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# Interactive Fiction Games: A Colossal Adventure

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# Introduction

- Interactive Fiction games are software environments in which players can observe, provide actions, or get scored in a simulated worlds
- Interactive Fiction environments is believed to provide a good testbed for studying AI
- Natural Language is key to interactive fiction
- Natural Language goes beyond games too, such as voice-activated personal assistants

# Papers Goals

- Introduces Jericho, a learning environment
- Introduces a template-based action space
- Conduct an evaluation of the learning agents

# Natural Language

- Natural language processing is key to interactive fiction
- Interactive fiction combines the challenges of commonsense reasoning, action spaces and language understanding
- Humans bring competencies into natural language understanding

*Observation:* This bedroom is extremely spare, with dirty laundry scattered haphazardly all over the floor. Cleaner clothing can be found in the dresser. A bathroom lies to the south, while a door to the east leads to the living room. On the end table are a telephone, a wallet and some keys.  
The phone rings.

**Action: Answer phone**

*Observation:* You pick up the phone. "Hadley!" a shrill voice cries. "Hadley, haven't you even left yet?? You knew that our presentation was at nine o'clock sharp! First the thing with the printers, now this - there won't even be enough left of you for Bowman to fire once he's done with you. Now get the hell down here!!"

**Action: Examine me**

*Observation:* You're covered with mud and dried sweat. It was an exhausting night - no wonder you overslept! Even making it to the bed before conking out was a heroic accomplishment.

# What is Jericho?

- Is a learning environment for human-made interactive fiction games.
- Is open sourced, python based environment
- Has the ability to extract world-object-trees to form the basis for world-change-detection and ground-truth object detection
- Has the ability to best-guess detect whether an action changed the world state of the game
- Supports a set of 56 human made interactive fiction games from many different genres

# World Object Tree and World Change Detection

- The world object tree is a semi-interpretable representation of the game state that an interactive fiction game uses
- Each object in the tree has a parent, child and sibling
  - These are used to encode presence
- World Change Detection is based on identifying changes to the world-object tree
  - Can fail to detect valid actions whose effects alter global variables instead of the object tree (These are considered rare)

# The Algorithms

- Interactive fiction game playing has been approached from a single-game agent perspective
- The paper uses three agents
  - Choice-Based Single-Game agent (DRRN)
  - Parser-Based Single-Game Agent (TDQN or Template-DQN)
  - Parser-Based General-Game Agent (NAIL)

# The Experiment

- The evaluation of the agents across a set of thirty-two Jericho-Supported games had the aims:
  - Showing Feasibility of Reinforcement learning on different Interactive Fiction games
  - Creating a reproducible benchmark
  - Investigating the differences between choice-based and template-based action spaces
  - Comparing performances of different agents

# The Results

- Random agent shows that more simple navigation and take actions are needed
- Comparing DRRN and TDQN highlights the utility of choice-based
- Comparing General to NAIL, NAIL agent performs well
- Note: T is templates and V is Vocabulary

Game	T	V	RAND	NAIL	TDQN	DRRN
905	82	296	0	0	0	0
acorncourt	151	343	0	0	.05	.33
anchor	260	2257	0	0	0	0
advent	189	786	.1	.1	.1	.1
adventureland	156	398	0	0	0	.21
afflicted	146	762	0	0	.02	.03
awaken	159	505	0	0	0	0
balances	156	452	0	.2	.09	.2
deephome	173	760	0	.04	0	0
detective	197	344	.32	.38	.47	.55
dragon	177	1049	0	.02	-.21	-.14
enchanter	290	722	0	0	.02	.05
gold	200	728	0	.03	.04	0
inhumane	141	409	0	0	0	0
jewel	161	657	0	.02	0	.02
karn	178	615	0	.01	0	.01
library	173	510	0	.03	.21	.57
ludicorp	187	503	.09	.06	.04	.09
moonlit	166	669	0	0	0	0
omniquest	207	460	0	.11	.34	.1
pentari	155	472	0	0	.25	.39
reverb	183	526	0	0	.01	.16
snacktime	201	468	0	0	.19	0
sorcerer	288	1013	.01	.01	.01	.05
spellbrkr	333	844	.04	.07	.03	.06
spirit	169	1112	.01	0	0	0
temple	175	622	0	.21	.23	.21
tryst205	197	871	0	.01	0	.03
yomomma	141	619	0	0	0	.01
zenon	149	401	0	0	0	0
zork1	237	697	0	.03	.03	.09
zork3	214	564	.03	.26	0	.07
ztuu	186	607	0	0	.05	.22

# Strengths Vs Weaknesses

## Strengths

- Jericho is a good platform to study on
- Proposed a novel template based action space which did not perform the best but did get second
- Provided a benchmark for future studies

## Weaknesses

- As there agents were trained and evaluated in individual games, it does not demonstrate true general interactive fiction gameplay
- Provided handicaps to the agents

# Conclusion

- Created Jericho, a experimental platform with key features to extract game specific action templates and vocabulary
- Proposed a template based action space named Template-DQN
- Evaluated many agents including Template-DQN, NAIL, and DRRN
- Aimed to provide benchmark results to help future Interactive Fiction studies and language understanding agents

# References

- Hausknecht, M., Ammanabrolu, P., Côté, M.-A., & Yuan, X. (2020). Interactive Fiction Games: A Colossal Adventure. Proceedings of the AAAI Conference on Artificial Intelligence, 34(05), 7903-7910.  
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