An Intelligent Approach for Reasoning the Stories Using Case Based Reasoning and Rule Based Reasoning

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Abstract - **Reasoning is the cognitive process of analyzing for certain conclusion, beliefs. Because of sixth sense, the human beings can analyze the facts and derive the conclusion from it. In the Artificial intelligence era, to make the computer system to analyze and reason the facts and derive the conclusion is very difficult to perform. The Reasoner algorithm helps to reason the stories for the dynamic construction of new stories with help of ontology. Ontology is a formal explicit shared conceptualization for anything that exists in the world. Ontology helps to check the semantic consistency based on the domain knowledge acquired. This paper focuses on the intelligent approach for reasoning the stories.**

Keywords Ontology; Story generation; Reasoning; Information retrieval;

I. INTRODUCTION

Reading story is an interesting task for everyone in the world but creating story is art for the people. The story writers should have creative knowledge to write the story. Making the system as "artificial author" is an attractive process to generate stories in the artificial intelligence era. However, stories are told or written with specific reader groups in mind: some stories are intended to be read by children, for example, and others by adults. A creative writer's goal to make the story readable to his/her target reader depends on the creation of the intended imagery in the target reader's mind [3].

In order to generate stories automatically based on the user's desire, the system has to consider the domain knowledge, and it has to make use of grammar for generating sentences for stories. We need to reason the existing stories for the dynamic creation of new stories. Automatic creation or generation of stories ought to provide more concentration about the change of settings, characters, location based on the user's desire. In order to provide, suitable settings, the story has to be reasoned properly. Reasoning is the biggest task for the system to perform. Reading story gives pleasure and excitement for different age group of people whereas, reasoning the story can be done only by few people. Reasoning the story gives the detailed description about the nature of the story. Ontology is a formal explicit shared conceptualization [1][13]. It provides the details about the characters played in the story and it is helpful for the consistency and semantic checking in the generated story. The characters are animals, birds, human beings etc and the location are Forests, palace, city, village, zoo etc. Based on the user's desire, the system may generate the stories by exploiting the use of story grammar. The ontology has the provision of upgrading new characters, settings and location through the user interaction environment.

The main reasons for reasoning the story are to classify them based on the characters involved, events and mainly used for dynamic construction of new stories. For the dynamic construction of stories, we need to analyze the characters and their interactions, situations and settings etc. Our proposed reasoner algorithm helps to reason the stories in a neat fashion. It identifies the sentence structure from the story and it follows up the noun, adjectives, verb from them and classifies it. Usually, kids' story adapts the simple sentence structure for the children to understand. The Reasoner algorithm incorporates the hybrid approach for Rule based and Case based reasoning.

Section 2 organizes related works about the story generation system and their reasoning activities. Section 3 discusses about the automatic Story generation system. Section 4 and section 5 provide the details about the Reasoning approach for the story. Chapter 6 shows the experimental results and Chapter 7 discusses the Conclusion and Future enhancements.

II. RELATED WORKS

Prop [2] discussed the story generation as; a tale is a whole that may be composed of *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). Terminal functions are at times a reward, a gain or in general the liquidation of a

misfortune, an escape from pursuit etc. 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. Peinado [4] discussed the used of KIIDSOnto for the story generation. KIIDSOnto incorporates sub-ontology of reusable knowledge for CBR processing which is used by the system to guide the CBR cycle. This sub-ontology follows some ideas presented in previous ontologies, such as CBROnto. Additionally, KIIDSOnto also incorporates specific narratological knowledge. For managing folk tales, the ontology imports the Proppian morphology, another domain-specific sub-ontology that extends the narrative concept Event with character functions and the narrative concept Existent with character roles.

Bailey [5] 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 [6], 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.

Jie Bao et al [7] discussed the Ontologies that explicitly identify objects, properties and relationships in specific domains are essential for collaborations that involve sharing of data, knowledge or resources among autonomous individuals and he insisted the need for collaborative environments for ontology construction, sharing and their usage. Dimitrios N. Konstantinou et al [3] 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 that includes, apart from a storyline, a plot, characters and a setting, the user's stylistic preferences and also point-of-view.

Riedl et al [12] sketches the flow of story as a linear progression of events with anticipated user actions and system-controlled agent actions together in a partially ordered plan. For every possible way the user can violate the story plan, an alternative story plan is generated. If narrative mediation is powerful enough to express the same interactive stories as systems that use branching story structures, then linear narrative generation techniques can be applied to interactive narrative generation with the use of narrative mediation.

Riedl et al [11] 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. For infinitely large domains such as a fictional story world, it is impossible to encode every fact about the world. The closed world assumption places a burden on the human author to describe a world that supports story generation. The ISR planning algorithm assumes creative control over aspects of the story world description.

Our Reasoner algorithm proposed the method for reasoning the stories in a systematic and efficient way.

III. STORY GENERATION SYSTEM

A story may be fictional or historical, but it is a coherent description of a set of events. Its coherence is not simply causal, such that the first event causes the second, which causes the third, etc. Narrative coherence can take many forms, including:

Unity of character (one agent does a set of things sequentially);

Unity of community (a set of connected agents do a set of things);

Teleological unity (a set of events build up to a significant conclusion);

Thematic unity (many things with similar meanings are described).

A theme is usually a concept or situation that is significant and that repeats throughout to form narrative. Theme conception places a vital role in the meaning of the story. If the story lacks in the proper conception of theme, the reader lacks their interest in reading the story. Chronological order of events helps to provide the interesting for the story readers. The Fig-1 depicts the automatic story generation system. The story generation involves two levels of computation such as knowledge level and process level [9]. In the knowledge level, the entire information about the story world is available with the ontology which is called domain ontology. It provides the background knowledge about the story such as conception of new themes, change of existing themes to construct new theme for the generation of different stories. In the process level, the computational aspect of the language is considered for the story generation, which makes the story as attractive one. Language grammar is efficiently utilized for the construction of sentences in the process level. The language grammar is incorporated in this project is given below,

S → NP VP
NP → Datum Noun
VP → verb PP
PP → prep NP

For example, the simple sentence generated as shown below:

Sentence ==> noun, verb phrase.
noun==>dog , noun==>cat, noun ==> fleas .
verb_phrase ==> verb , direct_object

direct_object ==> noun
verb==>chases, verb==>eats,
verb==>claws, verb ==> scratches

The respective phrases can be substituted in language grammar, so that the sentences can be generated as

Dog chases cat
Cat chases dog
Cat eats fleas
Fleas scratches dog …

Like wise by applying different combination, we can generate the so many possible numbers of sentences for story. Furthermore the sentence grammar is applied with the preposition too which is shown below:

Sentence = datum noun verb prep datum noun/pronoun.

For example, The Lion slept in the Den

Similarly, the story generation follows the story grammar in order to generate the simple stories. Story grammar for story generation is given below:

Story → Setting + Theme + resolution
Settings → Characters+ Location + Time
Theme → (Event)* + Goal
Resolution → Event* goal

Based on the simple story grammar, the story has settings, theme and goal. Settings represent the combinations of characters that involved in the story, location of the stories like forest, palace or city and the time of the story. Theme may be any number of ordered events which is represented in the story grammar as *. Resolution comes after the ordered events to give up the solution for the story. The sample attribute values are given in the Table -I.

TABLE I

SAMPLE ATTRIBUTES VALUES FOR STORY GENERATION

Settings	Characters → Lion Characters → Tiger Characters → Crow	Location→ Den Location→ Forest Location → nest	Time → day Time → night Time→ morning
Theme	See , eat, Sleep,	Drink, Fight, kill	Sleep ,play, kill

To generate the story, the knowledge data base consists of the required data and their attributes. Ontology helps to check the concept consistencies, semanticness of the story generate by the system. Table-2 depicts the sample stories with ordered number of events, characters, location as per the user's desire. The reordering of events can change the meaning of story.

IV. ROLE OF CBR IN REASONING THE STORY

Reasoning the stories involves not only the story generated by the system, but also includes the set of story documents. The parameters for reasoning the stories are characters, locations, set of events in the story and time etc. Understanding of story is necessary for the dynamic construction of new stories. Consider each story as cases in the case bases, and reason the same by identification of characters, events, location and settings etc.

TABLE II

STORY GENERATION.

S.no	Theme	Characters	Location	Stories
1.	See, eat, Sleep	Lion, Tiger	Den	Lion saw Tiger. Lion ate the Tiger. Lion slept in the den.
2.	See, eat ,sleep	Crow, Tiger, Lion	Den	Crow saw Lion Lion slept in the den Crow ate Tiger

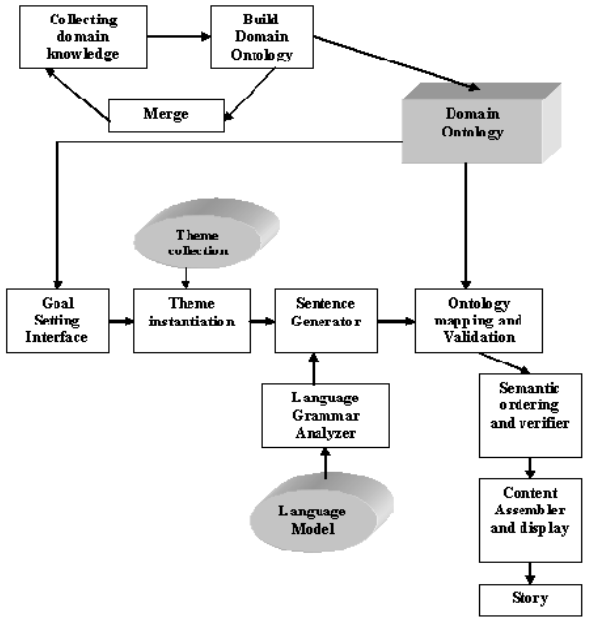

Figure 1 – Architecture diagram for automatic story generation using ontology

A story understanding is based on the creation of causal chains of meaning propositions called conceptualizations and assumed to represent the events in a story. These chains are subsequently linked together to create larger networks. Conceptual Dependencies, schemas and scripts are forms of such meaning propositions [8].

Generally Sentences follows the standard pattern by utilizing the language grammar and they are represented as a series of diagrams depicting actions using both abstract and real physical situations where actor and objects are represented. Actions are built up from primitive acts

modifiable by tense. Some examples of primitive acts are given below:

ATRANS -- Transfer of an abstract relationship. e.g. give.
PTRANS -- Transfer of the physical location of an object.
e.g. go.
PROPEL -- Application of a physical force to an object.
e.g. push.
MTRANS -- Transfer of mental information.
e.g. tell.
Some of the primitive elements examples are:

PP -- Real world objects, e.g. actors.
ACT -- Real world actions.
PA -- Attributes of objects.

The primitive acts and the primitive elements are connected together in the way shown in Figure 2 depicts the sample sentence "*John gives Mary a book*:"

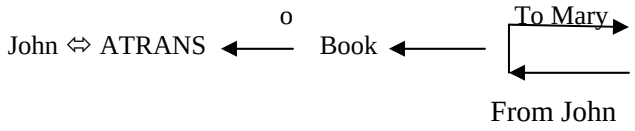

Figure 2: A Conceptual Dependency Example

In order to reasoning the stories, we need to analyze the sentences in such a way that proper identification of nouns, verbs, tense which helps for dynamic construction of stories. The proposed way for performing case based reasoning is given below.

Steps for case based reasoning:

Step-1: Input the story documents
Step-2: tokenize the story sentence-by-sentence and word-by-word.
Step-3: Analyze the sentence structure adapted for the story construction.
Step-4: understand the noun and verb
Step-5: map the functions noun, event using conceptual dependency graph
Step-6: Apply ontology to classify the noun and verb to the appropriate place
Step–7: if the noun and events are already exists break
Else add the newly identified noun, verb to the ontology for updation.

V. ROLE OF RULE BASED REASONING IN REASONING THE STORY

Rule based reasoning the cases helps to check the semantic consistency for the construction of new stories. For example,

Event → eat, characters → Lion, Characters → Goat

The generated sentence may be "***Lion ate the Goat"*** is semantically valid or Else if the generated sentence is ***"Goat ate the Lion"*** is semantically invalid even though it is story. By applying the rule based reasoning and in the ontology Lion is considered as wild animal and the Goat as domestic animal.

Living being → animals → wild → Lion (king, legs, anger, roar, carnivores)

→ Domestic → Goat (small, legs, herbivores)

→ Bird → crow (black, legs, fly)

Based the report of rule based reasoning, the ontology derives the semanticness with characters involved. The semantic checker raises the reports with suggested sentences are:

"Goat ate by the Lion"
"Lion ate the Goat"

The existing characters may be replaced by some other character. For example,

Character → fleas, character → Goat

"Fleas ate Goat"

The above sentence is semantically valid because fleas are omnivore's element whereas Goat is herbivores. The semantic checker accepts this sentence as semantically correct one.

VI. EXPERIMENTAL RESULTS

The system reasons the story for the construction of different stories. The following factors are considered for the system generated stories [10].

Overall: How is the story as an archetypal fairy tale?
Style: Did the author use an appropriate writing style?
Grammaticality: How would you rate the syntactic quality?
Flow: Did the sentences flow from one to the next?
Diction: How appropriate were the author's word choices?
Readability: How hard was it to read the prose?
Logicality: Did the story seem out of order?
Believability: Did the story's characters behave as you would expect?

Based on the above factors, the generated stories are given to the group of people to give their opinions about the generated stories with following scale factors with above said features.

Excellent – 5; V.Good – 4; Good -3; Fair – 2;
Needs improvement – 1;

The Figure -3 depicts the factors for assessment of story. The believability factor has the very good feedback among other factors. The other factors like overall content of

the story , style of the story, grammar content in the story , flow of the story are secured the very good factor and the other factors diction, readability , legibility are in the next level value good. We have to impose the knowledge factor for selection of word choice for story generation, so that it improves the linguistic part of the story generation.

TABLE III

Factors for Assessment of Story

S.no	Parameters	Weightage (max = 5)
1.	Overall	4.3
2.	Style	4.0
3.	Grammaticality	4.1
4.	Flow	4.2
5.	Diction	2.8
6.	Readability	3.7
7.	Logicality	3.6
8.	Believability	4.4

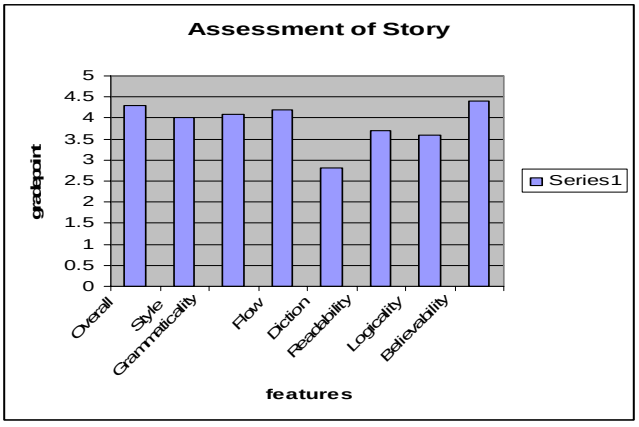

Figure 3: Assessment of the story

VII. CONCLUSION AND FUTURE ENHANCEMENTS

The case based reasoning and rule based reasoning has been implemented in the Story generation system for reasoning the stories. Ontology provides the semantic description about the characters, objects, and location etc. for the dynamic story generation. Now, story reasoning system can be enhanced in many different ways. Firstly, the story reasoning environment could be made more user-friendly. Secondly, changing the events in the system can be done with semantic ordering by imposing certain rules for theme conception. Thirdly, the system could reason the more number of medium size stories and novels in such a way that constructing varieties of stories. Fourthly, ontology can be reused for the construction of different plots in story generation which can be extended for novels too.

ACKNOWLEDGEMENT

The authors would like to express their thanks to Mr. Abdul Qadir A. Rahman Bubari, the Correspondent, Dr. V.M.Periasamy, the Principal and Dr. P.Sheik Abdul khader , HOD / Department of CA, B.S.A.Crescent Engineering College Chennai,Tamilnadu, India and Dr.Chellappan, HOD, Department of Computer science engineering, Anna Univerisity , Chennai , Tamilnadu, India for the environment provided.

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