N. Moorman*, N. Gopalan, A. Singh, E. Hedlund-Botti, **M. Schrum,** C. Yuang, L. Sheelman, and Matthew Gombolay. (2023). "Investigating the Impact of Experience on a User's Ability to Perform Hierarchical Abstractions." *Robots: Science and Systems* **[Best Student Paper Finalist]**.

[8] **M. Schrum***, G. Neville*, M. Johnson*, N. Moorman, R. Paleja, K. Feigh and M. Gombolay. (2021). "Effects of Social Factors and Team Dynamics on Adoption of Collaborative Robot Autonomy." In *Proceedings of the International Conference on Human-Robot Interaction* **[23% Acceptance Rate]**.

[9] **M. Schrum***, M. Johnson*, M. Ghuy*, M. Gombolay. (2022). "Concerning Trends in Likert Scale Usage in Human-Robot Interaction: Towards Improving Best Practices." In *ACM Transactions on Human-Robot Interaction*.

[10] S. Broida, **M. Schrum**, E. Yoon, A. Sweeney, M. Gombolay, S. T. Yoon. (2020). "Improving Surgical Triage in Spine Clinic: Predicting Likelihood of Surgery Using Machine Learning." In *Proceedings of the American Academy of Orthopedic Surgeons Annual Meeting.*

[11] **M. Schrum** and M. Gombolay. (2020). "When Your Robot Breaks: Active Learning During Plant Failure." In *IEEE Robotics and Automation Letters,* vol 5. no. 2, pp. 438-445.

[12] **M. Schrum** and M. Gombolay. (2020). When Your Robot Breaks: Active Learning During Plant Failure. In *IEEE International Conference on Robotics and Automation.*

[13] **M. Schrum***, M. Ghuy*, M. Johnson*, and M. Gombolay. (2020). "Four Years in Review: Statistical Practices of Likert Scales in Human-Robot Interaction Studies." In *Proceedings of the International Conference on Human-Robot Interaction* **[19% Acceptance Rate]**.

[14] **M. Schrum***, S. Ye*, G. Neville*, M. Gombolay, S. Chernova, and A. Howard. (2019). "Human Trust After Robot Mistakes: Study of the Effects of Different Forms of Robot Communication." In *IEEE International Conference on Robot and Human Interactive Communication.*

[15] **M. Schrum**, A. Canezin, S. Chakravarty, M. Laskowski, S. Comert, Y. Sevimli, G. Chirikjian, S. Hoffman, and R. Taylor. (2019) "An Efficient Production Process for Extracting Salivary Glands from Mosquitoes". arXiv:1903.02532 [q-bio.QM]

[16] **M. Schrum**, C, Park, A. Howard. (2019). "Humanoid Therapy Robot for Encouraging Exercise in Dementia Patients." In *Proceedings of the International Conference on Human-Robot Interaction.* [**Best Paper Award]**

[17] N. Moorman, E. Hedlund-Botti, **M. Schrum,** M. Natarajan, and M. Gombolay. (2023). "Impacts of Robot Learning on User Attitude and Behavior." *International Conference on Human-Robot Interaction.* **[25% Acceptance Rate]**

[18] K.M. Lee, A. Krishna, Z. Zaidi, R. Paleja, Z. Chen, E. Hedlund-Botti, **M. Schrum,** M. Gombolay. (2023). "The Effects of Robot Skill Level and Communication in Rapid, Proximate Human-Robot Collaboration." *International Conference on Human-Robot Interaction.* **[25% Acceptance Rate]**

[19] H. Phalen*, P. Vagdargi*, **M. Schrum**, S. Chakravarty, A Canezin, M. Pozin, I. Iorachita, S. Hoffman, G. Chirikjian, R. Taylor. (2020) "A Mosquito Pick-and-Place System for PfSPZ-based Malaria Vaccine Production." *IEEE Transactions on Automation Science and Engineering, Special Issue.*

[20] Chakravarty, S., Canezin, A., **Schrum, M**., Laskowski, M., Sevimli, Y., Chirikjian, G., ... & Hoffman, S. L. (2017). "Automation Triples Throughput Of Pfspz Malaria Vaccine Extraction From Mosquitoes With 20-Fold Reduction In Training Time." In *American Journal Of Tropical Medicine And Hygiene* (Vol. 97, No. 5, pp. 532-532). 8000 Westpark Dr, STE 130, Mclean, VA 22101 USA: Amer Soc Trop Med & Hygiene.

[21] Hazime, H., Rai, U., **Schrum, M**., Sim, B., Lee, K., Hoffman, S.L., Taylor, R.H. and Chakravarty, S. (2019). "Translating A Semi-Automated Mosquito Microdissection System For Manufacturing Pfspz Vaccines Under Cgmps." In *American Journal Of Tropical Medicine And Hygiene* (Vol. 101, pp. 326-326). 8000 Westpark Dr, Ste 130, Mclean, Va 22101 USA: Amer Soc Trop Med & Hygiene.

DOCTORAL CONSORTIUMS

[22] **M. Schrum,** and M. Gombolay. (2023). "Data-Driven Personalization Techniques to Account for Heterogeneity in Human-Robot Interaction." In *Robotics: Science and Systems. RSS Pioneers Doctoral Consortium.* **[22% Acceptance Rate]**.

[23] **M. Schrum,** E. Hedlund, and M. Gombolay. (2022). "Personalized Meta-Learning for Domain Agnostic Learning from Demonstration" In *Proceedings of the International Conference on Human-Robot Interaction: HRI Pioneers Doctoral Consortium.* **[29% Acceptance Rate]**.

WORKSHOPS AND OTHER VENUES

[24] **M. Schrum** and M. Gombolay. (2023). "Privacy and Personalization: Transparency, Acceptance, and the Ethics of Personalized Robots." In *Workshop on Social Robots Personalisation: at the Crossroads Between Engineering and Humanity.*

[25] **M. Schrum,** E. Hedlund, and M. Gombolay. (2022). "Towards Improving Life-Long Learning Via Personalized, Reciprocal Teaching" In *Life-Long Learning and Personalization in Long-Term Human-Robot Interaction (LEAP-HRI) Workshop.*

[26] **M. Schrum*,** E. Hedlund*, and M. Gombolay. (2021). "Improving Robot-Centric Learning from Demonstration via Personalized Embeddings." In *Artificial Intelligence for Human-Robot Interaction Symposium.*

[27] **M. Schrum**, E. Yoon, M. Gombolay, S. T. Yoon. (2020). "DeepTriage: A Deep Learning Approach to Efficiently Triaging Orthopedic Surgery Patients Based Upon Intake Questionnaires." In *Proceedings of the Lumbar Spine Research Society.*

[28] **M. Schrum** and M. Gombolay. (2019). "Improving Clinical Care of Pediatric Cerebral Palsy Patients with Inverse Reinforcement Learning." In *ICRA workshop: Human Movement Science for Physical Human-Robot Collaboration.*

[29] **M. Schrum** and M. Gombolay. (2019). "Mathematical Techniques for Improving Clinical Care of Cerebral Palsy Patients.' *In Southeastern Pediatric Research Conference.*

*CO-FIRST AUTHORS

PATENTS

[30] Inventor on Patent for Mosquito Salivary Gland Extraction Device and Methods of Use: #US10781419B2
[31] Inventor on Patent for Systems and Methods for Personalized Autonomous Driving: *Patent Pending*
[32] Inventor on Patent for System and Methods for Automated Deep Brain Stimulation Parameter Selection Via Meta-Active Learning of Evoked Potentials: *Patent Pending*

EXPERIENCE

Toyota Research Institute, *Human-Centered Autonomous Driving Intern* 05/2022 to 10/2022

- Develop novel, personalized machine learning techniques for optimizing autonomous vehicles
- Conduct human-subjects study investigating how to optimize human-vehicle relationship

Intuitive Surgical, *Software Intern* 05/2021 to 08/2021

- Worked on Ion surgical robot
- Developed computer vision, explainability, and activity recognition solutions for navigation team
- Improved prediction accuracy by over 10%

Galen Robotics, *Hardware Intern* 06/2017 to 09/2017

- Designed and developed components for the Mark 1.0 Galen surgical robot
- Aided in manufacturing and assembly of the robot
- Presented the robot at the AAO Otolaryngology Head and Neck Surgery Conference

Sonavex Inc, *SolidWorks Consultant* 10/2016 to 01/2017

- Designed a support structure for the testing of an ultrasound surgical marker
- Prototyped initial designs and iterated to develop final prototype
- Manufactured prototype via 3D printing

INVITED TALKS

Statistical Practices of Likert Scales in HRI

- Data Skeptic Podcast

Data-Driven Personalization Techniques to Account for Heterogeneity in Human-Machine Interaction

- Semiautonomous Seminar Series, University of California, Berkeley, March 2023

- Human-Robot Interaction Course, Georgia Institute of Technology, Feb 2023
- Colorado School of Mines Robotics Seminar Series, Jan 2023
- University of Colorado at Boulder, Jan 2023
- Human-AI Alignment Course, University of Utah, Nov 2022
- Konica Minolta, Tokyo, Japan. Oct 2022.

MIND MELD: Personalized Meta-Learning for Robot-Centric Imitation Learning

- Workshop on Machine Learning in Human-Robot Collaboration: Bridging the Gap**,** Sapporo, Japan. March 2022.
- Workshop on Human-Robot Interactive Learning, Sapporo, Japan. March 2022.

Safe and Efficient Adaptation of Interactive Robotic Systems

- Mines Interactive Robotics Research Lab Summer Speaker Series, Colorado School of Mines. July 2022
- Affective Intelligence and Robotics Laboratory, University of Cambridge. April 2022

Reciprocal MIND MELD: Improving Learning from Demonstration Via Personalized, Reciprocal Teaching

- Robograds Student Seminar Series, Georgia Institute of Technology. April 2022

PRESENTATIONS

"MAVERIC: A Data-Driven Approach to Personalized Autonomous Driving, February 2023. **Recipient of the College of Engineering Travel Award**

"MIND MELD: Personalized Meta-Learning For Robot-Centric Imitation Learning." CRIDC poster competition, February 2022. **Recipient of the Executive Vice Provost Research Award**

"Effects of Social Factors and Team Dynamics on Adoption of Collaborative Robot Autonomy." CRIDC poster competition, February 2021. **Recipient of the Executive Vice Provost Research Award**

"DeepTriage: A Deep Learning Approach to Efficiently Triaging Orthopedic Surgery Patients Based Upon Intake Questionnaires." **Podium Presentation** at the *Lumbar Spine Research Society,* November 2020*.*

"When Your Robot Breaks: Active Learning During Plant Failure". **Podium Presentation** at the *International Conference on Robotics and Automation*, May 2020.

"When Your Robot Breaks: Active Learning During Plant Failure". CRIDC poster competition, February 2020.

"Improving Clinical Care of Pediatric Cerebral Palsy Patients with IRL." ARMS Symposium poster presentation. April 2019.

"Humanoid Therapy Robot for Encouraging Exercise in Dementia Patients". CRIDC poster competition, February 2019. **Recipient of the College of Engineering Travel Award**

TEACHING

Foundations of Teaching and Learning Certificate 09/2021 to 05/2023

Completed certificate designed to teach participants about the fundamentals of pedagogy.

Georgia Institute of Technology Teaching Practicum 09/2021-12/2021

Delivered lectures, held office hours, and aided in creation and grading of assignments

Johns Hopkins PILOT Program 01/2016-05/2018

Tutor and PILOT Leader

MENTORING

Alicia Schildhauer, Masters of Computer Science, UC Berkeley	Fall 2023 - Present
Pruthvi Innamuri, Undergraduate Researcher, UC Berkeley	Fall 2023 - Present
Kishore Chidambaram, Undergraduate Researcher, UC Berkeley	Fall 2023 - Present
Michelle Pan, Undergraduate Researcher, UC Berkeley	Fall 2023- Present
Karthik Shaji, Masters of Computer Science Student, GT	Fall 2021 – Present
Viacheslav "Steve" Zakhorov, Masters of Computer Science Student, GT	Fall 2021 – Fall 2022
Nathaniel Belles, Masters of Robotics Student, GT	Fall 2021 – Present
Ziyang "John" Zhang, Undergraduate Researcher, GT	Spring 2020 – Fall 2022
Chris Wu, Undergraduate Researcher, GT	Fall 2021 - Present
Wendell Hom, Masters of Computer Science Student, GT	Spring 2020 – Fall 2021
Tanner Beard, Undergraduate Researcher, GT	Spring 2020 – Fall 2021
Nina Moorman, Undergraduate Researcher, GT	Fall 2020 – Spring 2021

ACADEMIC SERVICE

- Area Chair for *HRI Pioneers*
- Reviewer for *International Conference on Artificial Intelligence and Statistics* – **Top Reviewer**
- Reviewer for *IEEE/RJS International Conference on Intelligent Robots and Systems*
- Reviewer for *ACM/IEEE International Conference on Human-Robot Interaction.*
- Reviewer for *IEEE International Conference on Robotics and Automation.*
- Reviewer for *International Joint Conference on Artificial Intelligence.*
- Reviewer for *IEEE Conference on Robot and Human Interactive Communication.*
- Reviewer for *International Conference on Machine Learning*
- Reviewer for *Conference on Human Factors in Computing*
- Reviewer for *ACM Transactions on Human-Robot Interaction*

ACADEMIC COMMUNITY SERVICE

- Woodruff School Graduate Women – *Secretary*
- Georgia Tech Undergraduate Research – *Mentor*
- Johns Hopkins PILOT Program – *Tutor*