Muzhe Wu

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Research Interest

My research interest is in the intersection of artificial intelligence and human-computer interaction. I am specifically interested in creating interpretable and generalizable intelligent systems/agents that can learn from humans' behaviors and respond in alignment with humans' intents.

Education

University of Michigan **Ann Arbor, MI**
Bachelor of Science in Computer Science Aug 2021 - Apr 2023 (Expected)
- Advisors: Anhong Guo, Xu Wang, Veronica Perez-Rosas
- GPA: 3.95/4.00

Shanghai Jiao Tong University **Shanghai, China**
Bachelor of Science in Electrical and Computer Engineering Sept 2019 - Aug 2023 (Expected)
- GPA: 3.76/4.00 (ranked 21th out of 252 students in the class)

Publications, Presentations & Posters

2022 **Muzhe Wu***, Haocheng Ren*, Gregory Croisdale, Xu Wang, Anhong Guo. "Rubikon: A Multimodal Tutor for 3D Physical Task Learning." *Michigan AI Symposium 2022.* Poster Presentation & Demo. [Best Demo Award]

Research Experience

Towards Understanding the Relation between Misinformation and Engagement | NLP Jul 2022 - Present
LIT Lab (UMich) - Advisor: Veronica Perez-Rosas
- Designed a highly interpretable pipeline for online video engagement rating consisting of multimodal (visual, audio and textual) data preprocessing, mid-level feature extraction, time alignment, and an unbalanced early fusion model;
- Formally defined and labeled the engagement rate for the YouTube Prostate Cancer Dataset of 250 videos; trained the pipeline and performed a comparative study on the relation between misinformation and engagement.

MineDojo | RL Jul 2022 - Oct 2022
Jim-Team (NVIDIA) - Advisor: Jim Fan
- Enabled GPU acceleration for scalable MineDojo RL simulation on headless machines by investigating EGL docker image;
- Created a meta-dataset of 20 open-ended, task-oriented datasets; scraped web data (e.g., GitHub repos for front-end development frameworks, DALL-E-2 showcase) to construct knowledge bases for generalist agent training.

Multimodal Cognitive Tutor | HCI May 2022 - Present
HAIL Lab, Lifelong Learning Lab (UMich) - Advised by Xu Wang, Anhong Guo
- Designed a new ITS framework that leverages AI and AR and augments current tutorial methods for 3D physical tasks;
- Build the system for the Rubik's Cube learning, featuring domain/user modeling (by parsing and analyzing multimodal input, e.g., finger detection and ArUco markers), adaptive feedback (based on the abstractive knowledge tree and user/system initiatives), new task generation and low cognitive load guidance (voice aid, hidden side revelation, and spatial arrow).

Awards & Scholarships

2022 **Best Demo Award** at Michigan AI Symposium 2022
2021, 2022 **Dean's Honor List** at the University of Michigan
2021 **Mathematical Contest in Modeling Meritorious Winner Prize** (<9.5%)
2021 **University Physics Competition Silver Award** (<3%)
2020, 2021 **Undergraduate Excellent Scholarship** at Shanghai Jiao Tong University (<10%)

Selected Projects

Auxiliary Variables Improve Group Accuracy without Group Information [Link] Nov 2022 - Dec 2022
- Validated the effectiveness of auxiliary variables in the first stage of the JTT algorithm resolving the spurious correlation in ML;
- Designed, recreated, and collected visual datasets for spurious correlation research (e.g., configurable MNIST-CIFAR10).

FAD: Feature Alignment Discriminator for Text Summarization [Link] Mar 2022 - Apr 2022
- Introduced a BERT-based discriminator to BART text generator and designed feature alignment mechanism; achieved SOTA performance on CNN/DailyMail dataset for automatic abstractive text summarization.
- Trained the model with different settings (rDrop, layers used as features, and hyper-parameters) and compared it with baseline models (e.g., fine-tuned BART-base model) on ROUGE score.

Retro Game API for Reinforcement Learning [Link] Feb 2022

- Developed an API for retro game simulation with reinforcement learning focus.
- Applied *gym-retro* integration tools to build runnable ROMs; designed a simulation environment with regulation methods and compatible utility classes (recorder, interactor, and dataset); designed a simulation GUI with observation and state information visualized; implemented wrapper classes for vision transform (random cropping, random convolution, and gaussian noise).

Mask Distribution Simulator [Link] Jul 2020 - Aug 2020

- Created a C++ program that evaluates the number of masks needed by cities in Hubei Province during the COVID-19 period and simulated the transportation of masks within the province along with subsequent impacts on pandemic situations.
- Applied the SIR model to classify people into different groups; set up parameters per factors including mask numbers and social distance; designed an interactive GUI that displays simulation results with OpenGL.

Competitions

Mathematical Contest in Modeling | Meritorious Winner Prize Feb 2021

- Modeled an ecosystem of different types of fungi (competitive relationships) with limited nutrients and simulated their long-term growth trends in various weather conditions.
- Applied Competitive Lotka Volterra Equations to formulate differential equations of fungi's growth; formulated correlation factors with geometry and necessary simplifications; evaluated weather factors with linear regression method; visualized simulation results in diagrams with MATLAB and Python.

University Physics Competition | Silver Medal Nov 2020

- Formulated the route for a lightweight spacecraft traveling from earth to Saturn at the minimum fuel cost.
- Applied physics models, e.g., Conservation of Momentum, Kepler's Law, and Hohmann Transfer Orbit, to calculate the optimal track; established the relationships between fuel consumption and weight, distance, and time with Euler's Method.

Skills & Related Courses

SKILLS

Languages	Python, C/C++, Java, Javascript, SQL, C#, MATLAB, R, Verilog
Frameworks	PyTorch, Scikit-Learn, SwiftUI, React, Vue, Gatsby, Flask, Bootstrap, Scrapy
Tools	LaTeX, Unity, Mathematica, HTML, Figma, Linux (Ubuntu), Solidworks, Adobe Creative Suite

RELATED COURSES

ML/NLP/CV	Machine Learning; Natural Language Processing; Computer Vision; Science of Deep Learning;
HCI	User Interface Development; Human-Centered ML; Mind & Machine;
Other CS	Web Systems; Operating Systems; Computer Organization; Data Structures & Algorithms; Computer Security; Computer Science Foundations & Pragmatics;
Math	Multivariable & Vector Calculus; Linear Algebra; Differential Equations; Discrete Math; Probability & Statistics;
EE	Electrical Circuits; Signals & Systems; Logic Design; Analog Circuits;

Volunteer & Extracurricular Experience

Ann Arbor Figure Skating Club June 2022 – Present
Competed and volunteered in adult figure skating competitions in Ann Arbor.

SJTU Basketball Association Aug 2020 – Aug 2021
Organized and refereed in collegial basketball matches at Shanghai Jiao Tong University.

High School Advisory May 2020
Advised on the College Entrance Examination preparation for (≈700) senior students in Wenzhou No. 2 Foreign Language School.

UMJI Voluntary Association Oct 2019 – Aug 2020
Regularly visited Jiangchuan Sunshine nursing house, hosting events and caring for people with mental difficulties.

References

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