Yaru Niu

404-451-6366 | chrisyrniu.github.io | yarun@andrew.cmu.edu | github.com/chrisyrniu

EDUCATION

Carnegie Mellon University   Pittsburgh, PA
Ph.D. in Mechanical Engineering, Safe AI Lab   *Aug. 2022 – Present*
Advisor: Prof. Ding Zhao

Gerogia Institute of Technology   Atlanta, GA
M.S. in Electrical and Computer Engineering, CORE Robotics Lab   *Aug. 2019 – April 2022*
Advisor: Prof. Matthew Gombolay

South China University of Technology (SCUT)   Guangzhou, China
B.Eng. in Intelligence Science and Technology   *Sep. 2015 – June 2019*
Advisor: Prof. Zhijun Zhang

University of California, Irvine   Irvine, CA
Visiting Student in Department of EECS   *June 2018 – Aug. 2018*

University of California, Berkeley   Berkeley, CA
Exchange Student, Concentration in Computer Science   *Aug. 2018 – Dec. 2018*

PUBLICATIONS

(* indicates co-first authors)

1. Lingfeng Sun*, Chen Tang*, **Yaru Niu**, Enna Sachdeva, Chiho Choi, Teruhisa Misu, Masayoshi Tomizuka, Wei Zhan. Domain Knowledge Driven Pseudo Labels for Interpretable Goal-conditioned Interactive Trajectory Prediction. *International Conference on Intelligent Robots and Systems (IROS)*, 2022.

2. **Yaru Niu**. Adaptable and Scalable Multi-Agent Graph-Attention Communication. *Master's Thesis, Georgia Institute of Technology*, 2022.

3. Rohan Paleja*, **Yaru Niu***, Andrew Silva, Chace Ritchie, Sugju Choi, Matthew Gombolay. Learning Interpretable, High-Performing Policies for Autonomous Driving. *Robotics: Science and Systems (RSS)*, 2022.

4. **Yaru Niu***, Rohan Paleja*, Matthew Gombolay. Multi-Agent Graph-Attention Communication and Teaming. *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, 2021 (**Oral**).

5. **Yaru Niu***, Rohan Paleja*, Matthew Gombolay. MAGIC: Multi-Agent Graph-Attention Communication. *Mair2 Workshop at International Conference on Computer Vision (ICCV)*, 2021 (**Best Paper Award**).

6. Zhijun Zhang*, **Yaru Niu***, Ziyi Yan, Shuyang Lin. Real-time Whole-body Imitation by Humanoid Robots and Task-oriented Teleoperation Using an Analytical Mapping Method and Quantitative Evaluation. *Applied Sciences (Special Issue Human-Friendly Robotics, Impact Factor: 2.217)*, 2018.

7. Zhijun Zhang, **Yaru Niu**, Shangen Wu, Shuyang Lin, Lingdong Kong. Analysis of Influencing Factors on Humanoid Robots' Emotion Expressions by Body Language. *International Symposium on Neural Networks (ISNN), Lecture Notes in Computer Science (LNCS), Springer*, 2018.

8. Zhijun Zhang, Lingdong Kong, **Yaru Niu**. A Time-Varying-Constrained Motion Generation Scheme for Humanoid Robot Arms. *International Symposium on Neural Networks (ISNN), Lecture Notes in Computer Science (LNCS), Springer*, 2018.

PREPRINTS

(* indicates co-first authors)

1. Zhijun Zhang (PI), Lingdong Kong, **Yaru Niu**, Ziyang Liang. Modification of Gesture-Determined-Dynamic Function with Consideration of Margins for Motion Planning of Humanoid Robots. *arXiv Preprint*, 2020.

PATENTS

1. Zhijun Zhang, **Yaru Niu**. A Mapping Method of Human Postures Applied to Motion Imitation by Humanoid Robots (Translated from Chinese). *Published Authorization Number: CN107953331B.*

2. Zhijun Zhang, **Yaru Niu**. A Similarity Evaluation Method of Imitation by Humanoid Robots (Translated from Chinese). *Published Authorization Number: CN107818318B.*

3. Zhijun Zhang, **Yaru Niu**, Hao Wang. A Mapping Method of Human Body's Rotation and Displacement Applied to Humanoid Robots (Translated from Chinese). *Published Authorization Number: CN108858188B.*

4. Zhijun Zhang, **Yaru Niu**, Hao Wang. An Evaluation Metric of Humanoid Robot and Human Posture Similarity (Translated from Chinese). *Published Application Number: CN109064486A.*

RESEARCH EXPERIENCE

Baidu Research — Jan. 2022 – Present
Research Intern, Robotics and Autonomous Driving Lab (RAL) — *Advisor: Dr. Liangjun Zhang*
– Hierarchical Multi-Agent Reinforcement Learning
  • Designed a hierarchical multi-agent reinforcement learning algorithm for long-term heterogeneous tasks in construction scenarios.
– Reinforcement Learning for Excavation
  • Designed a reinforcement learning scheme for excavation behaviors with sparse rewards in SoftGym.

University of California, Berkeley — July 2021 – Feb. 2022
Research Intern, Mechanical Systems Control (MSC) Lab — *Advisor: Prof. Masayoshi Tomizuka*
– Project: Incorporating Logical Prior Knowledge into Goal-conditioned Interactive Trajectory Prediction
  • Processed and visualized data from the Waymo Open Dataset, implemented VectorNet from scratch with PyTorch Geometric to encode contextual and agent information on the map, and built out the goal-based interactive motion prediction model revised from DenseTNT.
  • Incorporated logical rule (e.g., speed limit in stop regions) regularization into the motion prediction model.
  • Completed a second-author paper published in *IROS 2022*).

Georgia Institute of Technology — Jan. 2020 – May 2022
Graduate Research Assistant, Cognitive Optimization and Relational Robotics Lab — *Advisor: Prof. Matthew Gombolay*
– Project: Multi-Agent Graph-Attention Communication
  • Proposed a fully differentiable scalable multi-agent communication protocol in which we learn 1) a Scheduler to decide when to communicate and whom to address messages to, and 2) a Message Processor using a designed Graph Attention Networks (GATs) with differentiable dynamic graphs to deal with communication signals.
  • Implemented the proposed method with PyTorch in Google Research Football, Traffic Junction and Predator-Prey environments, compared to the baselines such as CommNet, IC3Net, TarMAC and GA-Comm.
  • Completed a first-author paper published in *AAMAS 2021* (**Oral Presentation**) and presented at ICCV 2021 Mair2 Workshop (**Best Paper Award**).

– Project: Continuous Differentiable Decision Trees
  • Proposed a differentiable crispification method to train interpretable crisp decision trees with sparse linear sub-models in general reinforcement learning frameworks.
  • Implemented the proposed method with SAC and TD3 in continuous domains including Cart Pole, Lunar Lander and several autonomous driving scenarios with PyTorch; implemented imitation learning baselines on decision trees including CART and DAGGER.
  • Completed a co-first-author paper published in *RSS 2022*.

South China University of Technology — Aug. 2016 – June 2019
Undergraduate Researcher, Bionic Intelligent Robot (BIR) Lab — *Advisor: Prof. Zhijun Zhang*
– Project: Whole-Body Imitation by Humanoid Robots and Task-Oriented Teleoperation
  • Designed a novel whole-body imitation and teleoperation system on humanoid robots, and proposed an analytical motion mapping method called Geometrical Analysis Based on Link Vectors and Virtual Joints.
  • Designed gesture imitation learning methods on our proposed system using Dynamic Time Warping, Gaussian Mixture Model, Gaussian Mixture Regression and Semi-Hidden Markov Model.
  • Completed a co-first-author paper published in *Applied Sciences*, and three authorized patents.

– Project: Analysis of Influencing Factors on Humanoid Robots' Emotion Expressions by Body Language

- Designed the pilot study and experiment to investigate people's perception of the emotions conveyed by body language, and tested the hypothesis using two-sample T test and Mann-Whitney U test.
- Completed a second-author paper (PI as the first author) published in *ISNN 2018*.

University of California, Irvine Summer 2018

Undergraduate Researcher, Advanced Integrated Cyber-Physical Systems (AICPS) Lab *Advisor: Prof. Al Faruque*

– Project: DietMate – A Multimodal Diet Monitoring System

- Collected, processed and extracted features from the time-series data obtained from the piezo sensor, the strain sensor and the microphone, using NumPy, SciPy, and Pandas libraries.
- Trained classification models to estimate human behaviors using Scikit-learn and Tensorflow.

TEACHING EXPERIENCE

CS 4731/7632 Game Artificial Intelligence June 2020 – Dec. 2020

Graduate Teaching Assistant, Georgia Institute of Technology *Instructor: Dr. Stephen Lee-Urban*

CS 4641 Machine Learning Jan. 2021 – May 2021

Graduate Teaching Assistant, Georgia Institute of Technology *Instructor: Dr. Nakul Gopalan*

RELEVANT GRADUATE COURSES

Statistical Machine Learning, Georgia Tech, A (score 99.06%) Spring 2021

Human-Robot Interaction, Georgia Tech, A (score 99.80%) Fall 2020

Deep Learning, Georgia Tech, A (score 100.68%) Spring 2020

Probabilistic Graphical Models in Machine Learning, Georgia Tech, A (score 95.34%) Spring 2020

Interactive Robot Learning, Georgia Tech, A (score 97.38%) Fall 2019

Game Artificial Intelligence, Georgia Tech, A (score 98.28%) Fall 2019

Advanced Programming Techniques, Georgia Tech, A (score 104.48%) Fall 2019

HONORS

Best Paper Award, ICCV 2021 Mair2 Workshop (top 1) Oct. 2021

National Endeavor Scholarship, awarded by Ministry of Education of China (rank 2/51) Nov. 2016, Nov. 2018

The Jetta Scholarship, awarded by Jetta Company Limited (rank 3/51) Dec. 2017

2nd **Prize in China Undergrad. Math. Contest in Modeling (CUMCM)** (top 5% in SCUT) Oct. 2017

1st **Prize of Guangdong Province in CUMCM** (top 5% in SCUT) Oct. 2017

ACADEMIC SERVICE

Reviewer: AISTATS 2022, WAFR 2022, IROS 2022, AISTATS 2023
Program Committee: NeurIPS 2022 Workshop on ML4AD

SKILLS

Programming Languages: Python, C/C++, Matlab, Java
Open Source Libraries: PyTorch, Tensorflow, PyTorch Geometric, OpenAI Gym, Stable Baselines3, MuJoCo, Scikit-learn, OpenGL, OpenCV