

Joseph Campbell

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Academic Appointments

- 2024 – ···· **Assistant Professor**, Purdue University
Department of Computer Science
- 2021 – 2024 **Postdoctoral Fellow**, Carnegie Mellon University
Robotics Institute

Education

- 2016 – 2021 **Ph.D. in Computer Science**, Arizona State University
Dissertation: *Probabilistic Imitation Learning for Spatiotemporal Human-Robot Interaction*
Advisors: *Heni Ben Amor and Georgios Fainekos*
- 2013 – 2016 **M.S. in Computer Engineering**, Arizona State University
- 2006 – 2010 **B.S. in Computer Science**, Arizona State University

Academic and Industry Experience

- 2016 – 2021 **Graduate Research Associate**, Arizona State University
Topic: *Probabilistic machine learning for physical human-robot interaction*
- 2020 **Applied Scientist Intern**, Amazon AWS AI
Topic: *Visuomotor deep reinforcement learning for mobile robots*
- 2020 **Software Engineer Intern**, Google Brain
Topic: *Imitation learning for social navigation with mobile robots*
- 2019 **Research Intern**, Honda Research Institute
Topic: *Imitation learning for physical human-robot social interactions*
- 2017, 2018 **Visiting Researcher**, Osaka University
Topic: *Robot learning for physical human-robot interaction with soft-robotics*
- 2015 **Visiting Researcher**, National University of Singapore
Topic: *Real-time machine learning methods for traffic light detection in autonomous vehicles*
- 2014 – 2015 **Systems Engineer Intern**, Intel
Topic: *Linux kernel driver development for prototype hardware*
- 2011 – 2014 **Software Engineer**, Garmin
Topic: *Localization and data processing for automotive advanced driver assistance systems*
- 2009 – 2011 **Software Engineer**, WebPT
Topic: *Back-end and front-end development for an electronic medical record application*

Publications

Conference Proceedings

C . 1 ADAPTIVE ACTION ADVISING WITH DIFFERENT REWARDS.

- Y. Guo, X. Zhang, S. Stepputtis, **J. Campbell**, and K. Sycara. *CoLLAs*. 2024. **Oral**.
- C . 2 SHAPEGRASP: ZERO-SHOT TASK-ORIENTED GRASPING WITH LARGE LANGUAGE MODELS THROUGH GEOMETRIC DECOMPOSITION.
S. Li, S. Bhagat, **J. Campbell**, Y. Xie, W. Kim, K. Sycara, and S. Stepputtis. *IROS*. 2024.
- C . 3 HiKER-SGG: HIERARCHICAL KNOWLEDGE ENHANCED ROBUST SCENE GRAPH GENERATION.
C. Zhang, S. Stepputtis, **J. Campbell**, K. Sycara, and Y. Xie. *CVPR*. 2024.
- C . 4 SAMPLE-EFFICIENT LEARNING OF NOVEL VISUAL CONCEPTS.
S. Bhagat*, S. Stepputtis*, **J. Campbell**, and K. Sycara. *CoLLAs*. 2023. **Oral** ● **Presented**.
- C . 5 INTROSPECTIVE ACTION ADVISING FOR INTERPRETABLE TRANSFER LEARNING.
J. Campbell, Y. Guo, F. Xie, S. Stepputtis, and K. Sycara. *CoLLAs*. 2023.
- C . 6 LEARNING AND BLENDING ROBOT HUGGING BEHAVIORS IN TIME AND SPACE.
M. Drolet, **J. Campbell**, and H. Ben Amor. *ICRA*. 2023.
- C . 7 EXPLAINABLE ACTION ADVISING FOR MULTI-AGENT REINFORCEMENT LEARNING.
Y. Guo, **J. Campbell**, S. Stepputtis, R. Li, D. Hughes, F. Fang, and K. Sycara. *ICRA*. 2023.
- C . 8 A FRAMEWORK FOR INTERVENTION BASED TEAM SUPPORT IN TIME CRITICAL TASKS.
D. Hughes, H. Li, M. Chis, I. Oguntola, S. Stepputtis, K. Zheng, **J. Campbell**, K. Sycara, and M. Lewis. *SMC*. 2023.
- C . 9 THEORY OF MIND FOR MULTI-AGENT COLLABORATION VIA LARGE LANGUAGE MODELS.
H. Li, Y. Q. Chong, S. Stepputtis, **J. Campbell**, D. Hughes, M. Lewis, and K. Sycara. *EMNLP*. 2023.
- C . 10 ENHANCING STATE ESTIMATION IN ROBOTS: A DATA-DRIVEN APPROACH WITH DIFFERENTIABLE ENSEMBLE KALMAN FILTERS.
X. Liu, G. Clark, **J. Campbell**, Y. Zhou, and H. Ben Amor. *IROS*. 2023.
- C . 11 CHARACTERIZING OUT-OF-DISTRIBUTION ERROR VIA OPTIMAL TRANSPORT.
Y. Lu, Y. Qin, R. Zhai, A. Shen, K. Chen, Z. Wang, S. Kolouri, S. Stepputtis, **J. Campbell**, and K. Sycara. *NeurIPS*. 2023.
- C . 12 LONG-HORIZON DIALOGUE UNDERSTANDING FOR ROLE IDENTIFICATION IN THE GAME OF AVALON WITH LARGE LANGUAGE MODELS.
S. Stepputtis, **J. Campbell**, Y. Xie, Z. Qi, W. S. Zhang, R. Wang, S. Rangreji, M. Lewis, and K. Sycara. *EMNLP Findings*. 2023.
- C . 13 CONCEPT LEARNING FOR INTERPRETABLE MULTI-AGENT REINFORCEMENT LEARNING.
R. Zabounidis*, **J. Campbell***, S. Stepputtis, D. Hughes, and K. P. Sycara. *CoRL*. 2022.
- C . 14 LEARNING WHOLE-BODY HUMAN-ROBOT HAPTIC INTERACTION IN SOCIAL CONTEXTS.
J. Campbell and K. Yamane. *ICRA*. 2020. ● **Presented**.
- C . 15 LEARNING PREDICTIVE MODELS FOR ERGONOMIC CONTROL OF PROSTHETIC DEVICES.
G. Clark, **J. Campbell**, and H. Ben Amor. *CoRL*. 2020.
- C . 16 PREDICTIVE MODELING OF PERIODIC BEHAVIOR FOR HUMAN-ROBOT SYMBIOTIC WALKING.
G. Clark, **J. Campbell**, S. M. R. Sorkhabadi, W. Zhang, and H. Ben Amor. *ICRA*. 2020.
- C . 17 LANGUAGE-CONDITIONED IMITATION LEARNING FOR ROBOT MANIPULATION TASKS.
S. Stepputtis, **J. Campbell**, M. Phielipp, S. Lee, C. Baral, and H. Ben Amor. *NeurIPS*. 2020. **Spotlight**.
- C . 18 MULTIMODAL DATASET OF HUMAN-ROBOT HUGGING INTERACTION.
K. Bagewadi, **J. Campbell**, and H. Ben Amor. *AAAI-HRI*. 2019.
- C . 19 LEARNING INTERACTIVE BEHAVIORS FOR MUSCULOSKELETAL ROBOTS USING BAYESIAN INTERACTION PRIMITIVES.
J. Campbell, A. Hitzmann, S. Stepputtis, S. Ikemoto, K. Hosoda, and H. Ben Amor. *IROS*. 2019. ● **Presented**.

- C . 20 PROBABILISTIC MULTIMODAL MODELING FOR HUMAN-ROBOT INTERACTION TASKS.
J. Campbell, S. Stepputtis, and H. Ben Amor. *RSS*. 2019. ● **Presented**.
- C . 21 BAYESIAN INTERACTION PRIMITIVES: A SLAM APPROACH TO HUMAN-ROBOT INTERACTION.
J. Campbell and H. Ben Amor. *CoRL*. 2017. ● **Presented**.
- C . 22 BIO-INSPIRED ROBOT DESIGN CONSIDERING LOAD-BEARING AND KINEMATIC ONTOGENY OF CHELONIOIDEA SEA TURTLES.
A. Jansen, K. S. Luck, J. Campbell, H. Ben Amor, and D. M. Aukes. *Living Machines*. 2017.
- C . 23 FROM THE LAB TO THE DESERT: FAST PROTOTYPING AND LEARNING OF ROBOT LOCOMOTION.
K. S. Luck*, J. Campbell*, M. A. Jansen*, D. M. Aukes, and H. Ben Amor. *RSS*. 2017.
- C . 24 TRAFFIC LIGHT STATUS DETECTION USING MOVEMENT PATTERNS OF VEHICLES.
J. Campbell, H. Ben Amor, M. H. Ang, and G. Fainekos. *ITSC*. 2016. ● **Presented**.
- C . 25 MODELING CONCURRENCY AND RECONFIGURATION IN VEHICULAR SYSTEMS: A π -CALCULUS APPROACH.
J. Campbell, C. E. Tuncali, P. Liu, T. P. Pavlic, U. Ozguner, and G. Fainekos. *CASE*. 2016. ● **Presented**.
- C . 26 ADAPTIVE PERFORMANCE PREDICTION FOR INTEGRATED GPUS.
U. Gupta, J. Campbell, U. Y. Ogras, R. Ayoub, M. Kishinevsky, F. Paterna, and S. Gumussoy. *ICCAD*. 2016.
- C . 27 DISCoF+: ASYNCHRONOUS DISCoF WITH FLEXIBLE DECOUPLING FOR COOPERATIVE PATHFINDING IN DISTRIBUTED SYSTEMS.
K. Kim, J. Campbell, W. Duong, Y. Zhang, and G. Fainekos. *CASE*. 2015.

Journal Articles

- J . 1 LET ME HELP YOU! NEURO-SYMBOLIC SHORT-CONTEXT ACTION ANTICIPATION.
S. Bhagat, S. Li, J. Campbell, Y. Xie, K. Sycara, and S. Stepputtis. *RA-L*. 2024.

Workshop Papers

- W . 1 SYMBOLIC GRAPH INFERENCE FOR COMPOUND SCENE UNDERSTANDING.
A. Fnu, S. Stepputtis, S. Bhagat, J. Campbell, K. Lee, H. N. Mahjoub, and K. Sycara. *ICRA Workshop on Ontologies and Standards for Robotics and Automation*. 2024.
- W . 2 GEOMETRIC SHAPE REASONING FOR ZERO-SHOT TASK-ORIENTED GRASPING.
S. Li, S. Bhagat, J. Campbell, Y. Xie, W. Kim, K. Sycara, and S. Stepputtis. *ICRA Workshop on 3D Visual Representations for Robot Manipulation*. 2024.
- W . 3 A REWARD ANALYSIS OF REINFORCEMENT LEARNING FROM LARGE LANGUAGE MODEL FEEDBACK.
M. Lin, S. Shi, Y. Guo, B. Chalaki, V. Tadiparthi, S. Stepputtis, J. Campbell, and K. Sycara. *RLC Workshop on Reinforcement Learning Beyond Rewards*. 2024.
- W . 4 TRANSFER LEARNING VIA TEMPORAL CONTRASTIVE LEARNING.
W. Zeng, J. Campbell, S. Stepputtis, and K. Sycara. *ICRA Workshop on Multi-Agent Dynamic Games*. 2024.
- W . 5 KNOWLEDGE-GUIDED SHORT-CONTEXT ACTION ANTICIPATION IN HUMAN-CENTRIC VIDEOS.
S. Bhagat, S. Stepputtis, J. Campbell, and K. Sycara. *ICCV Workshop on AI for Creative Video Editing and Understanding*. 2023.
- W . 6 CHARACTERIZING OUT-OF-DISTRIBUTION ERROR VIA OPTIMAL TRANSPORT.
Y. Lu, Y. Qin, R. Zhai, A. Shen, K. Chen, Z. Wang, S. Kolouri, S. Stepputtis, J. Campbell, and K. Sycara. *NeurIPS Workshop on Optimal Transport and Machine Learning*. 2023.
- W . 7 PREDICTING OUT-OF-DISTRIBUTION ERROR WITH CONFIDENCE OPTIMAL TRANSPORT.
Y. Lu, Z. Wang, R. Zhai, S. Kolouri, J. Campbell, and K. Sycara. *ICLR Workshop on Pitfalls of Limited Data and Computation for Trustworthy ML*. 2023.

- W . 8 THEORY OF MIND AS INTRINSIC MOTIVATION FOR MULTI-AGENT REINFORCEMENT LEARNING.
I. Oguntola, **J. Campbell**, S. Stepputtis, and K. Sycara. *ICML Workshop on Theory of Mind in Communicating Agents*. 2023.
- W . 9 HiKER-SGG: HIERARCHICAL KNOWLEDGE ENHANCED ROBUST SCENE GRAPH GENERATION.
C. Zhang, S. Stepputtis, **J. Campbell**, K. Sycara, and Y. Xie. *NeurIPS Workshop on New Frontiers in Graph Learning*. 2023.
- W . 10 EXPLAINING AGENT BEHAVIOR WITH LARGE LANGUAGE MODELS.
X. Zhang, Y. Guo, S. Stepputtis, K. Sycara, and **J. Campbell**. *IROS Workshop on Human Multi-Robot Interaction*. 2023.
- W . 11 IMITATION LEARNING OF ROBOT POLICIES BY COMBINING LANGUAGE, VISION AND DEMONSTRATION.
S. Stepputtis, **J. Campbell**, M. Phielipp, C. Baral, and H. Ben Amor. *NeurIPS Workshop on Robot Learning*. 2019.
- W . 12 TOWARD MODELING CONCURRENCY AND RECONFIGURATION IN VEHICULAR SYSTEMS.
J. Campbell, C. Tuncali, T. Pavlic, and G. Fainekos. *Interaction and Concurrency Experience Satellite Workshop of DisCoTec*. 2016.

Book Chapters

- B . 1 INTRODUCTION TO MACHINE LEARNING.
H. Kerner, **J. Campbell**, and M. Strickland. *Machine Learning for Planetary Science*. 2022.

Patents

- P . 1 SYSTEMS AND METHODS FOR RAPID-PROTOTYPED ROBOTIC DEVICE.
D. M. Aukes, H. Ben Amor, K. Luck, M. Jansen, and **J. Campbell**. *US Patent No. 11,440,194*. 2022.
- P . 2 PHYSICAL HUMAN-ROBOT INTERACTION.
K. Yamane and **J. Campbell**. *US Patent No. 11,440,194*. 2022.

Honors and Awards

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| 2017 | National Science Foundation EAPSI Fellowship
East Asia and Pacific Summer Institutes - Japan
Project: <i>Multimodal Interaction Algorithm for Human-Robot Interaction with Biologically Inspired Robots</i> |
| 2015 | National Science Foundation EAPSI Fellowship
East Asia and Pacific Summer Institutes - Singapore
Project: <i>Object Recognition for the Purpose of Traffic Compliance of Autonomous Vehicles</i> |
| 2016 | IEEE Robotics and Automation Society Student Travel Award |
| 2017, 2020 | Arizona State University GPSA Travel Grant |
| 2016-2020 | Arizona State University Dean's Fellowship ■ Awarded to ~4% of PhD students |
| 2006-2010 | Arizona State University Provost's Scholarship |

Invited Talks

- 2024 **Explainable Machine Learning for Robotics**
Columbia University
Purdue University
University of Colorado Boulder
Tufts University
Polytechnique Montréal
University of Massachusetts Lowell
- 2024 **Human-Robot Interaction: Learning from People**
Carnegie Mellon University: 18-867 Human-Robot Interaction
University of Pittsburgh: INFSCI 2935 Human-Robot Interaction
- 2021 **Imitation Learning for Human-Robot Interaction**
Waymo Research
- 2020 **Social Navigation from Human Demonstrations**
Google Brain Robotics
- 2019 **Machine Learning and Predictive Biomechanics for Human-Robot Collaboration**
IROS Workshop: Progress in Ergonomic Physical Human-Robot Collaboration
- 2019 **Learning Whole-Body Human-Robot Haptic Interaction**
Honda Research Institute
- 2019 **Learning Interaction Primitives for Human-Robot Collaboration and Symbiosis**
RSS Workshop: AI + ACR
- 2017 **Bayesian Interaction Primitives: A SLAM Approach to Human-Robot Interaction**
Samsung Research
- 2015 **Object Recognition for the Purpose of Traffic Compliance of Autonomous Vehicles**
National University of Singapore: NSF EAPSI Research Program

Mentoring Activities

Research Mentor (Current)

Renos Zabounidis	PhD	CMU, RI
Ini Oguntola	PhD	CMU, MLD
Muhan Lin	MSR	CMU, RI
Shuyang Shi	MSR	CMU, RI

Research Mentor (Past)

Yue Guo	PhD	CMU, CSD	→ TikTok, Research Scientist
Weihao Zeng	MSR	CMU, RI	→ Tesla, Machine Learning Engineer
Sarthak Bhagat	MSR	CMU, RI	→ Scaled Foundations, Research Engineer
Yuzhe Lu	MSML	CMU, MLD	→ Amazon, Applied Scientist
Xijia Zhang	BS	University of Michigan	→ Georgia Tech, PhD
Zongyue Zhao	MSR	CMU, RI	→ Google, Software Engineer
Akshay Dharmavaran	MSR	CMU, RI	
Aishwarya Jadhav	MLT	CMU, LTI	
Fiona Xie	BSAI	CMU, SCS	→ Netflix, Software Engineer
Gus Brocchini	BS	Yale University	→ D.E. Shaw, Software Engineer

Grace Su	BS	Columbia University	→ CMU, MS
Michael Drolet	BS/MS	ASU, MSS	→ TU Darmstadt, PhD
Kunal Bagewadi	MS	ASU, CS	

Service

Organizing Committee

2023 **RSS Workshop** Articulate Robots: Utilizing Language for Robot Learning
2022 **IROS Workshop** Human Theory of Machines and Machine Theory of Mind for Human-Agent Teams

Conference and Journal Reviewer

AAAI Conference on Artificial Intelligence (AAAI)
ACL Rolling Review (ARR)
IEEE International Conference on Automation Science and Engineering (CASE)
Conference on Robot Learning (CoRL)
IEEE/CVF Computer Vision and Pattern Recognition Conference (CVPR)
Human-Robot Interaction (HRI)
International Conference on Learning Representations (ICLR)
International Conference on Machine Learning (ICML)
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)
Robotics and Automation Magazine (RAM)
Robotics: Science and Systems (RSS)
International Journal of Social Robotics (SORO)
IEEE Transactions on Human-Machine Systems (THMS)

Other Activities

Arizona State University: GPSA Research Grant Reviewer
Arizona State University: GPSA Travel Grant Reviewer