SUGISAKA MASANORI

Journal of Robotics, Networking and Artificial Life
Vol. 9(4); March (2023), pp. 379–384
ISSN (Online):2352-6386; ISSN (Print):2405-9021
https://alife-robotics.org/jrnal.html

Research Article

Story Units of Japanese Folktales Based on the Combination with the Noun Conceptual Dictionary in an Integrated Narrative Generation System

Jumpei Ono[1], Motoki Kumagai[2], Takashi Ogata[3]

[1]*Faculty of Software and Information Technology, Aomori University, 2-3-1 Kohbata, Aomori-shi, Aomori, 030-0943, Japan*
[2]*Graduate School of Software and Information Science, Iwate Prefectural University, 152-52 Sugo, Takizawa, Iwate, 020-0693, Japan*
[3]*Faculty of Software and Information Science, Iwate Prefectural University, 152-52 Sugo, Takizawa, Iwate, 020-0693, Japan*

ARTICLE INFO

Article History

Received 02 December 2021
Accepted 03 April 2023

Keywords

Narrative generation
Noun conceptual dictionary
Story generation

ABSTRACT

The story units in this study are the units described in Common Lisp based on the types of folktales analyzed by Seki et al. We have been developing story units for our integrated narrative generation system (INGS) as a type of narrative technique that generates a new narrative based on the synthesis, transformation, expansion, and so on, of a narrative structure. The story units function in the INGS with conceptual dictionaries. In this paper, we combine these story units with a verb conceptual dictionary and a noun conceptual dictionary. The constitutional elements of each story unit are verb and noun concepts; therefore, combining them with a noun conceptual dictionary enables the substantial function of story units based on the types of Japanese folktales as a group of narrative techniques in the INGS.

1. Introduction

There are various approaches to narrative generation. For instance, Ogata divided the majority of past narrative generation systems into a problem-solving or planning-based approach, a structural approach, and a synthetic approach [1]. Planning-based models view the sequence of events that make up a story as a causal sequence toward an end goal. For example, the TALE-SPIN system [2] generates a story by taking a character's goal as the story's goal and using an inference engine to connect the events that lead from the initial to the final state. In contrast, structural models involve a narrative generation process based on narrative structural formalizations, such as story grammar and story schema. Two systems, GESTER [3] and JOSEPH [4], consist of an interpreter with both a story grammar and a world model. The BRUTUS system [5] employs a blended approach by using various problem-solving methods, such as goal-based planning, and structural techniques, such as story grammar and theme structure. Such synthetic systems can be grouped into a third approach.

The comprehensive survey of narrative generation systems by Alhussain and Azmi [6] covers machine learning and neural network approaches as narrative generation techniques. For example, the Buncho system [7] uses GPT2, a version of a generative pre-trained transformer (GPT), to perform machine learning using a corpus of novels on the Web.

Moreover, the introduction of conceptual and literary knowledge is effective for more interesting narrative generation. These two themes were positioned at the center of our narrative generation research. Ogata developed several conceptual dictionaries to flexibly deal with conceptual and linguistic knowledge for various aspects of narrative generation [8] and presented a method to computationally treat the knowledge of types of folktales

Corresponding author's E-mail: j.ono@aomori-u.ac.jp, g231u020@s.iwate-pu.ac.jp, t-ogata@iwate-pu.ac.jp

[9]. Concerning the literary knowledge, Ogata published three books that systematically describe from the comprehensive survey of literary knowledge to the implementation of several systems combined to literary theories [10], [11], [12].

Alhussain and Azm also state that the literary knowledge based on narrative theories is critical for narrative interest in story generation. They cited our papers related to Genette's narrative discourse theory [13], [14], which showed a systematic classification of narrative discourse techniques in a novel [15].

In the above research context, we have developed an integrated narrative generation system (INGS) for story generation that introduces six types of knowledge [10], [11]. The INGS organically combines event generation using a conceptual dictionary [8] with narratology-based generation through a system [16], [17] based on Propp's theory [18] and Genette's narrative discourse [15]. Narratology has been used as a framework for sociological analysis in recent years; however, traditional narrative theory focuses on texts such as folktales and novels. Propp's theory is based on folktales, whereas Genette's narrative discourse is based on novel texts. We have been incorporating findings from narrative theory into our system, and this study extends the research that introduces the structural knowledge of stories in Japanese folktales.

This study focuses on "Nihon Mukashi-Banashi Taisei" ("The Complete Collection of Japanese Folktales") [19]. "The Complete Collection of Japanese Folktales" comprises the categories of folktales (types of folktales) based on the classification of European folktales by Aarne [20] and the collection of folktales by Seki et al. We used the types of folktales included in Volume 11 (Note: Volumes 1 to 10 contain the folktales Seki collected, and Volume 12 is a collection of research papers on folktales) for this study.

We created folktale programs based on these types of folktales [21], [22]. The structure, termed as "story units," was created from 825 folktales. Story units are knowledge used in story generation to create a story structure. The INGS synthesizes them based on conceptual dictionaries [8]. Therefore, we need to combine the story units and conceptual dictionaries for matched the case structure of events in the former with concepts stored in the latter. At first, we combined verbs in story units with verb concepts [9]. The remaining targets are elements (mostly nouns) stored in cases of the verbs of the story units.

In this paper, we aim to combine nouns in the story units with the noun conceptual dictionary to generate stories using the story units in various techniques shown in Section 4. This paper is closely associated with both conceptual and literary knowledge types for narrative generation, which are the most important topics in our narrative generation research.

2. Overview of Story Units and the Noun Conceptual Dictionary

This section describes the two elements that must be combined: the story units and the noun conceptual dictionary.

2.1. *Overview of story units and an example*

A story unit is the knowledge used to generate a story, and is a record of the story's structure. It is based on the structure of a Japanese folktale, and its content expresses the structure of the folktale compiled by Seki et al. A story unit contains two or more events. Events have a case structure consisting of a verb and its accompanying case, each of which is associated with the conceptual dictionaries described in Section 2.2. The INGS generates stories by editing story units or combining story units based on conceptual dictionaries.

Fig. 1 shows an example of the story unit. To make the story units available for story generation, we combined verbs and verb concepts [9]. However, the story units do not combine with noun concepts. The story shown in Fig.1 is "A woman wears a demon-mask in a mountain. A monster sees the mask and runs away from her. The woman takes a treasure and goes home or becomes the owner of the monster's house."

The details of Fig. 1 are described below. "motif0669" is the ID for the story unit. The "鬼の面[demon-mask]" is the story unit's name. The list of verbs that follow this name summarizes the structure of the story unit. It is followed by a list of the story unit's case structures. The verbs in the case structure are described using verb concepts. A verb concept has the descriptive form of a verb and a serial number. It indicates any one of the several meanings that the verb has, depending on this number. "Agent," "object," "counter-agent," "location," "to" are cases. Cases mainly store nouns, noun phrases, and adverbs and may store events. "(event 被る 1[wear] (agent (&sc 女[woman])) (object (&sc 鬼の面[demon-mask])) (location (&sc 山[mountain])"shows "A woman wears a demon-mask in a mountain."

```
(motif0669 (鬼の面[demon-mask]
 (被る 1[wear] 見る 1[look] 逃げる 1[run-away]
  (or (取る 1[take] 帰る 1[go-home])
  なる 1[become])))
 ((1 (event 被る 1[wear] (agent (&sc 女
[woman]))
       (object (&sc 鬼の面[demon-mask]))
       (location (&sc 山[mountain]))
  (2 (event 見る 1[look]
       (agent (&sc 化け物[monster]))
       (counter-agent (&sc 女[woman])))))
  (3 (event 逃げる 1[run-away]
       (agent (&sc 化け物[monster])))))
  (or
    (4a (event 取る 1[take]
         (agent (&sc 女[woman]))
         (object (&sc 宝物[treasure])))
        (event 帰る 1[go-home]
         (agent (&sc 女[woman]))))
    (4b (event なる 1[become]
         (agent (&sc 女[woman]))
         (to
(&sc 化け物屋敷の主人[host-of-monster-
house])))))))
```

Fig. 1. Example for a story unit.

2.2. *Overview of the noun conceptual dictionary*

The INGS has conceptual dictionaries [8]. Conceptual dictionaries are primarily referenced to generate events that comprise a story. There are nouns, verbs, and modifier conceptual dictionaries (adjectives, adjective verbs, and adverbs). This section describes the noun conceptual dictionary.

The noun conceptual dictionary contains 5,809 intermediate concepts and 115,769 terminal concepts. Intermediate concepts indicate the classification of noun concepts, and terminal concepts indicate the nouns that appear in the story. The hierarchical structure of the intermediate concepts had 13 levels. The subordinate noun concepts under an individual intermediate noun concept are (1) intermediate noun concepts only, (2) terminal noun concepts only, or (3) both intermediate and terminal noun concepts. Furthermore, general and proper nouns have different hierarchical structures. However, the description format remains the same.

Fig. 2 shows the structure of an intermediate noun concept. We combine noun concepts corresponding to "terminal" with the story unit nouns (Section 3). Each item is described as follows:

"Depth" indicates the position in the noun conceptual dictionary's hierarchical structure, which can contain values from 1 to 13.

- "Hype" indicates the intermediate concept of parent.
- "Hypo" refers to the intermediate concepts of children.
- "Terminal" shows intermediate concepts of children.
- "Frame" does not currently signify anything.

```
([Noun]
       (hierarchy
        (depth [Number])
        (hype [Intermediate noun concept])
        (hypo [Intermediate noun concept])
        (terminal [Terminal noun concepts]))
       (frame nil))
```

Fig. 2. The structure of an intermediate noun concept.

3. Combining Story Units with the Noun Conceptual Dictionary

This section presents the results in a previous research and solutions to the possible issues that can be raised in response to these results.

3.1. *Results from previous research and problems*

In the process of creating the story unit shown in Fig. 1, we divided the folktale events according to the case structure. Consequently, the event components were divided into (A) verb components and (B) other components. Thus, based on [21], (A) has been combined with the verb conceptual dictionary and there are 3,695 elements in (B) and 766 are nested structures of events with verbs. Therefore, 766 elements were combined into a verb conceptual dictionary. The remaining 2,929 elements in (B), were classified according to the results of the morphological analyzer MeCab (used IPA corpus) [23]. Consequently, 1,888 elements are nouns. The remaining 1,041 were combined for a separate study [24]. They include modifiers and character utterances.

3.2. *Method and results*

Among the 1,888 nouns, 1,062 can be combined with the noun conceptual dictionary. However, 826 cannot be combined. After describing the merging procedure, we summarize the details of each case. (1) First, for each of the 1,888 nouns, the noun concept was compared to that stored in the noun conceptual dictionary. (2) If the notation used to register the concept matched the noun in the story unit, it was considered a joinable noun. (3)

Then, each joinable noun was given an intermediate concept in the noun conceptual dictionary.

In the above procedure, we combine 1,062 nouns with the noun conceptual dictionary. Fig. 3 shows a motif combined with noun concept in the noun conceptual dictionary. In this figure, the description form of "@X" means that it shows an intermediate noun concept and the part of "X" indicates a particular intermediate noun concept. Each intermediate noun concept in the noun conceptual dictionary contains one or more concrete values. For instance, "@女" in the figure has the concrete noun concepts, such as "女[woman]," "妻[wife]," and "母[mother]." In this figure, "女@女" corresponds to a concrete "女[woman]" in the intermediate noun concept, "@女." This mechanism enables to generate diverse noun concepts in story generation according to the above manner.

There are two types of 1,062 nouns: single nouns, such as "snake" and "bull," and nouns with modifying words, such as "delicious dish." The former could be examined directly in conjunction with noun concepts. For the latter, we omitted elements that modified the word and examined noun concept binding. 826 nouns cannot be combined. There are two reasons for this finding: no corresponding noun concepts and inability

```
(motif0669 (鬼の面[demon-mask]
 (被る 1[wear] 見る 1[look] 逃げる 1[run-away]
  (or (取る 1[take] 帰る 1[go-home])
  なる 1[become])))
 ((1 (event 被る 1[wear] (agent (&sc 女@女
[woman]))
       (object (&sc 鬼の面[demon-mask]))
       (location (&sc 山@山{本
体}[mountain]))
  (2 (event 見る 1[look]
       (agent (&sc 化け物@魔物・化け物
[monster]))
       (counter-agent (&sc 女@女
[woman])))))
  (3 (event 逃げる 1[run-away]
       (agent (&sc 化け物@魔物・化け物
[monster])))))
  (or
    (4a (event 取る 1[take]
         (agent (&sc 女@女[woman]))
         (object (&sc 宝物@宝物[treasure])))
        (event 帰る 1[go-home]
         (agent (&sc 女@女[woman]))))
    (4b (event なる 1[become]
         (agent (&sc 女@女[woman]))
         (to
(&sc 化け物屋敷の主人[host-of-monster-
house])))))))
```

Fig. 3. Example of a motif combined with noun concepts.

to combine proper nouns. In any case, if a corresponding noun concept did not exist in the noun conceptual dictionary, we considered adding a new noun concept.

798 nouns have no corresponding noun concepts. The Japanese language uses several kinds of characters to write sentences; therefore, there are several ways to write a word. Noun concepts are not checked using a language notation dictionary for multiple notation methods. Nouns comprising two or more morphemes are not supported. For example, "radish" and "field" have corresponding noun concepts in the noun conceptual dictionary. However, "radish field" has no noun concept.

There are 28 proper nouns. The noun conceptual dictionary contains general noun and proper noun concepts. However, there are various proper nouns. Therefore, the noun conceptual dictionary not store all proper noun concepts that corresponded to them. Proper nouns that cannot be addressed are names currently uncommon and unique in the story.

4. Techniques for Using Story Units in the INGS

The INGS can attempt to generate a variety of stories using story units combined with noun concepts. Fig. 4 summarizes the possibilities of story generation: (A) As a simple approach, the INGS can generate a story according to the structure of a story unit. (B) The system can generate different story structures by editing the story unit. In particular, as described in Section 2.1, the INGS generates stories by editing story units based on conceptual dictionaries and by composing story units. For example, the INGS can generate different stories by changing noun concepts that appear in the story unit based on the hierarchical structure of the noun conceptual dictionary.

Moreover, as shown in Fig. 4 (C), new and longer stories can be generated by mixing and synthesizing two or more story units. In particular, the INGS can synthesize various story structures and story units. The INGS has knowledge bases for story generation, called "story content knowledge base." Story content knowledge represents a story structure of various granularities. Story content knowledge bases are also associated with conceptual dictionaries, and story units can be synthesized with story content knowledge

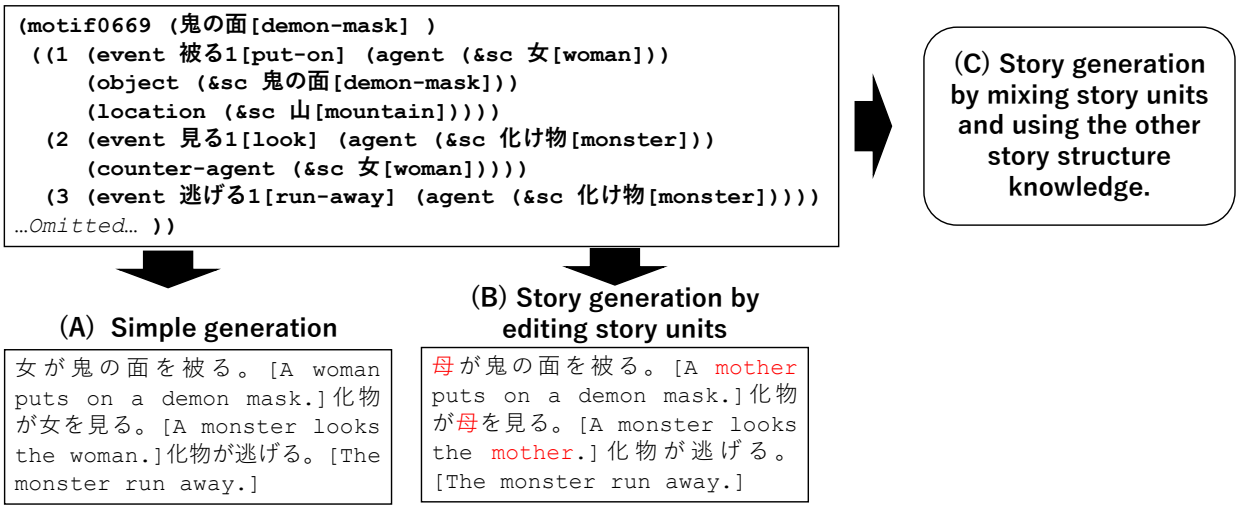

Fig. 4. Possibilities of story generation using story units combined with noun concepts.

through conceptual dictionaries. Consequently, the INGS can incorporate the story structure of Japanese folktales into multiple types of stories.

5. Conclusion

In this paper, we summarized the issues that arise story units created from types of folktales are combined with the noun conceptual dictionary. We then combined 1,062 nouns from 1,888 nouns with the noun conceptual dictionary. Nouns were combined with noun conceptual dictionary without considering their modifiers. The remaining 826 nouns had no corresponding concepts. Therefore, new noun concepts must be registered in the noun conceptual dictionary. In the future, we will address elements of story units that have not yet been combined with conceptual dictionaries.

Acknowledgement

This research was supported by the Japan Society for the Promotion of Science (JSPS KAKENHI) under grant no. 21K17870.

References

1. T. Ogata. A Computational, Cognitive, and Narratological Approach to Narrative Generation, Post-Narratology Through Computational and Cognitive Approaches. PA: IGI Global, 2019, pp. 1-84.
2. J. R. Meehan. Tale-Spin, an Interactive Program that Writes Stories. Proceedings of the Fifth International Joint Conference on Artificial Intelligence. 1977, pp. 91–98.
3. L. Pemberton. A Modular Approach to Story Generation. Proceedings of the Fourth Conference on European Chapter of the Association for Computational Linguistics. 1989, pp. 217-224.
4. R. R. Lang. A Declarative Model for Simple Narratives. Narrative Intelligence: Papers from the 1999 AAAI Fall Symposium, Technical Report. FS-99-01, 1999, pp. 134-141.
5. S. Bringsjord, D. A. Ferrucci. Artificial Intelligence and Literary Creativity Inside the Mind of BRUTUS, a Storytelling Machine. Routledge, London, 1999.
6. A. I. Alhussain, A. M. Azmi. Automatic Story Generation: A Survey of Approaches. ACM Computing Surveys, 2021, Volume 54(5), 1-38.
7. H. Osone, J. L. Lu, Y. Ochiai. BunCho: AI Supported Story Co-Creation via Unsupervised Multitask Learning to Increase Writers' Creativity in Japanese. Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems. 2021, pp. 1–10.
8. T. Ogata. Building Conceptual Dictionaries for an Integrated Narrative Generation System. Journal of Robotics, Networking and Artificial Life, Volume 1(4), 2015, 270-284.
9. T. Ogata, J. Ono. Implementing the Story Units of Japanese Folktales by Using a Verb Conceptual Dictionary. Journal of Robotics, Networking Artificial Life, 2022, Volume 9(2), 99-114.
10. T. Ogata. Toward an Integrated Approach to Narrative Generation: Emerging Research and Opportunities. IGI Global, Hershey (PA), 2020.
11. T. Ogata. Internal and External Narrative Generation Based on Post-Narratology: Emerging Research and Opportunities. IGI Global, Hershey (PA), 2020.
12. T. Ogata. Monogatari Seisei no Post-Narratology: Jinko Chino no Jidai no Narratology ni Mukete 2 (The Post-Narratology of Narrative Generation: Toward the

Naratology in the Age of Artificial Intelligence 2). Shin'yosha, Tokyo, 2022.
13. T. Ogata, S. Yamakage. A Computational Mechanism of the "Distance" Narrative: A Trial in the Expansion of Literary Theory. Proceedings of the 8th World Multiconference on Systemics, Cybernetics, and Informatics. 2004, Volume 14, 179–184.
14. T. Ogata. Computational and Cognitive Approaches to Narratology from the Perspective of Narrative Generation. Computational and Cognitive Approaches to Narratology. IGI-Global, Hershey (PA), 2016, pp.1-74.
15. G. Genette. Discours du Récit, Essai de Méthode, Figures III. Seuil, Paris, 1972.
16. S. Imabuchi, T. Ogata. A Story Generation System Based on Propp Theory: As a Mechanism in an Integrated Narrative Generation System. Lecture Note of Artificial Intelligence. Springer, Berlin, 2012, Volume 7614, pp. 312-321.
17. T. Akimoto, T. Ogata. Evaluation of a Narrative Discourse Generation System Based on the Concept of "Norm and Deviation". Journal of Robotics, Networking and Artificial Life, 2015, Volume 2(1), 50-53.
18. V. Propp. Morphology of the Folktale. University of Texas Press, Austin (TX), 1968.
19. K. Seki, J. Nomura, H. Ōshima (Eds.). Nihon Mukashi-Banashi Taisei 11: Shiryō-Hen (The Complete Collection of Japanese Folktales, Vol. 11: Data). Kadokawa Shoten, Tokyo, 1980.
20. A, Aarne. The Types of the Folktale: A Classification and Bibliography (S. Thompson, trans.). FF Communications. 1961, 184.
21. J. Ono, T. Ito, T. Ogata. Mukahi-Banashi no Motif no Program ka to Motif Kozo no Hikaku (Programs of the Motives of Folktales and the Comparison Among Motif Structures). Proceedings of the 61th Special Interest Group on Language Sense Processing Engineering. 2019, pp. 51-62.
22. T. Ito, J. Ono, T. Ogata. Using Motifs of Folktales for Narrative Generation. Proceedings of the 59th Special Interest Group on Language Sense Processing Engineering. 2018, pp. 8-11. (SMC2018 Workshop on Informational and Cultural Narratology and Cognitive Content Generation.).
23. MeCab. MeCab: Yet Another Part-of-Speech and Morphological Analyzer. https://taku910.github.io/mecab/, 2006.
24. M. Kumagai, J. Ono, T. Ogata. Implementation of Combining Story Units Based on the Types of Japanese Folktales with a Noun Conceptual Dictionary. Proceedings of the 68th Special Interest Group on Language Sense Processing Engineering. 2022, pp. 67-76.

Authors' Introduction

Dr. Jumpei Ono

Jumepi Ono received his bachelor's degree from the Faculty of Software and Information Science, Iwate Prefectural University, in 2010. He received his MS and PhD from the Graduate School of Software and Information Science, Iwate Prefectural University in 2014 and 2018, respectively. He worked as an Information and Communication Technology instructor at the Vocational School of Digital Arts Sendai from 2018 to 2020. He is currently an Assistant Professor at the Faculty of Software and Information Technology, Aomori University.

Mr. Motoki Kumagai

Motoki Kumagai has been an undergraduate student at the Faculty of Software and Information Science, Iwate Prefectural University, since 2019.

Dr. Takashi Ogata

Takashi Ogata received his BSS from Waseda University in 1983, his MS from Tsukuba University in 1992, and his PhD from the University of Tokyo in 1995. He has garnered industrial experience by working in software development companies since 1983. He was an Associate Professor in the Faculty of Engineering at Yamanashi University since 1997 and is currently a Professor in the Faculty of Software and Information Science at Iwate Prefectural University, where he has worked since 2005.