

Prithviraj (Raj) Ammanabrolu

RESEARCHER · ALLEN INSTITUTE FOR AI
AREAS: MACHINE LEARNING, NATURAL LANGUAGE PROCESSING, REINFORCEMENT LEARNING

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Education

Georgia Institute of Technology

Atlanta, GA

PHD IN COMPUTER SCIENCE

2018 - 2021

- GPA: 4.0
- Advisor: Professor Mark O. Riedl
- Thesis: Language Learning in Interactive Environments
- Thesis Committee: Drs. Mark Riedl, Devi Parikh, Charles Isbell, Matthew Hausknecht, Jason Weston
- Research Areas: Natural Language Processing, Reinforcement Learning, Interactive Narrative, Knowledge Graphs, and Computational Creativity

Georgia Institute of Technology

Atlanta, GA

BS IN COMPUTER SCIENCE

2015 - 2018

- GPA: 3.9
- Threads: Intelligence and Theory, Dean's List 2015-2018

Professional Experience

Aug. 2021 - **Researcher**, Mosaic Team, Allen Institute for AI
present

Jan. 2017 - **Research Assistant**, Entertainment Intelligence Lab, Georgia Tech
July 2021

Jan. 2017 - **Teaching Assistant**, Georgia Tech
July 2020

Summer 2020 **Research Intern**, Facebook AI Research

Summer 2019 **Research Intern**, Microsoft Research

Summer 2018 **Research Intern**, Oracle Intelligent Bots

Summer 2017 **Research Intern**, Radix Health

Publications

PRE-PRINTS

- [1] Prithviraj Ammanabrolu, Ethan Tien, Matthew Hausknecht, and Mark O Riedl. How to avoid being eaten by a grue: Structured exploration strategies for textual worlds. *arXiv preprint arXiv:2006.07409*, 2020. URL: <https://arxiv.org/abs/2006.07409>.
- [2] Youngjae Yu, Jiwan Chung, Heeseung Yun, Jack Hessel, JaeSung Park, Ximing Lu, Rowan Zellers, Prithviraj Ammanabrolu, Ronan Le Bras, Gunhee Kim, and Yejin Choi. Multimodal knowledge alignment with reinforcement learning. *arXiv preprint arXiv:2205.12630*, 2022. URL: <https://arxiv.org/abs/2205.12630>.
- [3] Ruoyao Wang*, Peter Jansen*, Marc-Alexandre Côté, and Prithviraj Ammanabrolu. Behavior cloned transformers are neurosymbolic reasoners. 2022. URL: <https://arxiv.org/abs/2210.07382>.
- [4] Rajkumar Ramamurthy*, Prithviraj Ammanabrolu*, Kianté Brantley, Jack Hessel, Rafet Sifa, Christian Bauckhage, Hannaneh Hajishirzi, and Yejin Choi. Is reinforcement learning (not) for natural language processing?: Benchmarks, baselines, and building blocks for natural language policy optimization. *arXiv preprint arXiv:2210.01241*. URL: <https://arxiv.org/abs/2210.01241>.

CONFERENCES AND JOURNALS

- [1] Ximing Lu, Sean Welleck, Liwei Jiang, Jack Hessel, Lianhui Qin, Peter West, Prithviraj Ammanabrolu, and Yejin Choi. Quark: Controllable text generation with reinforced unlearning. In *Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS)*, 2022. URL: <https://arxiv.org/abs/2205.13636>.
- [2] Xiangyu Peng, Mark O Riedl, and Prithviraj Ammanabrolu. Inherently explainable reinforcement learning in natural language. In *Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS)*, 2022. URL: <https://arxiv.org/abs/2112.08907>.
- [3] Zeqiu Wu, Ryu Parish, Hao Cheng, Sewon Min, Prithviraj Ammanabrolu, Mari Ostendorf, and Hannaneh Hajishirzi. Inscit: Information-seeking conversations with mixed-initiative interactions. *Transactions of the Association for Computational Linguistics (TACL)*, 2022. URL: <https://arxiv.org/abs/2207.00746>.
- [4] Ruoyao Wang*, Peter Jansen*, Marc-Alexandre Côté, and Prithviraj Ammanabrolu. Scienceworld: Is your agent smarter than a 5th grader? In *Empirical Methods in Natural Language Processing (EMNLP)*, 2022. URL: <https://arxiv.org/abs/2203.07540>.
- [5] Prithviraj Ammanabrolu, Liwei Jiang, Maarten Sap, Hannaneh Hajishirzi, and Yejin Choi. Aligning to social norms and values in interactive narratives. In *North American Chapter of the Association for Computational Linguistics (NAACL)*, 2022. URL: <https://arxiv.org/abs/2205.01975>.
- [6] Prithviraj Ammanabrolu, Renee Jia, and Mark O Riedl. Situated dialogue learning through procedural environment generation. In *Association for Computational Linguistics (ACL) 2022*, 2022. URL: <https://arxiv.org/abs/2110.03262>.
- [7] Prithviraj Ammanabrolu and Mark Riedl. Modeling worlds in text. In *Thirty-fifth Conference on Neural Information Processing Systems Datasets and Benchmarks Track (Round 1)*, 2021. URL: <https://openreview.net/forum?id=7FHnnENUG0>.
- [8] Prithviraj Ammanabrolu and Mark Riedl. Learning knowledge graph-based world models of textual environments. In *Thirty-fifth Conference on Neural Information Processing Systems*, 2021. URL: <https://arxiv.org/abs/2106.09608>.
- [9] Wai Man Si, Prithviraj Ammanabrolu, and Mark O Riedl. Telling stories through multi-user dialogue by modeling character relations. In *SIGDIAL 2021*, 2021. URL: <https://arxiv.org/abs/2105.15054>.
- [10] Prithviraj Ammanabrolu and Mark O Riedl. Situated language learning via interactive narratives. *Patterns*, Cell Press, 2021. URL: [https://www.cell.com/patterns/fulltext/S2666-3899\(21\)00159-8](https://www.cell.com/patterns/fulltext/S2666-3899(21)00159-8).
- [11] Prithviraj Ammanabrolu, Jack Urbanek, Margaret Li, Arthur Szlam, Tim Rocktäschel, and Jason Weston. How to motivate your dragon: Teaching goal-driven agents to speak and act in fantasy worlds. In *Proceedings of the 2021 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies*, pages 807–833, Online, June 2021. Association for Computational Linguistics. URL: <https://aclanthology.org/2021.naacl-main.64>, doi:10.18653/v1/2021.naacl-main.64.
- [12] Prithviraj Ammanabrolu, Wesley Cheung, William Broniec, and Mark O Riedl. Automated storytelling via causal, commonsense plot ordering. In *Thirty-Second AAAI Conference on Artificial Intelligence*, 2020. URL: <https://arxiv.org/abs/2009.00829>.
- [13] Prithviraj Ammanabrolu, Ethan Tien, Wesley Cheung, Zhaochen Luo, William Ma, Lara J. Martin, and Mark O. Riedl. Story realization: Expanding plot events into sentences. volume 34, pages 7375–7382, Apr. 2020. URL: <https://ojs.aaai.org/index.php/AAAI/article/view/6232>, doi:10.1609/aaai.v34i05.6232.

- [14] Matthew Hausknecht, Prithviraj Ammanabrolu, Marc-Alexandre Côté, and Xingdi Yuan. Interactive fiction games: A colossal adventure. In *Proceedings of the AAAI Conference on Artificial Intelligence*, volume 34, pages 7903–7910, 2020. URL: <https://arxiv.org/abs/1909.05398>.
- [15] Prithviraj Ammanabrolu, William Broniec, Alex Mueller, Jeremy Paul, and Mark O. Riedl. Toward automated quest generation in text-adventure games. In *International Conference on Computational Creativity (ICCC)*, 2020. URL: <https://arxiv.org/abs/1909.06283>.
- [16] Prithviraj Ammanabrolu, Wesley Cheung, Dan Tu, William Broniec, and Mark O Riedl. Bringing stories alive: Generating interactive fiction worlds. In *Proceedings of the Sixteenth AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE-20)*, 2020. URL: <https://www.aaai.org/ojs/index.php/AIIDE/article/view/7400>.
- [17] Prithviraj Ammanabrolu and Matthew Hausknecht. Graph constrained reinforcement learning for natural language action spaces. In *International Conference on Learning Representations*, 2020. URL: <https://openreview.net/forum?id=B1x6w0EtwH>.
- [18] Prithviraj Ammanabrolu and Mark Riedl. Playing text-adventure games with graph-based deep reinforcement learning. In *North American Chapter of the Association for Computational Linguistics (NAACL-HLT) 2019*, 2019. URL: <https://aclanthology.org/N19-1358/>.
- [19] Lara J Martin, Prithviraj Ammanabrolu, Xinyu Wang, William Hancock, Shruti Singh, Brent Harrison, and Mark O Riedl. Event representations for automated story generation with deep neural nets. In *Thirty-Second AAAI Conference on Artificial Intelligence*, pages 868–875, 2018. URL: <https://www.aaai.org/ocs/index.php/AAAI/AAAI18/paper/viewPDFInterstitial/17046/15769>.

PEER REVIEWED WORKSHOPS

- [1] Lara J Martin, Prithviraj Ammanabrolu, Xinyu Wang, Shruti Singh, Brent Harrison, Murtaza Dhuliawala, Pradyumna Tambwekar, Animesh Mehta, Richa Arora, Nathan Dass, et al. Improvisational storytelling agents. In *Workshop on Machine Learning for Creativity and Design (NeurIPS 2017)*, page 4, 2017. URL: https://nips2017creativity.github.io/doc/Improvisational_Agents.pdf.
- [2] Prithviraj Ammanabrolu and Mark Riedl. Transfer in deep reinforcement learning using knowledge graphs. In *Proceedings of the Thirteenth Workshop on Graph-Based Methods for Natural Language Processing (TextGraphs-13) at EMNLP*, 2019. URL: <https://www.aclweb.org/anthology/D19-5301>.
- [3] Prithviraj Ammanabrolu, Ethan Tien, Wesley Cheung, Zhaochen Luo, William Ma, Lara Martin, and Mark Riedl. Guided neural language generation for automated storytelling. In *Proceedings of the Second Workshop on Storytelling*, pages 46–55, Florence, Italy, August 2019. Association for Computational Linguistics. URL: <https://www.aclweb.org/anthology/W19-3405>, doi:10.18653/v1/W19-3405.
- [4] Sahith Dambekodi, Spencer Frazier, Prithviraj Ammanabrolu, and Mark O Riedl. Playing text-based games with common sense. In *The Second WordPlay: When Language Meets Games Workshop at NeurIPS*, 2020. URL: <https://arxiv.org/abs/2012.02757>.
- [5] Prithviraj Ammanabrolu and Mark Riedl. Modeling worlds in text. In *The First Workshop on Common-sense Reasoning and Knowledge Bases (CSKB) at AKBC*, 2021. URL: <https://openreview.net/forum?id=7FHnnENUGO>.
- [6] Xiangyu Peng, Prithviraj Ammanabrolu, and Mark Riedl. Explainable reinforcement learning agents with stacked hierarchical graph attention. In *Workshop on Explainable Graph-based Machine Learning at AKBC*, 2021.
- [7] Rajkumar Ramamurthy*, Prithviraj Ammanabrolu*, Kianté Brantley, Jack Hessel, Rafet Sifa, Christian Bauckhage, Hannaneh Hajishirzi, and Yejin Choi. Is reinforcement learning (not) for natural language processing?: Benchmarks, baselines, and building blocks for natural language policy optimization. In *Second Workshop*

on Interactive Learning for Natural Language Processing (InterNLP) @ NeurIPS. URL: <https://arxiv.org/abs/2210.01241>.

PATENTS

- [1] Gautam Singaraju and Prithviraj Venkata Ammanabrolu. Techniques for building a knowledge graph in limited knowledge domains, 2020. US Patent App. 20200057946, Priority 16/542,017. URL: <https://www.freepatentsonline.com/y2020/0057946.html>.

Teaching Experience

Mar. 2022 -	CSE 473: Introduction to AI (Graduate Level) , Guest Instructor	University of
June. 2022		Washington
Jan. 2017 -	CS 3600: Introduction to AI (Undergraduate Level) , Teaching Assistant	Georgia Tech
Aug. 2020		

Mentoring

2020 - Curr.	Xiangyu (Becky) Peng , PhD Student, Georgia Institute of Technology
2021 - Curr.	Ellen (Zeqiu) Wu , PhD Student, University of Washington
2022 - Curr.	Rajkumar Ramamurthy , PhD Student, IAIS Fraunhofer
2022 - Curr.	Jennifer Hu , PhD Student, Massachusetts Institute of Technology
2022 - Curr.	Pei Zhou , PhD Student, University of Southern California
2021 - Curr.	Ruoyao Wang , PhD Student, University of Arizona
2021 - 2022	Liwei Jiang , PhD Student, University of Washington
2020 - 2021	Dan Tu , PhD Student, Georgia Institute of Technology
2019 - 2021	Ran (Renee) Jia , MS Student, Georgia Institute of Technology
2019 - 2021	Wai Man (Raymond) Si , MS Student, Georgia Institute of Technology, Now: PhD Student at Max Planck/Helmholtz Institute
2019 - 2021	Sahith Dambekodi , MS Student, Georgia Institute of Technology
2020 - 2021	Winston Li , MS Student, Georgia Institute of Technology
2019 - 2021	William Broniec , MS Student, Georgia Institute of Technology
2018 - 2021	Ethan Tien , MS Student, Georgia Institute of Technology,
2018 - 2021	Wesley Cheung , MS Student, Georgia Institute of Technology, Now: Software Engineer at Facebook
2018 - 2021	William Ma , MS Student, Georgia Institute of Technology, Now: Software Engineer at Amazon
2021 - Curr.	Deepti Ramani , BS Student, University of Washington
2021 - Curr.	Ximing Lu , Pre-doc, Allen Institute for AI
2022 - Curr.	Ravi Ghadia , Now: GPU Architect at Nvidia
2018 - 2020	Jeffery Luo , BS Student, Georgia Institute of Technology, Now: Research Analyst at Goldman Sachs
2018 - 2020	Alejandro Escontrela , BS Student, Georgia Institute of Technology, Now: Research Engineer at Google Brain
2018 - 2020	Anush Mattapalli , BS Student, Georgia Institute of Technology, Now: Software Engineer at NCR Corporation

Research Experience

Mosaic Team, Allen Institute for AI

Seattle, WA

MANAGERS: PROF. YEJIN CHOI, PROF. HANNANEH HAJISHIRZI

Aug. 2021 - Present

- Building agents that align to human's preferences through feedback.
- Creating world models for agents to learn from environmental observation.

Entertainment Intelligence Lab, Georgia Tech

Atlanta, GA

ADVISOR: PROF. MARK RIEDL

Jan 2017 - July 2021

- Exploring the use of deep reinforcement learning with natural language state and action spaces
- Using knowledge graphs to inject domain knowledge into language-based tasks such as automated story generation and procedural content generation
- **Mentored 10 Bachelor's and Master's students** on their research theses

Facebook AI Research

New York City, NYC

ADVISORS: JASON WESTON, PROF. TIM ROCKTÄSCHEL, ARTHUR SZLAM

May 2020 - Aug. 2020

- Worked on the ParlAI team and LIGHT, a large-scale crowdsourced text-game
- Collected and released datasets **crowdsourced by over 15,000 players** of natural language quests in LIGHT and a common-sense knowledge graph ATOMIC-LIGHT
- Developed goal-driven questing agents with reinforcement learning that act and speak in LIGHT

Microsoft Research

Redmond, WA

ADVISOR: MATTHEW HAUSKNECHT

May 2019 - Aug. 2019

- Worked on the Reinforcement Learning team and aided in development of baseline text-game playing agents for Jericho, a text-game playing platform
- Developed **SOTA RL algorithm that is able to dynamically generate language** in text-games

Oracle Inc.

Redwood City, CA

INTELLIGENT BOTS SERVICE

May 2018 - Aug. 2018

- Developed a **patented algorithm to create knowledge graphs** for low resource natural language datasets
- Created a method that improves the natural language understanding capabilities by over 10% (classification rate) of the chat-bot platform using the generated graph and graph embedding techniques

Radix Health

Atlanta, GA

ADVISORS: ARUN MOHAN, ANUP LAKARE, RAVINDRA JORE

May 2017 - May 2018

- Used predictive analytics techniques to model patients' no-show risks for healthcare clinics
- Used natural language processing to design a chatbot to improve patient access by triaging diagnostics
- Built and deployed machine learning systems for these cases from scratch to production, currently **used by over 40 clinics and over a 1,000 doctors** across America

Skills

TECHNICAL

- Natural Language Processing, Reinforcement Learning, Machine Learning, Knowledge Graphs, Semantic Web Technologies, Computer Vision, Predictive Analytics, Agile Methodologies, NoSQL

PROGRAMMING LANGUAGES

- Python, R, Java, C/C++, C#, SQL, SPARQL

FRAMEWORKS AND TOOLS

- pyTorch, scikit-learn, Tensorflow, nltk, AutoML, Couchbase, MongoDB, Spring Boot, Unity Engine

LANGUAGES

- English, Telugu, Sanskrit, Tamil, Hindi

Professional Activities

ORGANIZER

- 2023 **Creative AI Across Modalities**, AAAI 2023 <https://creativeai-ws.github.io/>
- 2022 **Wordplay When Language Meets Games**, NAACL 2022
<https://wordplay-workshop.github.io/>
- 2020 **Wordplay When Language Meets Games**, NeurIPS 2020
<https://wordplay-workshop.github.io/wordplay2020/>

PROGRAM COMMITTEE

- Aug. 2018 - **Conferences, Journals, and Workshops**,
Present
- Transactions on Machine Learning Research (TMLR) 2022
 - Neural Information Processing Systems (NeurIPS) 2019, 2020, 2021, 2022
 - Meeting of the Association for Computational Linguistics (ACL) main and demo tracks 2020, 2021, 2022
 - ACL Rolling Review 2021, 2022
 - North American Chapter of the Meeting of the Association for Computational Linguistics (NAACL) 2019, 2021
 - AAAI Conference on Artificial Intelligence (AAAI) 2019, 2020
 - International Conference on Machine Learning (ICML) 2020, 2021, 2022
 - International Conference on Learning Representations (ICLR) 2020, 2021
 - Empirical Methods in Natural Language Processing (EMNLP) 2020, 2022
 - ACM CSUR Computing Surveys
 - Interactive Learning for Natural Language Processing (InterNLP) at NeurIPS2022
 - TextGraphs Workshop at EMNLP 2020
 - Language and Reinforcement Learning Workshop (LaReL) at ICML2020
 - Workshop on Learning in Artificial Open Worlds (LAOW) at ICML 2020

SERVICE AND OUTREACH

- Aug. 2018 - **Institutional Service, Georgia Institute of Technology** *Atlanta, GA*
Jul. 2021
- Reviewer for President's Undergraduate Research Awards (PURA) 2019
 - Co-founder of the MCV PhD Student Support Group 2018-2020
 - School of Computer Science's Prospective Student Visit Week, Coordinator 2019
 - School of Interactive Computing's Prospective Student Visit Week, Volunteer 2019, 2020

EXTRACURRICULARS

- Aug. 2015 - **Hackathons and Video Game Development**,
July 2018
- HackIllinois: Health Desk - Desktop app that checks posture using computer vision
 - SwampHacks: Labyrinth - 3D survival maze game built with Unity engine and C#; top 10 overall
 - HackGT: CorCal - App to sync multiple calendars; built with Java and the Swing library
 - Video Game Development Club (VG Dev) at Georgia Tech: HowRogue a Roguelike built in C++

Selected Media Coverage

How role-playing a dragon can teach an AI to manipulate and persuade MIT Tech Review. Will Douglas Heaven. November 20, 2020. [LINK](#).

How to Train Your AI: Researchers Teach AI How to Move Around Fantasy Worlds Science Times. Mark B. November 5, 2020. [LINK](#).

AI can make your favourite game characters speak to each other INDIAai National AI Portal of India. November 5, 2020. [LINK](#).

Teaching AI agents to communicate and act in fantasy worlds Tech Xplore. Ingrid Fadelli, November 3, 2020. [LINK](#).

Researchers combine reinforcement learning and NLP to escape a Grue monster Venture Beat. Khari Johnson, June 30, 2020. [LINK](#).

Sztuczna inteligencja jako pisarz: Generowanie fabuły (Translation from Polish: Artificial Intelligence as a Writer: Story Generation) Zeszyty Maryny. Patrycja Świeczkowska, Oct 4, 2019. [LINK](#).

Georgia Tech Artificial Intelligence Research Includes Collaborative Approaches with Humans, Automating Content, and More Georgia Tech GVU Center. Joshua Preston, Feb 2, 2018. [LINK](#).

Changing the Conversation: Georgia Tech Researchers Provide New Approach to Automated Story Generation Georgia Tech School of Interactive Computing. David Mitchell, Feb 4, 2020. [LINK](#).

References

- Mark O. Riedl (PhD Advisor), Professor, Georgia Institute of Technology, riedl@cc.gatech.edu
- Yejin Choi, Professor, University of Washington & Allen Institute for AI, yejin@cs.washington.edu
- Hannaneh Hajishirzi, Associate Professor, University of Washington & Allen Institute for AI, hannaneh@cs.washington.edu
- Chris Callison-Burch, Associate Professor, University of Pennsylvania, ccb@upenn.edu
- Charles Lee Isbell Jr., Professor and Dean, Georgia Institute of Technology, isbell@cc.gatech.edu