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Yue (Sophie) Guo

EDUCATION

Carnegie Mellon University *Pittsburgh, PA Aug, 2018 - Present*
Current PhD student in Computer Science Department, School of Computer Science
Master Degree in Research certified in 2021
Brown University *Providence, RI Aug, 2014 - May, 2018*
Bachelor of Science in Applied Math - Computer Science, Honors, Professional Track, Magna Cum Laude

PUBLICATIONS

[1] Guo, Yue; Jena, Rohit; Hughes, Dana; Lewis, Michael; Sycara, Katia *Pittsburgh, PA Jul, 2021*
*Transfer Learning for Human Navigation and Triage Strategies Prediction in a Simulated Urban Search and Rescue Task [*link*]*
Proceedings of 2021 RO-MAN
[2] Guo, Yue; Wang, Boshi; Hughes, Dana; Lewis, Michael; Sycara, Katia *Pittsburgh, PA Aug, 2020*
*Designing Context-Sensitive Norm Inverse Reinforcement Learning Framework for Norm-Compliant Autonomous Agents [*link*]*
Proceedings of 2020 RO-MAN
[3] Hughes, Dana; Agarwal, Akshat; Guo, Yue; Sycara, Katia *Pittsburgh, PA Aug, 2020*
Inferring Non-Stationary Human Preferences for Human-Agent Teams [link]
Proceedings of 2020 RO-MAN
[4] Krishnamoorthy, Vigneshram; Li, Huao; Milani, Stephanie; Luo, Wenhao; Guo, Yue; Lewis, Michael; Sycara, Katia
A Computational Framework for Norm-Aware Reasoning for Autonomous Systems (under submission to AIJ)
[5] Guo, Yue; Konidaris, George *Providence, RI May, 2018*
Finding Optimal Strategies over Families of Tasks in Reinforcement Learning [link]
2018 Brown University Department of Computer Science Undergraduate Honors Theses
[6] Guo, Yue; Binnig, Carsten; Kraska, Tim *Chicago, IL May, 2017*
What you see is not what you get!: Detecting Simpson's Paradoxes during Data Exploration [link]
Proceedings of the 2nd Workshop on Human-In-the-Loop Data Analytics, pp. 2, ACM 2017.
[7] Abel, David; Jinnai, Yuu; Guo, Yue; Konidaris, George; Littman, Michael *Stockholm, Sweden Jul, 2018*
Policy and Value Transfer in Lifelong Reinforcement Learning [link]
Proceedings of 2018 ICML

RESEARCH & TEACHING

Carnegie Mellon University School of Computer Science, Research Assistant *Pittsburgh, PA Oct, 2018 - Present*
Advanced Agent-Robotics Technology Lab, directed by Professor Katia Sycara
Artificial Social Intelligence for Successful Teams (ASIST)
Aims at developing foundational AI theory and systems that demonstrate the basic machine social skills to infer the goals and situational knowledge of human partners, predict what they will need, and offer context-aware help. The theories and systems are applied to an urban search and rescue (USAR) mission.

- Teacher - student framework is built to transfer policies for Multi-agent Reinforcement Learning Team from experts. Machine Theory of mind model is incorporated to learn from the imperfect information scenario. The teacher estimates RL team and give advice accordingly to boost their performance. Work in progress.
- Model the navigation of USAR mission into graphs, and build the clique group that formulate a hierarchical connection of the connectivity graph, which correspond to the hierarchical spatial cognation of humans.
- The graph is further divided into sub graphs using the clique group assignment. With the locations of rescuers and the sub graph assignment, graph features is formed to sent to the TL-DCRNN network. This network demonstrates the potential usage of transfer learning on predicting single-player navigation in the USAR mission.
- Predict the coordination time when the players call teammates to come for rescuing a trapped teammates and critical victims with respect to their different roles in the missions.
- Construct a rule-based navigation prediction using the hierarchical graph, in order to predict the immediate next room and the group of rooms that are likely to be visited next. Test done on human data.
- Build the human data collection pipeline using the Minecraft Malmo platform. Data is collected to have human annotators predict what the next actions the the players will take, and study human abilities on predicting USAR.

Context-Sensitive Norm Inverse Reinforcement Learning
Developed a new inverse reinforcement learning framework, Context-Sensitive Norm IRL (CNIRL) that treats states and contexts separately, and learns the reward functions of norms from norm-compliant expert trajectories.

- Led the project from forming motivations and models, organizing discussions, designing and implementing scenarios, analyzing comparisons with benchmarks, and writing the paper.
- Motivated from the Modular Normative Markov Decision Process, formulated the inverse reinforcement learning approaches to learn the implicit reward functions that are related to various norms and how conflicts are resolved.
- Designed the demo scenarios that have context-sensitive norms, and compared with the inverse reinforcement learning methods of bayesian (BIRL), maximum entropy (Maxent IRL) and maximum likelihood (MLIRL).

Ethical Norms

Provided a principled, scalable, safe, and unified computational framework that integrates robot task planning and normative reasoning. i.e. Make the robot not only reason about the domain goals but also about ethical & social norms.

- Designed and implemented the Inverse Reinforcement Learning algorithms (Maximum Entropy and Bayesian) to recover the reward map of a navigation scenario with norms.
- Designed and implemented a demo scenario of environmental context tree using Malmo platform. In this scenario, the robot was faced with the dilemma of putting out a fire that erupted in the kitchen first or getting a child that is walking towards the fire to safety. *[video link]*
- Developed a program using Sim-rank algorithm to generalize robot ethical reasoning to unseen scenarios, and designed new scenarios of robot reasoning in situations with conflicting norms.

Brown University Department of Computer Science, Research Assistant *Providence, RI May, 2016 - May, 2018*

Data Science & Database Lab, directed by Professor Tim Kraska and Professor Carsten Binnig

Simpson's Paradox

Explored ways to efficiently detect Simpson's Paradoxes. Paper accepted by HILDA@SIGMOD 2017, 1st author.

- Utilized statistical methods to approach estimation on the existence of paradox and proved validity.
- Designed algorithms using confidence bounds and multi-batches to reduce the number of samples needed.

PCA Index

Utilized PCA method to reduce higher dimensional queries into lower ones with the original queried data still kept.

- Programed the experiment of reducing queries in C++.

Intelligent Robot Lab, directed by Professor George Konidaris

Optimal Action Priors

Designed proofs clarifying which policy is optimal for each policy class under three important variations of the multitask reinforcement learning setting. Paper accepted to 2018 ICML.

- Programed experiments of various environments and compared results of different agents on overall rewards.
- Explored the unfixed transition functions of fixed but unknown distribution case in Undergraduate Honors Thesis.

Fields Institute for Research in Mathematical Sciences, Research Assistant *Toronto, CA Jul - Aug, 2017*

2017 Fields Undergraduate Summer Research Program
Mentored by Professor Mary Pugh (University of Toronto) and Dr. Tyler Wilson (Fields Institute)
Project on Using the Lattice Boltzmann Method to Simulate a Rapidly Spinning Baseball.

- Based on LBM and fluid dynamics knowledge constructed models simulating a basic ball in a fluid using Python.
- Implemented Parallel Computing on GPU with Python PyOpenCL and C to handle mass computation.

Brown University Department of Sociology GIS Project, Research Assistant *Providence, RI Mar - Aug, 2016*

A historical study of neighborhood change in American cities through the construction of a US map of the 1940 census.

- Used Stata to process the 1940 census with reference to multiple documents for geocoding residents' addresses.

Shanghai Xi'Tian Information Technology Co. Ltd, Research Intern *Shanghai, China Jun - Aug, 2015*

A research company that specializes in generating medical data analysis and 3-D graph for medical use.

- Applied basic Machine Learning methods to roughly determine abnormal indices of simulated patients.

Brown University Computer Science Department, Teaching Assistant *Providence, RI Fall 2017 - Spring 2018*

CSCI1430 Computer Vision (Prof. James Tompkin) CSCI1420 Machine Learning (Prof. Michael L. Littman)

ACADEMIC BACKGROUND

Applied Math

Strong computation ability in machine learning, statistics, and probability, including common algorithms and distributions, non-parametric statistics, statistical applications, computational linear algebra, etc.
Solid ability in computation theory including Turing Machine, P & NP reduction and complexity analysis.
Solid background in competing species, predator & prey models, Fourier Series, heat/wave equations.
Familiarity in operations research topics including Markov Chain, Martingale, Poisson, and Brownian.

Computer Science

Have programmed with Python, Matlab, C, C++, JavaScript, Java, Scala, SQL, HTML, CSS, Go, and Stata.

Projects in AI+ML+CV:
IRL and Deep SARSA: inserted a virtual agent to navigate through real human intersections in Python. Group project.
Music Generation: generated stylistic melody given chord regressions and demos via RL in Python. Group project.
Simplex, Sudoku, and Stackelberg: explored the implementation and applications of linear programming in Python.
Hybrid Images: created hybrids by low/high pass frequencies based on the Fourier Transform in Matlab.
Feature Matching: found interest points and features of images by gradients, and matched with confidence in Matlab.
Camera Calibration: estimated the camera projection matrix in camera and scene geometry in Matlab.
Scenery Categorizations: used basic Machine Learning and Deep Learning to categorize scenery images in Matlab.
Face Detection: utilized sliding window and Machine Learning to detect faces in Matlab.
Tile Game: implemented algorithms of BFS, DFS, IDS and A* to find solutions in Python.
Tron: programed to control adversarial players with Alpha-Beta pruning in Python.
Ghost Busters, Taxi: implemented the online belief update and classical reinforcement learning examples in Python.
Machine Learning Algorithms: programed the whole algorithms such as LSE and LAD regression, naive Bayes classifier, MAP estimate, multi-class SVM with gradient descent, EM algorithm for fitting mixtures of Gaussians, nearest neighbor (NN) classification and dimensionality reduction in Matlab.
Classification: implemented the GD and SGD algorithms for softmax classifier with cross-entropy loss in Python.
MH & NN: implemented the Metropolis-Hastings algorithms and a simple deep neural network by hand in Python.

Projects in Database + Data Science:
Schedule: proposed a multi-user, multi-device resource scheduler in heterogeneous systems in Python. Group project.
Keyboard Layout Optimization: explored ML algorithms to optimize the keyboard layout. Group project.
Spark Classifier: utilized page rank, regression models, map reduce, and gradient descent to model tasks in Python.
DataIntegration, Etl: performed data cleaning and sentiment analysis in Python/do query in SQL and Java.
Data Visualization: generated data visualization graphs using d3 for crime and commercial statistics in JavaScript.
Gitbuddy: built a webpage to display activeness of some Github users for a company in Javascript. Group project.
Simple DB: utilized algorithms of wait-die to avoid deadlock and checkpoints to recover data in Java.

System - Related Projects:
Distributed systems: programed with Go to realize Tapestry, Raft, and Puddlestore (simple Oceanstore). Pair Project.
Database: coded server and client connecting them to realize multiple clients processing in database in C.
Data Website: extracted relevant Twitter data from a server and displayed them on the webpage in JavaScript.
Chatroom: created a client for message viewed or sent and a server connected to database in JavaScript.
Shell: built a terminal with functions of file manipulations, “fg”, “bg”, signal receiving, etc in C.
Maze, Tetris, Pacman and Doodle Jump: coded games of Maze in C, Tetris, Pacman, and Doodle Jump in Java.