

Joseph Campbell

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Research Interests: machine learning, explainable artificial intelligence, human-robot interaction, robotics

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EDUCATION

- Ph.D. in Computer Science**, Arizona State University 2016 – 2021
Advisors: Heni Ben Amor, Georgios Fainekos
Dissertation: Probabilistic Imitation Learning for Spatiotemporal Human-Robot Interaction
- M.S. in Computer Engineering**, Arizona State University 2013 – 2016
Advisor: Georgios Fainekos
Thesis: Traffic Light Status Detection Using Movement Patterns of Vehicles
- B.S. in Computer Science**, Arizona State University 2006 – 2010

ACADEMIC EXPERIENCE

- Carnegie Mellon University**, Postdoctoral Fellow 2021 – Present
PI: Katia Sycara
Topic: Explainable machine learning for human-AI interaction.
- Arizona State University**, Graduate Research Associate 2016-2021
Advisors: Heni Ben Amor and Georgios Fainekos
Topic: Probabilistic imitation learning for human-robot interaction.
- Osaka University**, Visiting Researcher Summer 2017, Fall 2018
Hosts: Koh Hosoda and Shuhei Ikemoto
Topic: Imitation learning for human-robot interaction with soft-robotics.
- Arizona State University**, Graduate Research Assistant 2013-2016
Advisor: Georgios Fainekos
Topic: Machine learning for traffic light detection; verification for autonomous vehicle networks.
- National University of Singapore**, Visiting Researcher Summer 2015
Host: Marcelo Ang
Topic: Real-time machine learning methods for traffic light detection in autonomous vehicles.

INDUSTRY EXPERIENCE

- Amazon AWS AI**, Applied Scientist Intern Fall 2020
Host: Sahika Genc
Topic: Visuomotor deep reinforcement learning for mobile robots.
- Google Brain**, Software Engineering Intern Summer 2020
Host: Alexander Toshev
Topic: Imitation learning for social navigation.
- RadiusAI**, Data Science Consultant 2020
Topic: Vision-based learning methods for robust object tracking.
- Honda Research Institute**, Research Intern Summer 2019
Host: Katsu Yamane
Topic: Imitation learning for human-robot social interactions.
- Intel**, Systems Engineer Intern 2014-2015
Topic: Linux kernel driver development.

Garmin, Software Engineer 2011-2014
Topic: Localization and data processing for automotive advanced driver assistance systems.

WebPT, Software Engineer 2009-2011
Topic: Back-end and front-end development for an electronic medical record web-based application.

PUBLICATIONS

PEER-REVIEWED CONFERENCE PAPERS

Y. Lu, Y. Qin, R. Zhai, A. Shen, K. Chen, Z. Wang, S. Kolouri, S. Stepputtis, **J. Campbell**, and K. Sycara **NeurIPS 2023**
Characterizing Out-of-Distribution Error via Optimal Transport.
Conference on Neural Information Processing Systems.

S. Stepputtis, **J. Campbell**, Y. Xie, Z. Qi, W. Zhang, R. Wang, S. Rangreji, M. Lewis, and K. Sycara **EMNLP 2023**
Long-Horizon Dialogue Understanding for Role Identification in the Game of Avalon with Large Language Models.
Conference on Empirical Methods in Natural Language Processing.

H. Li, Y.Q. Chong, S. Stepputtis, **J. Campbell**, D. Hughes, M. Lewis, and K. Sycara **EMNLP 2023**
Theory of Mind for Multi-Agent Collaboration via Large Language Models.
Conference on Empirical Methods in Natural Language Processing.

D. Hughes, H. Li, M. Chis, I. Oguntola, S. Stepputtis, K. Zheng, **J. Campbell**, K. Sycara, and M. Lewis **SMC 2023**
A Framework for Intervention-Based Team Support in Time Critical Tasks.
IEEE International Conference on Systems, Man, and Cybernetics.

J. Campbell, Y. Guo, F. Xie, S. Stepputtis, and K. Sycara **CoLLAs 2023**
Introspective Action Advising for Interpretable Transfer Learning.
Conference on Lifelong Learning Agents.

S. Baghat*, S. Stepputtis*, **J. Campbell**, and K. Sycara **CoLLAs 2023**
Sample-Efficient Learning of Novel Visual Concepts.
Conference on Lifelong Learning Agents.

X. Liu, G. Clark, **J. Campbell**, Y. Zhou, and H. Ben Amor **IROS 2023**
Enhancing State Estimation in Robots: A Data-Driven Approach with Differentiable Ensemble Kalman Filters.
IEEE/RSJ International Conference on Intelligent Robots and Systems.

Y. Guo, **J. Campbell**, S. Stepputtis, R. Li, D. Hughes, F. Fang, and K. Sycara **ICRA 2023**
Explainable Action Advising for Multi-Agent Reinforcement Learning.
IEEE International Conference on Robotics and Automation.

M. Drolet, **J. Campbell**, and H. Ben Amor **ICRA 2023**
Learning and Blending Robot Hugging Behaviors in Time and Space.
IEEE International Conference on Robotics and Automation.

R. Zabounidis*, **J. Campbell***, S. Stepputtis, D. Hughes, and K. Sycara **CoRL 2022**
Concept Learning for Interpretable Multi-Agent Reinforcement Learning.
Conference on Robot Learning.

S. Stepputtis, **J. Campbell**, M. Phielipp, S. Lee, C. Baral, and H. Ben Amor **NeurIPS 2020**
Language-Conditioned Imitation Learning for Robot Manipulation Tasks.
Conference on Neural Information Processing Systems. Spotlight (top ~4% submitted papers).

G. Clark, **J. Campbell**, and H. Ben Amor **CoRL 2020**
Learning Predictive Models for Ergonomic Control of Prosthetic Devices.
Conference on Robot Learning.

- J. Campbell** and K. Yamane ■ ICRA 2020
Learning Whole-Body Human-Robot Haptic Interaction in Social Contexts.
IEEE International Conference on Robotics and Automation.
- G. Clark, **J. Campbell**, S.M.R. Sorkhabadi, W. Zhang, and H. Ben Amor ICRA 2020
Predictive Modeling of Periodic Behavior for Human-Robot Symbiotic Walking.
IEEE International Conference on Robotics and Automation.
- K. Bagewadi, **J. Campbell**, and H. Ben Amor AAAI-HRI 2019
Multimodal Dataset of Human-Robot Hugging Interaction.
AAAI Fall Symposium on Artificial Intelligence for Human-Robot Interaction.
- J. Campbell**, A. Hitzmann, S. Stepputtis, S. Ikemoto, K. Hosoda, and H. Ben Amor ■ IROS 2019
Learning Interactive Behaviors for Musculoskeletal Robots Using Bayesian Interaction Primitives.
IEEE/RSJ International Conference on Intelligent Robots and Systems.
- J. Campbell**, S. Stepputtis, and H. Ben Amor ■ RSS 2019
Probabilistic Multimodal Modeling for Human-Robot Interaction Tasks.
Robotics: Science and Systems.
- J. Campbell** and H. Ben Amor ■ CoRL 2017
Bayesian Interaction Primitives: A SLAM Approach to Human-Robot Interaction.
Conference on Robot Learning.
- M.A. Jansen, K.S. Luck, **J. Campbell**, H. Ben Amor, and D.M. Aukes LM 2017
Bio-inspired Robot Design Considering Load-bearing and Kinematic Ontogeny of Cheloniodea Sea Turtles.
Conference on Biomimetic and Biohybrid Systems (Living Machines).
- K.S. Luck*, **J. Campbell***, M.A. Jansen*, D.M. Aukes, and H. Ben Amor RSS 2017
From the Lab to the Desert: Fast Prototyping and Learning of Robot Locomotion.
Robotics: Science and Systems.
- J. Campbell**, H. Ben Amor, M.H. Ang Jr., and G. Fainekos ■ ITSC 2016
Traffic Light Status Detection Using Movement Patterns of Vehicles.
IEEE International Conference on Intelligent Transportation Systems.
- U. Gupta, **J. Campbell**, U.Y. Ogras, R. Ayoub, M. Kishinevsky, F. Paterna, and S. Gumussoy ICCAD 2016
Adaptive Performance Prediction for Integrated GPUs.
IEEE/ACM International Conference on Computer Aided Design.
- J. Campbell**, C.E. Tuncali, P. Liu, T.P. Pavlic, U. Ozguner, and G. Fainekos ■ CASE 2016
Modeling Concurrency and Reconfiguration in Vehicular Systems: A Pi-Calculus Approach.
IEEE International Conference on Automation Science and Engineering.
- K. Kim, **J. Campbell**, W. Duong, Y. Zhang, and G. Fainekos CASE 2015
DisCoF+: Asynchronous DisCoF with Flexible Decoupling for Cooperative Pathfinding in Distributed Systems.
IEEE International Conference on Automation Science and Engineering.

PEER-REVIEWED WORKSHOP PAPERS

- X. Zhang, Y. Guo, S. Stepputtis, K. Sycara, and **J. Campbell** HmRI 2023
Explaining Agent Behavior with Large Language Models.
IROS Workshop on Human Multi-Robot Interaction.
- C. Zhang, S. Stepputtis, **J. Campbell**, K. Sycara, and Y. Xie GLFrontiers 2023
HiKER-SGG: Hierarchical Knowledge Enhanced Robust Scene Graph Generation.
NeurIPS Workshop on New Frontiers in Graph Learning.

- Y. Lu, Y. Qin, R. Zhai, A. Shen, K. Chen, Z. Wang, S. Kolouri, S. Stepputtis, **J. Campbell**, and K. Sycara **OTML 2023**
Characterizing Out-of-Distribution Error via Optimal Transport.
NeurIPS Workshop on Optimal Transport and Machine Learning.
- S. Bhagat, S. Stepputtis, **J. Campbell**, and K. Sycara **CVEU 2023**
Knowledge-Guided Short-Context Action Anticipation in Human-Centric Videos.
ICCV Workshop on AI for Creative Video Editing and Understanding.
- I. Oguntola, **J. Campbell**, S. Stepputtis, and K. Sycara **ToM 2023**
Theory of Mind as Intrinsic Motivation for Multi-Agent Reinforcement Learning.
ICML Workshop on Theory of Mind in Communicating Agents.
- Y. Lu, Z. Wang, R. Zhai, S. Kolouri, **J. Campbell**, and K. Sycara **TrustML-(un)Limited 2023**
Predicting Out-Of-Distribution Error With Confidence Optimal Transport.
ICLR Workshop on Pitfalls of Limited Data and Computation for Trustworthy ML.
- S. Stepputtis, **J. Campbell**, M. Phielipp, C. Baral, and H. Ben Amor **NeurIPS-WRL 2019**
Imitation Learning of Robot Policies by Combining Language, Vision and Demonstration.
NeurIPS Workshop on Robot Learning.
- J. Campbell**, C.E. Tuncali, T.P. Pavlic, and G. Fainekos **ICE 2016**
Toward Modeling Concurrency and Reconfiguration in Vehicular Systems.
Interaction and Concurrency Experience Satellite Workshop of DisCoTec.

BOOK CHAPTERS

- H. Kerner, **J. Campbell**, and M. Strickland 2022
Introduction to Machine Learning.
Machine Learning for Planetary Science.

PREPRINTS / UNDER REVIEW

- X. Zhang, Y. Guo, S. Stepputtis, K. Sycara, and **J. Campbell** 2023
Understanding Your Agent: Leveraging Large Language Models for Behavior Explanation.
arXiv:2311.18062.
- R. Zabounidis, I. Oguntola, K. Zhao, **J. Campbell**, S. Stepputtis, and K. Sycara 2023
Benchmarking and Enhancing Disentanglement in Concept Bottleneck Models.
arXiv:2312.00192

PATENTS

- K. Yamane and **J. Campbell** 2022
Physical Human-Robot Interaction.
US Patent No. 11,440,194.
- D.M. Aukes, H. Ben Amor, K. Luck, M. Jansen, and **J. Campbell** 2021
Systems and Methods for Rapid-Prototyped Robotic Device.
US Patent No. 11,148,286.

- : Indicates that I gave a corresponding conference talk.
* : Contributed equally.

HONORS AND AWARDS

- National Science Foundation**
East Asia and Pacific Summer Institutes (EAPSI) Fellowship - Japan 2017

Project: Multimodal Interaction Algorithm for Human-Robot Interaction with Biologically-Inspired Robots.
East Asia and Pacific Summer Institutes (EAPSI) Fellowship - Singapore 2015
Project: Object Recognition for the Purpose of Traffic Compliance of Autonomous Vehicles.

IEEE Robotics and Automation Society
Student Travel Award 2016

Arizona State University
Dean's Fellowship 2016 – 2020
GPSA Individual Travel Grant 2017, 2020
Provost's Scholarship 2006 – 2010

TEACHING EXPERIENCE

GUEST LECTURES

Human-Robot Interaction: Learning from People.
INFSCI 2935 Topics: Human-Robot Interaction, University of Pittsburgh 2023
18-867: Human-Robot Interaction, Carnegie Mellon University 2023

MENTORING ACTIVITIES

Research Mentor (Current)

Yue Guo (PhD), *CMU CSD*
Renos Zabounidis (PhD), *CMU RI*
Ini Oguntola (PhD), *CMU MLD*
Yuzhe Lu (MSML), *CMU MLD*
Sarathak Bhagat (MSR), *CMU RI*
Weihao Zeng (MSR), *CMU RI*
Muhan Lin (MSR), *CMU RI*
Shuyang Shi (MSR), *CMU RI*

Research Mentor (Past)

Xijia Zhang (BS), *CMU RI Summer Scholar* 2022
Zongyue Zhao (MSR), *CMU RI* 2021-2022
Akshay Dharmavarman (MSR), *CMU RI* 2021-2022
Aishwarya Jadhav (MLT), *CMU LTI* 2021-2022
Fiona Xie (BSAI), *CMU SCS* 2022-2023
Gus Brocchini (BS), *CMU RI Summer Scholar* 2022
Grace Su (BS), *CMU RI Summer Scholar* 2021
Michael Drolet (BS/MS), *ASU MSS* 2019-2021
Kunal Bagewadi (MS), *ASU CS* 2018-2019

Graduate LTI Capstone Mentor, Carnegie Mellon University 2021-2023
2022-2023: Xinyu Lu, Chenzhun Huang, Ruiyu Wang, Sanketh Rangreji, Tinglong Zhu, Zhengyang Qi
2021-2022: Noel Chen, Ying Chen, Haocheng Han

Undergraduate CIDSE Capstone Mentor, Arizona State University 2014-2018
2017-2018: Caleb Ripley, Zachary Lee, Nidhal Selmi, Anton Dahlin
2015-2016: Aaron James, Scott Krohn, Justin Willeman, Jeff Mehnert, Josh Lincoln
2014-2015: Brandon Caffie, Michael Storto, Nick Keohane, Rodolfo Torres, William Haselwood

INVITED TALKS

Bayesian Interaction Primitives: Imitation Learning for Human-Robot Interaction. 2021

Joseph Campbell

Waymo Research.

Social Navigation from Human Demonstrations. 2020

Google Brain.

Machine Learning and Predictive Biomechanics for Human-Robot Collaboration. 2019

IROS Workshop: Progress in Ergonomic Physical Human-Robot Collaboration.

Learning Whole-Body Human-Robot Haptic Interaction in Social Contexts. 2019

Honda Research Institute.

Learning Interaction Primitives for Human-Robot Collaboration and Symbiosis. 2019

RSS Workshop: AI + ACR.

Bayesian Interaction Primitives: A SLAM Approach to Human-Robot Interaction. 2017

Samsung Research.

Object Recognition for the Purpose of Traffic Compliance of Autonomous Vehicles. 2015

National University of Singapore, NSF EAPSI Research Program.

ACADEMIC SERVICE

ORGANIZATION AND LEADERSHIP ACTIVITIES

Organizing Committee

RSS Workshop: Articulate Robots: Utilizing Language for Robot Learning 2023

IROS Workshop: Human Theory of Machines and Machine Theory of Mind for Human-Agent Teams 2022

Program Committee

IROS Workshop: Synergies Between Learning and Interaction 2017

Conference Session Chair

ITSC Session: *Sensing, Vision, and Perception I* 2016

REVIEWING ACTIVITIES

Conference/Journal Paper Reviewer

Autonomous Robots (AURO)

AAAI Conference on Artificial Intelligence (AAAI)

IEEE International Conference on Automation Science and Engineering (CASE)

Conference on Robot Learning (CoRL)

Human-Robot Interaction (HRI)

International Conference on Learning Representations (ICLR)

IEEE International Conference on Robotics and Automation (ICRA)

IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

Conference on Neural Information Processing Systems (NeurIPS)

IEEE Robotics and Automation Letters (RA-L)

International Journal of Social Robotics (SORO)

IEEE Transactions on Human-Machine Systems (THMS)

Grant Reviewer

ASU GPSA Research Grant Reviewer 2018 – 2019

ASU GPSA Travel Grant Reviewer 2017 – 2019