Zhonghao (Jonathan) Shi

Contact Information

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Research Statement

My research focuses on developing intelligent agents that can learn from, reason about, and interact with the real world by leveraging heterogeneous, noisy, and imperfect information from human-centered environments. More specifically, I work on: 1) designing and developing socially assistive robotic systems that can help people with special needs such as children with ASD; 2) applying machine learning and deep learning to enable human activity recognition in human-human/human-computer/human-robot interaction; 3) using reinforcement learning and multi-armed bandit algorithms to allow real-time personalization of interaction based on users' preferences.

Research Interests

Human-Computer Interaction, Robotics (Human-Robot Interaction), Computer Vision, Multimodal Machine Learning, Socially Assistive Robotics (SAR), Human Activity Recognition, Personalized Affective Computing, Assistive Educational Technology

Education

Ph.D., Computer Science, University of Southern California (USC)
– Research Advisor: Professor Maja J. Matarić
– GPA: 4.00/4.00 *Expected Dec 2024*

BSc, Computer Science, University of Southern California (USC)
– Research Advisor: Professor Maja J. Matarić
– GPA: 4.00/4.00 *Aug 2017 - May 2020*

BEng, Electronic and Electrical Engineering, University College London (UCL)
– Academic Advisor: Professor Martyn Fice
– GPA: 3.89/4.00 Sep 2015 - May 2017 (transferred)

Work Experience

USC Interaction Lab
Ph.D. Research Assistant, Los Angeles, CA *May 2020 - Present*
Advised by Professor Maja J. Matarić

- **Human-Computer/Human-Robot Interaction**: Developing an open-sourced socially assistive robot platform using the blossom robot with real-time multimodal sensing and socially interactive capabilities [github]; applying multi-armed bandit with correlated arms algorithms to enable preference personalization in social human-robot interaction settings [github]
- **Computer Vision**: Working on developing skeleton-based action recognition models with multimodal data for indoor human-human/human-computer/human-robot interaction
- **Applied Multimodal Machine Learning** Applied supervised/unsupervised domain adaptation to design personalized supervised machine learning models outperforming non-personalized baselines for affective recognition to detect cognitive affective states for children with ASD [github, paper]; Applied supervised machine learning methods to model user engagement from children with ASD [paper]

J.P.Morgan Chase & Co.
Summer Research Associate, New York, NY *Jun 2022 - August 2022*

- Working on applied machine learning projects with the aim of introducing and validating novel artificial intelligence research solutions in scientific publications.

USC Interaction Lab
Undergraduate Research Assistant, Los Angeles, CA *Jan 2018 - May 2020*
Advised by Professor Maja J. Matarić

- **VR/AR and Robotics** Integrated ROS into Unity 3D's C# environment along with software engineering using the Mixed Reality Toolkit for the Microsoft Hololens [paper]
- **Applied Machine Learning:** Trained both normal and individualized Bayesian Knowledge Tracing models to study the learning curves for individual participant with autism after studying with our socially assistive robot math tutor [paper]
- **Applied Machine Learning:** Developed a multimodal data processing pipeline to synchronize and synthesize a multimodal dataset collected from in-home SAR deployments

ARM Holdings
Computer Engineering Intern, Cambridge, United Kingdom *Jun 2017 - July 2017*

- Designed real-time operating system (RTOS) coursework in C on micro-controller Nucleo F401RE as part of the ARM University Program
- Documented RTOS education kit for ARM University Program

London Centre for Nanotechnology
Research Intern, Cambridge, United Kingdom *Aug 2016 - Sep 2016*

- Tested and validated the PCB board design for the open-source atomic force microscope (openAFM) project
- Translated design team's UX mockups into responsive, interactive features, using HTML/CSS and JavaScript

Publications:

* Indicates Co-first Author

Refereed Journal Articles

[1] **Shi, Z.**, Groechel, T.R., Jain, S., Chima, K., Rudovic, O. and Matarić, M.J., 2021. Toward Personalized Affect-Aware Socially Assistive Robot Tutors in Long-Term Interventions for Children with Autism. *ACM Transactions of Human-Robot Interaction (THRI)*.

[2] Jain, S., Thiagarajan, B., **Shi, Z.**, Clabaugh, C. and Matarić, M.J., 2020. Modeling engagement in long-term, in-home socially assistive robot interventions for children with autism spectrum disorders. *Science Robotics*, 5(39).

[3] Clabaugh, C., Mahajan, K., Jain, S., Pakkar, R., Becerra, D., **Shi, Z.**, Deng, E., Lee, R., Ragusa, G. and Matarić, M.J., 2019. Long-term personalization of an in-home socially assistive robot for children with autism spectrum disorders. *Frontiers in Robotics and AI*, 6, p.110.

Refereed Conference Papers

[4] Zhou, E.*, **Shi, Z.***, Qiao, X., Matarić, M.J. and Bittner A.K., 2021. Designing a Socially Assistive Robot to Support Older Adults with Low Vision. Proceedings of the *2021 International Conference on Social Robotics (ICSR)*.

[5] Groechel, T., **Shi, Z.**, Pakkar, R. and Matarić, M.J., 2019, October. Using socially expressive mixed reality arms for enhancing low-expressivity robots. Proceedings of the *2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)* (pp. 1-8). IEEE.

[6] Clabaugh, C., Jain, S., Thiagarajan, B., **Shi, Z.**, Mathur, L. and Mahajan, K., 2018. Attentiveness of children with diverse needs to a socially assistive robot in the home. Proceedings of the *2018 International Symposium on Experimental Robotics*.

Refereed Workshop or Short Papers

[7] Chen, H.*, **Shi, Z.***, Dennler, N., Humber, N. and Matarić, M.J., 2021. Your Voice of Mindfulness: Evaluating and Personalizing Text-to-Speech Voices for Mindfulness Practice *2022 IEEE International Conference on Robotics and Automation (ICRA 2022) Workshop on Sound for Robots.*

[8] **Shi, Z.** and Matarić, M.J., 2022. Recognizing Fine-Grained Cognitive-Affective Behaviors of Children with Autism Spectrum Disorder. Accepted in International Society for Research on Emotion conference.

[9] **Shi, Z.**, Cao, M., Pei, S., Tarbox, J.J. and Matarić, M.J., 2021. Toward Personalized Automated Annotation of Targeted Behaviors of Children with ASD in Robot-Assisted ABA Interventions. Proceedings of the *2021 Virtual Conference of Technology, Mind, and Behavior.* APA.

[10] **Shi, Z.**, Pei, S., Qiao X., Groechel T.R. and Matarić, M.J., 2021. Personalized Affect-Aware Socially Assistive Robot Tutors Aimed at Fostering Social Grit in Children with Autism. *ACM/IEEE International Conference on Human Robot Interaction (HRI) Workshop on Child-Robot Interaction and Child's Fundamental Rights.*

Honors and Awards

USC Robotics George Bekey Service Award	*May 2021*
USC Computer Science Award for Outstanding Research	*May 2020*
USC Computer Science Outstanding Student Award	*May 2020*
USC Provost Award (Top 1% of the Graduating Class)	*May 2020*
USC Provost's Undergraduate Research Fellowship	*Aug 2020*
USC Undergraduate Research Symposium First Award	*Apr 2019*
UCL Goldsmid Prize for Outstanding Students (Top 3 of the Class)	*May 2017*

Student Research Mentoring

Students

– Sophia Pei	Computational Biology, USC Undergraduate Student
– Lydia DiBlasio	Computer Science, USC Undergraduate Student
– Han Chen	Computer Science, USC Undergraduate Student
– Natalie Humber	Computer Science, USC Undergraduate Student
– Martin Liu	Computer Science, USC Undergraduate Student
– Flora Jia	Computer Science, USC Undergraduate Student
– Eunsook (Victoria) Shin	Computer Science, USC Undergraduate Student
– Maÿlis Whetsel	Computer Science, Columbia University Undergraduate Student
– Amanda Yao	Computer Science, UC Berkeley Undergraduate Student
– Riya Ranjan	SHINE program, High School Student
– Anishka Raina	SHINE program, High School Student
– Allen Wang	SHINE program, High School Student

Service

Reviewer

- MDPI AI 2022
- IEEE International Conference on Robot Human Interactive Communication (RO-MAN) 2022
- International Conference on Robotics and Automation (ICRA) 2021
- MDPI Brain Sciences 2020
- International Journal of Human-Computer Interaction 2020

K-12 Educational Outreach

Robotics Family Night
Monterey Hills Elementary, South Pasadena, CA *May 2019, Nov 2019*

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

USC Remote Robotics Open House
USC, Los Angeles, CA *May 2020*

RELEVANT COURSEWORK

Computer Science: Deep Learning, Advanced Computer Vision, Robotics, Machine Learning for Data Science, Computational Human-Robot Interaction, Applied Natural Language Processing, Multimodal Learning of Human Communication
Electronic Engineering: Digital Electronics, Analog Electronics, Control System

TECHNICAL SKILLS

Languages: Python, Java, Javascript, C/C++, C#, Bash, SQL, HTML, CSS
Libraries and Tools: Pytorch, MXNET, OpenCV, Tensorflow, Robot Operating System (ROS), Numpy, Pandas, Seaborn, Scikit-Learn, Hadoop/HBase, Git