An Intelligent Framework for Reasoning on Story Plots Using Word-net

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Abstract

Reasoning refers to mental process that generates conclusion, based on the activities of the mind such as analyzing, comparing, inferring, and predicting. It helps in taking decision based on the facts. Reasoning is a casual process for the human beings whereas making the system to reason with the available facts to take decision is a tedious process. But in the Artificial intelligence era, reasoning helps the system to take decision with available facts and also makes the system as an intelligent one. People are interested in reading the various kinds of stories like romantic, comedy, thriller and etc. They are having the capability to analyze the story by means of characters involved, settings, location, situation and etc. An intelligent framework is developed using WordNet to benefit the system in order to reason the facts in the story and to arrive at conclusion. The Wordnet ontology helps the system by providing the concepts from many domains. This can be extended to other languages apart from English.

(Keywords – Framework, Reasoning, story, word net)

1 Introduction

Reason is a type of thinking process and the ability of reasoning shows the intelligence of a person deriving conclusion based on the facts and figures. It helps for the system to take decision. Reasoning is the process of using a rational, systematic series of steps based on sound mathematical procedures to arrive at a conclusion; the drawing of conclusions from given facts and mathematical principles; often used as a problem solving strategy. The automatic story generation system aims to generate the stories based on the user's wish. The efficiency of the Purdom's algorithm is used for language generation and using this language generator, sentences are constructed to represent the story. Since the sentences are generated by the system, it needs to undergo the semantic validation. Mainly, the validation can be performed by two ways. They are:

1. Syntactic oriented validation
2. Semantic oriented validation.

Syntactic oriented validation concentrates on the language structure and the grammar adhered for the sentence generation. For example, 'Lion was come to den'. The above sentence has the problem with sentence formation structure. System has to reason the sentence based on the sentence grammar and detects the problem in the language structure. It suggests the corrected sentence as 'Lion came to den or Lion was coming to Den.' which helps to correct the sentence in the story by selecting any one of the above.

Semantic oriented validation focuses on the real world meaning of the generated sentences. Reasoning helps in validating the sentences semantically to produce the meaningful stories. For example, one of the generated sentences for the lion story is 'Rat killed the Lion. '. Even though the sentence is syntactically correct, based on the reality, rat cannot kill the lion. Because, rat is a domestic animal and Lion is a wild animal. Human beings can understand the reality easily. Similarly, the system has to detect the semantic problem and should change into meaningful sentence. Utilization of WordNet lexical database helps in reasoning process that system has to understand as human being that rat cannot kill the Lion. The validator suggests the sentence as 'Lion killed the rat or Rat killed by the Lion'

WordNet is efficiently utilized for these kinds of sentence validation in both ways which include syntactic and semantic ways .WordNet is a large lexical database of any language. Nouns, verbs, adjectives and adverbs are grouped into sets of cognitive synonyms (synsets), each expressing a distinct concept. Synsets are interlinked by

means of conceptual-semantic and lexical relations. The resulting network of meaningfully related words and concepts can be navigated with the browser. WordNet's structure makes it a useful tool for computational linguistics and natural language processing.

Section 2 discusses the related work and Section 3 gives the reasons for reasoning the stories. Section 4 discusses about the intelligent frame work for reasoning the stories. Section 5 focuses on the role of Wordnet in reasoning. Section 6 discusses the conclusion and future works.

2 Related works

There are different types of story generators available for the purpose of automatic story generation and their evolution is described below.

Propp (1968) discussed the story generation as; a tale is a whole that may be composed of thirty one moves. A move is a type of development proceeding from villainy or a lack, through intermediary functions to marriage, or to other functions employed as a denouement (ending). One tale may be composed of several moves that are related between them. One move may directly follow another, but they may also interweave; a development, which has begun pauses and a new move, is inserted.

Bailey (1999) described an approach to automatic story generation based on the twin assumptions that it is possible for the generation of a story to be driven by modeling of the responses to the story of an imagined target reader, and that doing so allows the essence of what makes a story work (its 'storiness') to be encapsulated in a simple and general way.

Charles, F et al (2001), presented results from a first version of a fully implemented storytelling prototype, which illustrates the generation of variants of a generic storyline. These variants result from the interaction of autonomous characters with one another, with environment resources or from user intervention.

Dimitrios N. Konstantinou et al (2002) discussed about the story generation model HOMER. It receives natural language input in the form of a sentence or an icon corresponding to a scene from a story and it generates a text-only narrative apart from a story line and it includes a plot, characters, settings, the user's stylistic preferences and also their point-of-view.

Riedl et al (2004) had provided planning algorithm for story generation. The story planners are limited by the fact that they can only operate on the story world provided, which impacts the ability of the planner to find a solution story plan and the quality and structure of the story plan if one is found, but which lacks semantics.

George miller (1998) provided a wonderful environment to have the collection of words and their synonyms and they are put together **to** form a lexical database. It helps to retrieve the meaning for any kinds of words in any language.

Feinerer (2009) discussed about WordNet package and it provides Java interface to the WordNet1 lexical database of English which is commonly used in linguistics and text mining.

Reasoner framework helps to overcome the semantic lacking of story which can be resolved by reasoning the stories in a systematic and efficient way using the advantages of WordNet.

3 Reasons for reasoning the story

As described earlier part of the paper, many story generation model generates different kinds of story. Jaya et al (2007) stated the development of automatic story generation with ontology. Generated story may lack in meanings which pull down the interest of the readers. In order to afford meaningful stories, they need to undergo the reasoning process. It provides the semantically validated stories in neat and efficient way. The main reasons for reasoning the stories are given below:

- To check the syntactical structure of the story
- To provide the semantics to the sentence by means of
    - characters and their attributes
    - Events in stories which helps to generate new ones.
- To avoid ambiguity over the sentences
- To assist in validation of any kinds of stories
- To strengthen the stories, by acquiring knowledge from the WordNet.

Framework for reasoning the stories

The framework for reasoning the stories are shown in Figure – 1 and it helps in story analysis to perform the validation. Mainly, this framework has been designed for the story which is automatically generated by the system. This framework mainly divides into two phases such as parser and reasoner.

4.1 Parser

Parser contains the two phases namely separator and analyzer. Separator helps to separate the story into story segments called sentences. The separation of sentences helps to check the sentences by its form of sentence structure and the meaning of the story. Analyzer used to identify the noun, verb, settings, location and etc from the story which helps in semantic validation.

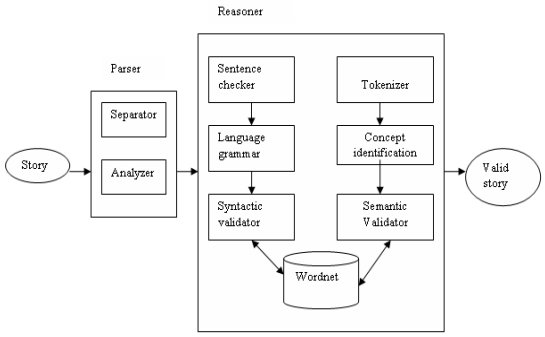

Figure – 1 Framework for reasoning the story

For example, location: forest, character: noun, if one of the sentences in the story is, "Lion was walking in to mall", and then validator needs to correct the sentence as "Lion was walking in to den". As a human beings, know that forest based stories will not have a location called mall and the city based the stories will have the mall. This kind of simple reasoning helps to provide the semantic validation to the story.

4.2 Reasoner

Reasoner divides its path into two such as syntactic validation framework and semantic validation framework. Syntactic validation framework helps to check the sentence structure of the sentences. If the generated sentence is "Lion was sleep den" in the 'Lion and mouse 'story then, it needs to undergo the syntactic validation and the generated sentence should be either as "Lion was sleeping in the den" or "Lion slept". The Figure - 2 shows the syntactic validation of sentence using WordNet. Since WordNet provides the clear view of noun, verb and their tense, helps to change the tense too. It is a large lexical database of any language. Figure -3 provides the extraction of the word "Lion" from the word net. It gives four dimension of lion such as animal, social animal, astrology, zodiac sixth sign. Based on the context, the word lion has been identified and the suitable phrase can be utilized for the validation.

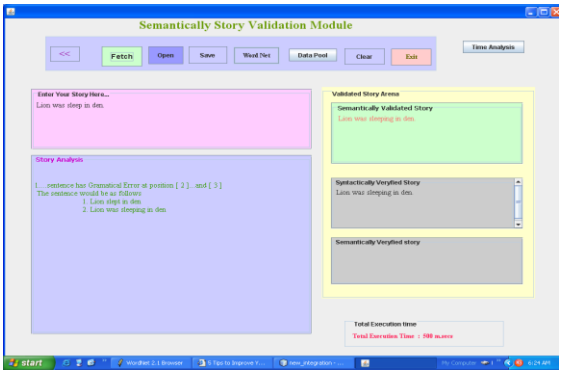

Figure – 2 syntactic validation of story using Wordnet

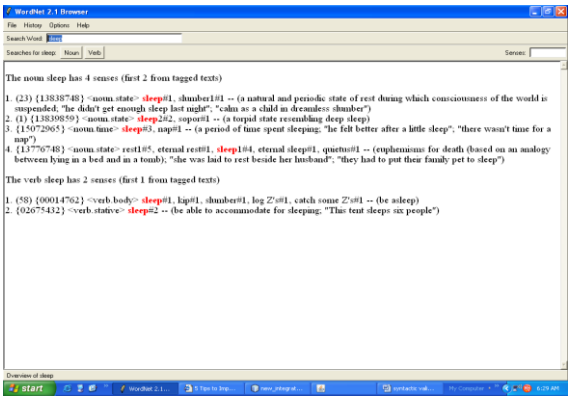

Figure – 3 Extraction of word from Wordnet

For the semantic validation, machine generated stories definitely needs to undertake the validation criteria. The generated sentences may be meaningless for the real world aspects; it needs to come across the semantic validation. For example, Automatic Story Generator generates the following sentence, "cat killed lion". In the reasoner module, the sentence has been tokenized in the tokenizer module. The noun and verb has been extracted from the sentence, each token parsed to the Wordnet and their characteristics has been extracted from the WordNet which helps in semantic validation. As discussed earlier, the lion has four dimensions in Wordnet.

Since ‘cat’ is already in the sentence, animal dimension for lion in the Wordnet has been identified, extracted and validated.

In the next level of validation, Even though cat and lion are animals, but the difference here is, the cat belongs to domestic animal family, lion belongs to wild animal family. In the concept identification module, domestic has lower value than the wild. Therefore, the conclusion here is,’ the cat cannot kill the lion’. So the semantic validator detects the concepts and suggest the sentence as ‘cat killed by lion’ or ‘lion killed cat’. This validation module was depicted in the Figure 4

Figure – 4 Semantic validation of story using Wordnet

Similarly, consider one more sample sentence as;” donkey was crossing the bank in forest”. The noun bank refers to different dimensions. Since donkey and forest exists in the Sentence, ambiguity of the word ‘bank’ has been resolved, and the correct dimension of the bank is river bank which has been extracted from the WordNet. Otherwise, the bank which is the place for transaction of money can also brings the ambiguity of the word. The Figure 5 shows the multi dimensional view of the word ‘Bank’. All the sentences in the story should be validated in both ways which includes syntactic and semantic. The semantic Validation elevates the interest of the reader on the story.

5 Role of Wordnet in reasoning

WordNet acts as brain of the system to provide artificial intelligence to the system for reasoning the stories. WordNet is independent of domains and it provides knowledge for any word given to the system. Wordnet helps the system for reasoning in the following ways

- Provides common understanding for the multi disciplinary group of people.
- Provides all possible meaning for the particular word.
- Easy integration with automatic story generation system.

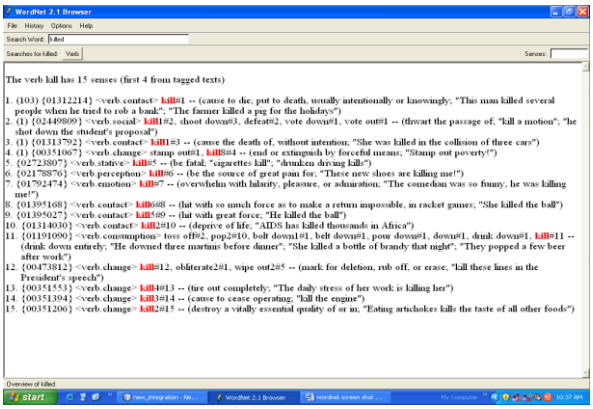

Figure – 5 Multidimensional view of a word in WordNet

WordNet is organized by the concept of synonym sets (synsets), groups of words that are roughly synonymous in a given context. Nouns, verbs, adjectives and adverbs are grouped into sets of cognitive synonyms (synsets), each expressing a distinct concept. Synsets are interlinked by means of conceptual-semantic and lexical relations. A Synsets represents a concept, and contains a set of Words, each of which has a sense that names that concept. The Wordnet is a system for bringing together different lexical and semantic relations between the words.

6 Implementation and Results

The above framework has been implemented in Java and uses the Java JDBC to connect to MySQL server and retrieve the relevant values. GUI is developed using Java Swing. For retrieving the single word, the frame work utilizes the lexical database and it helps to retrieve the different senses of the word with their identification number of synsets. The synset_id for each sense are identified by the extractor and by using the look up operation relative synsets information are retrieved. The retrieved results are used for the semantic checking.

The framework has been built and tested for various stories. The system parses the sentence to the framework for the reasoning purpose. Charles (2002) proposed a set of factors that are

considered to check the quality of the story. These factors are utilized to check the quality of reasoned stories. Based on the above factors, the generated stories are given to a group of people to give their opinions about the generated stories with following scaling factors and with above said features. Excellent – 5; V. Good – 4; Good - 3; Fair – 2; needs improvement – 1;

S.no	Factor	describes
1	Overall	How is the story as an archetypal fairy tale?
2	Style	Did the author use an appropriate writing style?
3	Grammaticality	How would you rate the syntactic quality?
4	Flow	Did the sentences flow from one to the next?
5	Diction	How appropriate were the author's word choices?
6	Readability	How hard was it to read the prose?
7	Logicality	Did the story seem out of order?
8	Believability	Did the story's characters behave as you would expect?

Figure 6: Factors for Assessment of Story

S.no	Parameters	Before reasoning (max = 5)	After reasoning (max = 5)	Improvement
1.	Overall	4.3	4.7	1.09
2.	Style	4.0	4.5	1.13
3.	Grammaticality	4.1	4.8	1.17
4.	Flow	4.2	4.5	1.07
5.	Diction	2.8	3.4	1.21
6.	Readability	3.7	4.0	1.08
7.	Logicality	3.6	4.1	1.14
8.	Believability	4.4	4.7	1.07

Table1: Results of Story Assessment

The Table 1 depicts the calculated values for the stories before reasoning and after reasoning. The Figure – 7 shows the assessment value of story. After reasoning, the quality of the story is improved on an average of 1.12 times better than the before reasoning. The believability factor and overall content have very good feedback among other factors. The other factors like style of the story, grammar content in the story, flow of the story are the good factors in the next level and also the other good factors in the next level are diction, readability, and legibility.

7 Conclusion

Since the WordNet is not domain specific, the framework can be applied for all kinds of sentences in the story.

Figure 7: Assessment of the story

The framework can be improved by reasoning the sentences in the story as means of cause and effect. The sentences in the system generated story should be related with each other. If not so, the system has to reason the story and identify the relative order of sentences in the story. This will helps to make the Automatic Story Generation as effective one. The concept of automatic story generation helps the entertainment world in various aspects like automatic script writing, plot generation, screenplay writing etc.

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