

SUNNY AMATYA

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Summary:

I am a research engineer modeling humans in human-robot interaction (HRI). Fundamentally, I work with ideas such as primitive, intermittency, and transfer, which are common human qualities with strong mathematical and control backing. I have a strong background in reinforcement learning, deep learning, intent inference, and planning algorithms. My research involves efficiently modeling humans in tightly coupled interactions, this includes accurate prediction of intent, motion, and reward(value) of the agents in various real-world applications.

Education:

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| • PhD in Systems Engineering Arizona State University (ASU) | 09/2018 - <i>estimated</i> (11/2024) |
| • MSc in Robotics Università degli studi di Genova, Italy | 09/2017 - 09-2018 |
| • Masters in Advanced Robotics École Centrale de Nantes, France | 09/2016 - 07/2017 |
| • BSE in Mechatronics Engineering Asian Institute of Technology (AIT) | 09/2011 - 05/2015 |
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Professional Experience:

Graduate Researcher - Robotics and Intelligent Systems Laboratory, ASU 05/2019- Present

Developed algorithms including deep learning and reinforcement learning techniques to address the research problem in modeling human behavior in human-robot interaction. This includes algorithms in intent inference, motion planning, and value transfer. Worked as a part of a larger team and ensured project completion in the following projects.

Transfer learning | Deep Learning, Multi-Agent Reinforcement Learning, Planning

- Implementation of Successor Feature-based Multi-Agent Reinforcement Learning (MARL) Algorithm to test transfer in a turn-based game. Successfully conducted transfer experiment with reduced cost function in transfer between models. Contraction proof for the proposed transfer in the Markov game model.
- Implemented Successor feature for transfer learning in planning algorithms like MCTS to perform multi-step inference and verified in Interaction Dataset.

Efficient Human Modeling | Reinforcement Learning, Intent Inference, Optimization

- Implemented a Reinforcement Learning algorithm to test the cost and benefits of calculating equilibrium parameters in incomplete information dynamic games. Using a two-vehicle uncontrolled intersection case, the proposed algorithm reduces the computation cost of updates by 59% when agents have full observations of physical states. Implementation of lane-changing scenario for generation of Hamilton-Jacobi-Bellman Solution for multi-agent interaction.
- Published papers in top venues for control and robotics (ACC, ICRA)

Tightly Coupled Interaction | Motion Primitive, Human Learning, pHRI

- Implementation and testing of Dynamic Movement Primitives (DMP) for learning human walking in a three-legged walking scenario. DMP modeling of human walking can better predict

human gait between interactions as well as within interactions with 45% higher accuracy than the baseline algorithm. Quantifying human behavior using Bounded Rationality in upper limb physical Human-Robot Interaction using NOVIT Falcon. Published paper in ACC and IROS

Identification of Research Needs and SOTA in HRI | Thematic Analysis, Literature Review

- Literature Review and Identification of Latent Dynamics in Human-Robot Interaction. Identification of models used for Mutual Adaptation and Influence. Work submitted to a reputed journal, THMS
- Thematic Analysis from responses from participants of industry, academia, and defense on the requirements for a Human-Autonomy Teaming Testbed. Work published in RO-MAN 2024.

Graduate Researcher - Bio-Inspired Robotics Laboratory, ASU

09/2018- 05/2019

Fabricated and tested soft robots. This included fabricating soft robots using fabric and silicone and characterizing soft robots to build control models for the soft robots and testing in real-life applications.

Soft Robots | Rapid Prototyping, Sensor Characterization

- Fabrication of anthropomorphic soft ankle prosthesis and testing of fabric-based soft robotic ankle mimicking human torque during walking. Fabricated and characterized soft sensors. Published **three** works in ICORR and Robosoft

Graduate Researcher - DIBRIS, UNIGE

12/2017- 09/2018

Developed planning and prediction model for task and motion planning in multi-agent systems.

Goal-Based Cooperation and Reasoning for Heterogeneous Robots | Planning, Reasoning

- Developed High-level planning using predicate logic for controlling aerial and mobile robots
Developed hybrid planning for cooperative task and motion planning using SOTA PDDL+ planner in ROS using C++. Results presented in AAI Fall Symposium, I-RIM

Research Assistant - Vision and Graphics Lab, AIT

10/2015 – 07/2016

Developed Vision-based algorithm for object detection and tracking in low-frame rate videos

Computer Vision

- Completed a project on HOG detection and tracking models for low-frame rate videos.
- Conducted research on supervised learning methods such as SVM, pattern recognition, feature-keypoint detection, and mathematical modeling

Technical Skills

- **Programming Language / Framework:** Python, C++, MATLAB, ROS
- **Libraries:** Tensorflow, PyTorch, Keras, Numpy
- **Miscellaneous:** Simulation tools(Gazebo, Meta-Drive, Commonroad-RL, Overcooked-AI), Linux(Ubuntu)

Publications:

Sunny Amatyia, and Wenlong Zhang “*Successor Feature for Transfer in Games*” in the IEEE Robotics and Automation Society (RA-L) 2024 (In the process of submission)

Mason Smith, **Sunny Amatyia**, Seyed Yousef Soltanian, Jonathan Bush, and Wenlong Zhang “*Mutual Adaptation and Influence: Survey of Latent Dynamics Models in Human-Robot Interaction*” in IEEE

Transactions on Human-Machine Systems (THMS) 2024 (In Review)

Sunny Amatya, Mason Smith, Ashish Amresh, Jamie Gorman, Matthew Johnson, Nancy Cooke, and Wenlong Zhang “*Research Needs in Human-Autonomy Teaming: Thematic Analysis of Priority Features for Testbed Development*” in the IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), 2024

Yiwei Wang, Pallavi Shintre, **Sunny Amatya**, and Wenlong Zhang “*Bounded Rational Game-theoretical Modeling of Human Cooperation under Incomplete Information*” in International Conference on Intelligent Robots and Systems (IROS), 2022

Sunny Amatya, Mukesh Ghimire, Yi Ren, Zhe Xu, and Wenlong Zhang “*When Shall I Estimate Your Intent? Costs and Benefits of Intent Inference in Multi-Agent Interactions*” in American Control Conference (ACC), 2022

Yi Chen, Lei Zhang, Tanner Merry, **Sunny Amatya**, Wenlong Zhang, Yi Ren. “*When Shall I Be Empathetic? The Utility of Empathetic Parameter Estimation in Multi-Agent Interactions*” in IEEE International Conference of Robotics and Automation (ICRA), 2021

Pham H. Nguyen, Zhi Qiao, Sam Seidel, **Sunny Amatya**, Imran I. B. Mohd, and Wenlong Zhang “*Towards an Untethered Knit Fabric Soft Continuum Robotic Module with Embedded Fabric Sensing*” in the IEEE International Conference of Soft Robotics (RoboSoft), 2020

Sunny Amatya, Seyed Mostafa Rezayat Sorkhabadi, and Wenlong Zhang “*Human Learning and Coordination in Lower-limb Physical Interactions*” in American Control Conference (ACC), 2020

Antony Thomas, **Sunny Amatya**, Fulvio Mastrogiovanni and Marco Baglietto. “*Task-assisted Motion Planning in Belief Space*” in Italian Conference on Robotics and Intelligent Machines (I-RIM), 2019

Sunny Amatya, Amir Salimi Lafmejani, Souvik Poddar, Saivimal Sridar, Thomas Sugar, Panagiotis Polygerinos “*Design, Development, and Control of a Fabric-Based, Soft Ankle Module to Mimic Human Ankle Stiffness*” in International Conference on Rehabilitation Robotics (ICORR), 2019

Pham H. Nguyen, Saivimal Sridar, **Sunny Amatya**, Carly M. Thalman, Panagiotis Polygerinos. “*Fabric Soft Grippers Capable of Selective Distributed Bending for Assistance of Daily Living Tasks*” in IEEE International Conference of Soft Robotics (RoboSoft), 2019

Antony Thomas, **Sunny Amatya**, Fulvio Mastrogiovanni, and Marco Baglietto. “*Towards Perception Aware Task and Motion Planning*” in AAAI 2018 Fall Symposium, 2018

Antony Thomas, **Sunny Amatya**, Fulvio Mastrogiovanni and Marco Baglietto. “*Task-Motion Planning in Belief Space*” in RSS Workshop on Exhibition and Benchmarking of Task and Motion Planners, 2018

Sunny Amatya and Somrak Petchartee. “*Real-time Kinect-based robotic arm manipulation with five degrees of freedom.*” in IEEE Asian Conference on Defence Technology (ACDT), 2015

Awards

- Block Grant University Graduate Fellowship by The Polytechnic School, ASU for Spring 2020, Fall 2023
- American Control Conference (ACC) Travel Award 2022, 2023
- Graduate Collage Travel Award by the Graduate School, ASU for 2022
- Robotics Science and System (RSS) Inclusion Award 2020
- European Masters in Advanced Robotics (EMARO+) scholarship for 2016-2018
- Asian Institute of Technology (AIT) fellowship on a merit basis for 2012, 2013, and 2014 with 6

dean's list.

- Top 10 in Thai Ariel Mission Engineering Challenge (TAMECH), representing AIT
- Awarded scholarship in High School for active participation in co-curricular activities