



DUNGEONS AND DRAGONS FANTASY ADVENTURE GENERATION

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CONTENT



Dungeons
and Dragons



Research
Problem



Literature
Survey



Progress Map



Dungeons and Dragons

DUNGEONS AND DRAGONS (D&D, DnD)

- Open-ended
- Pen and paper
- Tabletop
- Role Playing Game (RPG)
- Since 1974
- Predefined rules
- Setting
 - lore, species, artifacts, statistics, and rules

DUNGEON MASTER

- Conducts gameplay
- Plays NPCs
- Regulate player actions

ADVENTURE

- A guide
- Self-contained game narrative
- Quest
- States:
 - Initial state
 - Intermediate states + transition conditions
 - End state (goal)
- NPCs, rewards, objects + Narrative



FORGOTTEN REALMS

- De-facto default setting for D&D 5e
- High fantasy
- Medieval to Middle Eastern and Asian
- Has the most resources
- Fandom Wikia
 - <https://forgottenrealms.fandom.com/>
- 41 000 articles





Research Problem

RESEARCH PROBLEM

- “Generating self-standing adventures for Dungeons and Dragons game-play.”
- DMs create their own adventures
- 3-4 hours preparation for 1 hour of game-play
- No “complete adventure” generators
- Piece together sections



Literature Survey

AUTOMATED QUEST GENERATION

- High demand by digital games for new content (MMORPG)
- Digital games vs. D&D
 - Open ended actions
- Types of quests^[1]:
 - Objective oriented quests
 - Place oriented quests
 - Time oriented quests

[1] E. Aarseth, "From hunt the wumpus to everquest: Introduction to quest theory," in International Conference on Entertainment Computing. Springer, 2005, pp. 496–506.

AUTOMATED STORY GENERATION

- Automated text generator for Short stories by S. Sato^[2]
 - Passed the first of four screenings at a Japanese literature award
- Laclaustra et al^[3]. proposed a simulation based story generator
 - Multiple agents try to achieve different goals and record the states
- Si et al.^[4] presents a method to generate character driven narratives
 - Dialogue based stories using extended version of CRD3^[5]
- Limitations with Story generators
 - Evaluating the goodness
 - Plot devices
 - Cohesion

[2] S. Sato, "A challenge to the third hoshi shinichi award," pp. 31–35, 12 2016.

[3] I. M. Laclaustra, J. Ledesma, G. Méndez, and P. Gervás, "Kill the dragon and rescue the princess: Designing a plan-based multi-agent story generator." in ICCG, 2014, pp. 347–350.

[4] W. M. Si, P. Ammanabrolu, and M. O. Riedl, "Telling stories through multi-user dialogue by modeling character relations," arXiv preprint arXiv:2105.15054, 2021.

[5] R. Rameshkumar and P. Bailey, "Storytelling with dialogue: A Critical Role Dungeons and Dragons Dataset," in Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics. Online: Association for Computational Linguistics, Jul. 2020, pp. 5121–5134. [Online]. Available: <https://aclanthology.org/2020.acl-main.459>

PROCEDURAL CONTENT GENERATION

- Formalize and automate design process
 - There are a lot of work done on PCG ^[6,7]
- Popularized by game design
- Rogue (1980)^[8]
- Rule based vs. Search based (more popular^[9])
- Dungeon generation categorization: Niemann and Preuß^[10], Shaker et al. ^[11]
 - Binary space partitioning
 - Agent based dungeon growing
 - Cellular automata
 - Grammar based methods

[6] J. Togelius, G. N. Yannakakis, K. O. Stanley, and C. Browne, "Search-based procedural content generation: A taxonomy and survey," IEEE Transactions on Computational Intelligence and AI in Games, vol. 3, no. 3, pp. 172–186, 2011.

[7] A. M. Smith and M. Mateas, "Answer set programming for procedural content generation: A design space approach," IEEE Transactions on Computational Intelligence and AI in Games, vol. 3, no. 3, pp. 187–200, 2011.

[8] R. Khaled, M. J. Nelson, and P. Barr, "Design metaphors for procedural content generation in games," in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, ser. CHI '13. Association for Computing Machinery, 2013, p. 1509–1518.

[9] B. M. Viana and S. R. dos Santos, "A survey of procedural dungeon generation," in 2019 18th Brazilian Symposium on Computer Games and Digital Entertainment (SBGames). IEEE, 2019, pp. 29–38.

[10] M. Niemann and M. Preuß, "Constructive generation methods for dungeons," in Seminar-Thesis in Procedural Content Generation for Games. Westfälische Wilhelms Universität Münster, 2015.

[11] N. Shaker, A. Liapis, J. Togelius, R. Lopes, and R. Bidarra, "Constructive generation methods for dungeons and levels," Procedural Content Generation in Games Computational Synthesis and Creative Systems, p. 31–55, 2016.

PCG: DISADVANTAGES

- Pereira de Araujo and Souto^[12]
 - Monotonous elements (Diablo)
 - Randomized PCG: uncanny scenarios (Crusader Kings)
 - Overly simple gameplay (No Man's Sky)
 - Cannot capture complex interactions for game-play mechanics
 - Gameplay experience loses significance (Skyrim)
 - Requires human generated assets
- Viana and dos Santos^[10]
 - Barriers to control player progression
- Khaled et al.^[9]
 - Assume that designer is well versed in the PCG workings
 - Lack of traceability (how and why)

[9] R. Khaled, M. J. Nelson, and P. Barr, "Design metaphors for procedural content generation in games," in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, ser. CHI '13. Association for Computing Machinery, 2013, p. 1509–1518.

[10] B. M. Viana and S. R. dos Santos, "A survey of procedural dungeon generation," in 2019 18th Brazilian Symposium on Computer Games and Digital Entertainment (SBGames). IEEE, 2019, pp. 29–38.

[12] R. Pereira de Araujo and V. T. Souto, "Game worlds and creativity: The challenges of procedural content generation," Lecture Notes in Computer Science, p. 443–455, 2017.

GENERATING QUESTS BASED ON PLAYER TYPE

- Lee and Cho^[13] player type and expectations
 - a) hardcore gamers – extreme and stressful (e.g. combat)
 - b) casual gamers – a pleasant experience (e.g. exploration, gathering material)
- Bayesian network (last n games)
 - Quest type, hours of gameplay and number of deaths
- Petri net for multi-variable interactions^[14,15,16] – map a quest (interconnected events)
- Implemented in Neverwinter Nights using Doran and Parberry^[17] quest classification
- Generate different types of quests with same gameplay experience
- Drawbacks – Handcrafted Bayesian network
- Player types need a separate study (Lazzaro^[18] identifies 4)

[13] Y.-S. Lee and S.-B. Cho, "Context-aware petri net for dynamic procedural content generation in role-playing game," IEEE Computational Intelligence Magazine, vol. 6, no. 2, pp. 16–25, 2011.

[14] C. Brom and A. Abonyi, "Petri-nets for game plot," in Proceedings of AISB artificial intelligence and simulation behaviour convention, Bristol, vol. 3, 2006, pp. 6–13.

[15] W. M. van der Aalst, "Process discovery: Capturing the invisible," IEEE Computational Intelligence Magazine, vol. 5, no. 1, pp. 28–41, 2010.

[16] J. L. Peterson, Petri net theory and the modeling of systems. Prentice Hall PTR, 1981.

[17] J. Doran and I. Parberry, "A prototype quest generator based on a structural analysis of quests from four mmorpgs," in PCGames '11, 2011.

[18] N. Lazzaro, "Why we play games: Four keys to more emotion in player experiences," in Proceedings of GDC, vol. 306, 2004, pp. 1–8.

MIXED INITIATIVE AND SEMI-AUTOMATED SYSTEMS

- Human and computer takes turns to provide input
- Evolutionary Dungeon Design (EDD)^[19]
 - Tile based (6 different tiles) dungeon designer
 - Inspire game developers
 - Apply game design patterns
 - Calculate values for the criteria
 - Evaluate fitness – feasible vs infeasible
 - Mutate each type
 - Improvements from high level patterns^[20,21] to Mixed Initiative Co-Creativity^[22,23] and Quality Diversity model^[24-25]
- Olsson and Grevillius^[26] – Dornan's^[17] classification with Mixed Initiative
 - User and computer arrange the events sequence
 - Fill in the rest with modified grammars

[19] A. Baldwin, S. Dahlskog, J. M. Font, and J. Holmberg, "Mixed-initiative procedural generation of dungeons using game design patterns," in 2017 IEEE conference on computational intelligence and games (CIG). IEEE, 2017, pp. 25–32.

[20] A. Baldwin, S. Dahlskog, J. M. Font, and J. Holmberg, "Towards pattern- based mixed-initiative dungeon generation," in Proceedings of the 12th International Conference on the Foundations of Digital Games, 2017, pp. 1–10.

[21] S. Dahlskog and J. Togelius, "A multi-level level generator," in 2014 IEEE Conference on Computational Intelligence and Games. IEEE, 2014, pp. 1–8.

[22] A. Liapis, G. N. Yannakakis, and J. Togelius, "Designer modeling for sentient sketchbook," in 2014 IEEE Conference on Computational Intelligence and Games. IEEE, 2014, pp. 1–8.

[23] G. N. Yannakakis, A. Liapis, and C. Alexopoulos, "Mixed-initiative co-creativity," 2014.

[24] A. Alvarez and J. Font, "Learning the designer's preferences to drive evolution," arXiv preprint arXiv:2003.03268, 2020.

[25] A. Alvarez, J. M. M. F. Fernandez, S. Dahlskog, and J. Togelius, "Interactive constrained map-elites: Analysis and evaluation of the expressiveness of the feature dimensions," IEEE Transactions on Games, 2020.

[26] E. Olsson and E. Grevillius, "Mixed-initiative quest generation," 2020.

QUEST GRAPH

- Outline of the quest(plot) in graph notation
- Dormans^[27] – quest and quest space (map) as 2 graph grammars
 - Eliminate randomness, fully utilize each
- Recursive grammar to create plot points
 - Contingencies against too short plots (3 part story structure grammar)
 - Non-linear quest plots
 - Special edges to indicate prerequisites
- Needs new grammar if the vision of the game is changed
 - Requires domain experts

[27] J. Dormans, “Adventures in level design: generating missions and spaces for action adventure games,” 2010.

DUNGEON AND QUEST GENERATION PHILOSOPHIES

CHOICES AND CONSTRAINTS VS GAME-PLAY EXPERIENCE

- Sullivan et al.^[28] observe that most game quests are task oriented
 - They lack interesting choices
 - Not goal oriented
- Final Fantasy
 - Finely crafted stories but lack choice
 - Playing “someone else’s pre-arranged story”
- Elder Scrolls
 - Too many choices
 - Lack significance to story
- Pitfall on tabletop games
 - “feel lost and unsure of where to go”
 - DM – balance with constraints

[28] A. Sullivan, M. Mateas, and N. Wardrip-Fruin, “Questbrowser: Making quests playable with computer-assisted design,” 2009.

DUNGEON AND QUEST GENERATION PHILOSOPHIES

MEANINGFUL QUEST ENGAGEMENT

- Doran and Parberry^[17]
 - Quest offered by NPC → Narrative is better/ more organic
 - 750 quests, 4 MMORPGs – only 9 categories (NPC motivations)
 - Proposes special grammar
- Ashmore and Nitsche^[29]
 - Key-lock genre
 - World map grows as player progresses
 - Map is influenced by player past behaviour
 - Terrain to control player progression
- Need to find balance NPC offered quests vs Key-lock and other mechanics

[17] J. Doran and I. Parberry, “A prototype quest generator based on a structural analysis of quests from four mmorpgs,” in PCGames ’11, 2011.

[29] C. Ashmore and M. Nitsche, “The quest in a generated world.” in DiGRA conference. Citeseer, 2007

DUNGEON AND QUEST GENERATION PHILOSOPHIES

NON-LINEAR STORIES

- “A plot often contains a process of plans being created, thwarted, readjusted and dropped repeatedly” – Brenner^[30]
- Multiple paths to complete a quest.
 - Some paths may be dead ends
 - Infinite endings
- Soares de Lima et al.^[31]
 - Hierarchical task decomposition
 - Models quest as a steps to follow
 - Complexity (multiple sub quests, goal states) makes it goal oriented and choice driven

[30] M. Brenner, “Creating dynamic story plots with continual multiagent planning,” in Twenty-Fourth AAAI Conference on Artificial Intelligence, 2010.

[31] E. Soares de Lima, B. Feijó, and A. L. Furtado, “Hierarchical generation of dynamic and nondeterministic quests in games,” in Proceedings of the 11th Conference on Advances in Computer Entertainment Technology, 2014, pp. 1–10.

OTHER RELATED WORK

- Rameshkumar and Bailey^[5] – CRD3 dataset.
 - Critical role web series
 - Fandom Wikia
- Lange et al.^[32] – iPopulator
 - Extract structured information from Wiki Test
 - Based on info boxes
 - Importance of first paragraph
 - 1/3 Wikipedia pages contain infobox
 - Forgotten Realms Wikia – 73%

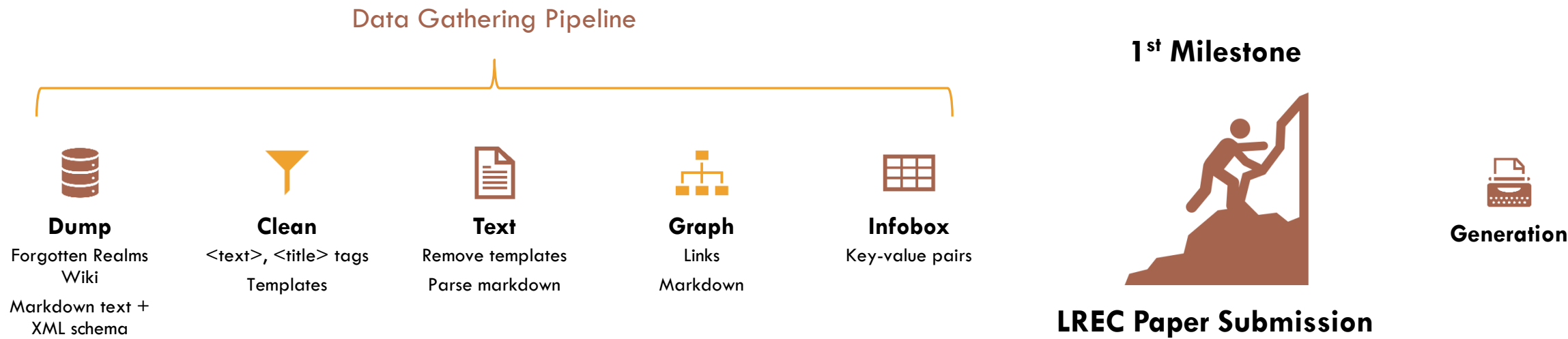
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[32] D. Lange, C. Böhm, and F. Naumann, in Extracting structured information from wikipedia articles to populate infoboxes, 2010.



Progress Map

PROGRESS MAP



FORGOTTEN REALMS WIKI (FRW) DATASET

Dataset	Description
FRW-P	Raw plain text
FRW-J	A JSON structure with plain text indexed by article title
FRW-FJ	A JSON structure with only the first paragraph of articles indexed by article title
FRW-L	A directional graph indicating all the references in the articles to other articles
FRW-FL	A directional graph indicating the first references in the articles to other articles
FRW-CL	A directional graph indicating the category references in the articles to category articles
FRW-I	A JSON structure for the Wikipedia infobox substructures indexed by article title
FRW-PE	Poincaré embedding for the first links
FRW-W	2 Word2Vec models for full text (CBOW and Skip-gram)
FRW-D	2 Doc2Vec models for full text (PV-DBOW and PV-DM)
FRW-FD	2 Doc2Vec models for first paragraph text (PV-DBOW and PV-DM)

CONTENT



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- [21] S. Dahlskog and J. Togelius, “A multi-level level generator,” in *2014 IEEE Conference on Computational Intelligence and Games*. IEEE, 2014, pp. 1–8.
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- [32] D. Lange, C. Böhm, and F. Naumann, in Extracting structured information from wikipedia articles to populate infoboxes, 2010.



THANK YOU

Let the QUESTioning begin

MISSING

The gentleman's
have escaped and
have been found
who return the
and would



HIRING

Wanted a man
making a new shop
at the door



SEEKING ESCORT

I want
a man to
go to the
court at a
point of
time