

Spencer John Frazier  
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## Summary

- CS Intelligent Systems PhD Candidate ABD focusing on **value-aligned reinforcement learning**
- Publications in review or published in AAAI/AAMAS/AIIDE/AIES/INLG/NeurIPS/IITSEC/SeriousPlay
- Currently interested in **socially normative AI, AI value alignment, learning from stories, interactive machine learning**
- Leader with past roles as cofounder, CTO, technical product manager, senior lead engineer
- 10 App-Store published applications including Drizly (cofounded, acquired by Uber for \$1.1b)

## Education

**PhD in Computer Science - Human-Centered AI Lab (Sociocultural AI)**, Expected Graduation 2022~  
Georgia Institute of Technology, College of Computing; Atlanta, GA  
Advisor: Mark Riedl (Human Centered AI Lab)

**Masters in Computer Science - Information Sciences Institute (Multi-Agent Systems)**, Graduated December 2012  
University of Southern California, Viterbi School of Engineering; Los Angeles, CA  
Advisors: Rajiv Maheswaran and Yu-Han Chang (Information Sciences Institute - Computational Behavior Group)

**Bachelors in Computer Science, Bachelors in Communications, Minor in Philosophy**, Class of 2011  
Boston College, College of Arts and Sciences; Chestnut Hill, MA  
Advisor: Stella X Yu (Now at UC Berkeley)

## Work & Research Experience

**Human-Centered AI / Entertainment Intelligence Lab - Georgia Tech**  
**Graduate Research Assistant (Under Mark Riedl [riedl@cc.gatech.edu](mailto:riedl@cc.gatech.edu))**  
**January 2019 - Present**

Sociocultural AI: Interactive machine learning, value alignment, norm classification and transfer learning from stories. Using stories corpora as a strong prior for value alignment. Published and in review work drives reinforcement learning agents with a normative classifier (large scale language model) fine-tuned on large text corpora. Also have utilized the same method to reduce toxic/non-normative speech generated by GPT. Some ongoing work exploring advice and critique supported reinforcement learning in 3D environments. Also currently working on a project for group-constrained inverse reinforcement learning. See: <https://arxiv.org/abs/1912.03553> and <https://arxiv.org/abs/2001.08764>

## Lockheed Martin

**Senior (Lead) Software Engineer (Advanced Technical Leadership Sr )(Under Suraiya Suliman [suraiya.h.suliman@lmco.com](mailto:suraiya.h.suliman@lmco.com))**  
**June 2014 - December 2018**

**Leadership:** Primary Investigator and advisor to Chief Science Officer on quantum-encryption related research project. Technical Product Manager/ Engineering Lead for DARPA simulation effort in a team of 15+. Co-lead engineer responsible for delivering in person program updates to DARPA (as a proxy for primary investigator). Advanced Technical Leadership Class of 2019. Authored veteran warfighter financial readiness machine learning proposal for ADL/DoD in collaboration with StandardsWork. Co-authored DARPA proposal award at 7-8 figure cost estimates. Lead machine learning engineer for dismounted UAV/HMD/AR research effort. Held regular coding interviews and advised on hiring decisions. Transitioned multiple internal "Destination Innovation" research proposals to patents and IRAD programs. Delivered recruitment talks at Boston-area schools (MIT) on distributed systems and human-machine trust. Agile scrum leader/TPM on multiple projects.

**Research:** Multiple R&D efforts across ML/RL/AR/VR/Human Performance/homomorphic quantum cryptography. Multiple patents. Worked closely with Yale Emotional Intelligence lab and Air Force Research Labs to design a virtual avatar simulation and biophysical monitoring research study with UAV Analysts. Invited presenter at SeriousPlay. Co-author/co-presenter of research paper @ IITSEC 2016. Primary author for distributed training paper IITSEC 2018. Invited encrypted machine learning poster presentation @ internal conference. Worked with educational researchers (ADL) and NASA to run a school competition using an open source game.

**Engineering & Architecture:** Designed and implemented containerized distributed system "GIMBAL" for human performance data collection and assessment integrating Tobii eyetracking, fNIR and many other hardware sensors. Managed system integration for year-end AFRL demo integrating Prepar3D (internal sim tool), AR weapon platform and UAV analyst feeds. Designed/built architecture for human performance data capture and human-machine teaming used at 4 day live exercise (TechWarrior). Rapidly developed geospatial mapping capabilities and fixed multi-platform browser compatibility for LMCO/ONR tactical decision kit. Contributed significantly to the Mars Game and Virtual World Framework open source initiatives by writing drivers, scenario behaviors, trigger system, extending Google Blockly and a scenario generation tool. Provided devops support and server management/application deployment on the GENI network. Top 10% engineer in yearly evaluations.

**Entertainment Intelligence Lab - Georgia Tech**  
**Graduate Research Assistant (Under Mark Riedl [riedl@cc.gatech.edu](mailto:riedl@cc.gatech.edu))**  
**August 2013 - June 2014**

Research assistant concerned with examining agent behavior, agent modeling, proactive sensing, games with purpose, machine learning and narrative generation. Built research-oriented mobile applications on Google Glass, iOS and Android devices. Primarily tasked with programming mobile game test clients, backends and services, organizing tests and writing research papers.

**Drizly Inc**  
**Technical Co-Founder, CTO**  
**July 2012 - December 2013**

Cofounder, principle architect, designer and lead engineer for a mobile customer/merchant/distribution platform and consumer facing application. Currently used by hundreds of liquor stores and thousands of drivers in dozens of states. Efforts enabled Drizly to raise a 6 million pre-money, 9 million post-money funding round December 2013. Drizly has subsequently raised over \$100mm~ and is available internationally. It was recently acquired by Uber for \$1.1b

**Information Sciences Institute - USC - Computational Behavior Group**  
**Research Assistant (Under Rajiv Maheswaran and Yu-Han Chang)**  
**September 2011 - December 2012**

Research assistant concerned with examining agent behavior, agent modeling, decision support agents, cooperative, collaborative and competitive scenarios. Produced HComp game ZombieSC managing a large team of other students. Attended AAMAS 2012 to demonstrate location-based MAS game, Team-It. Notable paper in AIIDE 2012 contrasting virtual immersive agent interaction to real world collaboration and negotiation behaviors. Briefly worked with university police to develop a campus safety application.

### **Selected Research Publications & Demonstrations**

**Group-Constrained Inverse Reinforcement Learning Paper Under Blind Review**  
Spencer Frazier. In review.

**TextWorld Reinforcement Learning + Normative Classifier Paper Under Blind Review**  
Spencer Frazier, Md Sultan Al Nahian, Mark Riedl, Brent Harrison. In review.

**Fine-Tuning a Transformer-Based Language Model to Avoid Generating Non-Normative Text**  
Xiangyu Peng, Siyan Li, Spencer Frazier, Mark Riedl. To appear in INLG 2021, Full Paper <https://arxiv.org/abs/2001.08764>

**Learning Norms from Stories: A Prior for Value Aligned Agents**  
Spencer Frazier, Md Sultan Al Nahian, Mark Riedl, Brent Harrison. AIES 2020, Full Paper, <https://arxiv.org/abs/1912.03553>

**Impact of Interaction Design on Human Satisfaction Teaching Reinforcement Learning Agents in Partially Observable Domains**  
Divya Srivastava, Spencer Frazier, Karen Feigh. WIRL ICRA 2020, Full Paper.

**Improving Deep Reinforcement Learning in Minecraft Using Action Advice**  
Spencer Frazier, Mark Riedl. AIIDE 2019, Full Paper, <https://arxiv.org/abs/1908.01007>

**Securing Distributed Simulation and Training using Blockchain Technologies**  
Spencer Frazier, Shawna Boucher, Mohammed Elshennawy, Joshua Jacobs, Heather Kurtz, Benjamin Noble. IITSEC 2018 Full Paper and Presentation

**Technological Architecture to Enable State Awareness of Human Collaborators in Human-Autonomy Teams**  
Spencer Frazier, Patrick Craven and Kevin Oden. AHFE 2018 - Abstract

**Federated Learning on Homomorphically Encrypted Machine Learning Models**  
Spencer Frazier. Lockheed Fellows Conference 2018 - Poster

**The Impact of Non-Technical Skills on Trust and Stress**  
Lohani, Stokes, Oden, Frazier et. al. 2017 ACM/IEEE International Conference on Human-Robot Interaction - Article

**Mars Game: Creating and Evaluating an Engaging Educational Game**  
Kevin Dill, Spencer Frazier, Barbara Freeman Ed.D., Juan Benito. IITSEC 2016 - Full Paper and Presentation

**Persistent and Pervasive Real-World Sensing using Games**  
Spencer Frazier and Mark O. Riedl. Proceedings of the 2nd AAAI Conference on Human Computation (AAAI 2014) - Workshop Paper

**Team-It : Location-Based Gaming in Real and Virtual Environments**  
Spencer Frazier, Alex Newnan, Fotos Frangoudes, Yu-Han Chang and Rajiv Maheswaran. AIIDE 2012 -Full Paper

**Patents:** US20140279516 - Authenticating a Physical Device (pending), US20150186963 - Distribution of Products (pending), US20140201100 - Confirmation of Identity (pending), Computer Vision Related Patent (passed IPRB), Hardware/AR Computer Vision Related Patent (passed IPRB), Hardware/AR Computer Vision Related Patent (passed IPRB)