Storyline Generation System using Situation Cases

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Abstract

In this paper, a situation-based storyline generation system is proposed. The generated new plot is a modification of situations stored in situation database, which is different from previous character-based and story-based systems. The new plot is generated based on the current plot with rules applied from the constraint database. The number of possible plots will be huge by applying this method. After the generation stage, a director module will check if the plot is the end of the story. We discuss detailed process modules as well as the situation and constraint database.

Keywords: *Story-based, storyline generation.*

1. Introduction.

In this paper, we propose a storyline generation system based on situations. The situation database contains many situations with some attributes, from which new situations can be easily generated. A new situation is the next development of the current situation. The rule-based constraint database is used to generate new storylines and plots, whereas the director module checks whether a newly generated one is the end of the story or not. Also newly generated ones will be added to the situation database if they are different from the stories already stored in the situation database. In this way, numerous new stories can be generated and updated. In this paper, we discuss detailed story generation modules as well as the situation and constraint databases. We also present an example of the story generation process in a simulation. This paper consists of the followings. We discuss the background of previous research in the next section, after which the architecture and process of the proposed system will be discussed in Section 3 and Section 4 respectively. Section 5 draws conclusions.

2. Previous Research on Storytelling Systems

2.1. The Nature of Storytelling System

Up to the present, studies on interactive drama (ID) or interactive digital storytelling (IDS) have been generally classified into story-based and character-based systems. Many researchers have proposed not only various technical solutions but also design paradigms.

The IDtension system demonstrates the combination of narratives and interactivity [1]. In this paradigm, the users can select dramas and intervene in their stories. Also their actions affect the sequence of the dramas. Nicolas Szilas addresses that as the users can choose and intervene in the story, the action of the characters in the story is dramatic [2].

ID and IDS used the HTN (Hierarchical Task Network) planning [3] algorithm. In the upper system, actors interact dynamically with the users through the plot. The HTN planning search algorithm uses a tree structure. It is an algorithm of interactive storytelling that is influenced by action plans during a development. The last result of an action is predefined at the beginning. The affinity value, which is a numerical value of virtual character intimacy, can help the system to generate every possible way of various storylines, instead of fixed story ending [4]. In [5], the action of virtual characters is based on the VIBES [5] framework. It is one of important techniques in interactive storytelling. Differently from previous storytelling systems, this system uses the architecture of virtual brain, from which the system gathers orders of data and generates results.

2.2. Character-based Approach

This system is a story generation system capitalizing virtual humans [6, 7, 8]. It performs the story generation process through the plot creating system. It stands on the basis of Director agent system such as SAGA [9, 10]. Director agent is essential to implement the emotion of characters in the character-based story generation system. Its main role is to accomplish given goals that are combined into different constituents throughout the plot creation activity.

Another famous character-based story generation system, the Automatic Virtual Actor [11] receives instructions from the Virtual Brain module standing on the basis of VIBES and Learning Classifier System [12]. It offers autonomous virtual character and intelligent actions. Consequently, human-like actions are developed, but in the last analysis, all these systems are as good as story generation techniques that plot coherence and character believability formed by the results of stories and traits of virtual characters..

2.3. Rule-based Approach

People use rules everyday for making decisions whether they are conscious of it or not. Some rules are documented in a written form whereas some are not. For example, no one dare to cross a street filled with running cars, even though there is no such written rule. People know that it is very dangerous to cross a busy street even though they have not been involved in a car accident. This is common sense.

A problem in rule-based systems [13] is that terms used in the systems are not quite well applied to real situations. The rules should be somewhat specific to a given situation. Consequently, we may have a lot of rules even for a simple case. In order to have a reasoning system that can produce fine output from a given input, these rules should be stored somewhere in the system and applied properly according to situation.

However, the problem is that every individual has his/her own rules in a sense and this is a very important factor in the way of reasoning. Another problem in rule-based reasoning is that it is too general to apply to specific cases and the terms used in rule-based systems are often ambiguous. If we store all the exceptions and special cases, the amount of these data will be voluminous and it may not be tolerable. This is why a fine grain of outputs cannot be generated with a rule-based system alone and a case-based reasoning system is needed.

The proposed rule-based system is employed in the constraint database. It is used in the process of generating logically reasonable sequences of plots. The selected situation in the previous indexing and retrieval step is the basis of this stage. Each rule is associated with many consequences that can happen afterward. These consequences

have a numerical value of possibility. Details of this constraint database will be discussed further in Section 4.

2.4. Case-based Approach

One of the advantages of the case-based system [14] is that it remembers past experiences and uses them later on. The main weakness of the rule-based system lies in its generality. It is so general that in some case it is not applicable. One solution for this problem is making the rules more specific. However, it certainly leads to another problem related to how to store and index the rules and the special cases. The search space will be large and there may be no matching rule for certain cases.

The second solution is using another approach for the case-based system. In the system, there are a certain number of existing cases for a domain, and the given input fills the slot of each case. This system uses past cases to solve the current case, and data stored by a specific case are indexed. However, there can be no case for the current situation, or no data to fill the slot. Certainly no one can guarantee this. Therefore, the best approach in this case is employing a system that is both rule-based and case-based, and letting the two functions help each other to produce a fine output. This is why rule-based reasoning is necessary. For this reason, in this paper we used a case-based system as a tool for the situation database whereas a rule-based system plays an assistant role of the constraint database. Situations are stored in the situation database in the form of cases.

3. The Architecture of the Situation-based Storyline Generation System

The situation database is a collection of situated cases, whereas the constraint database is a collection of actionable rules. Unlike several established story generation systems, situation-based storytelling is a novel approach in which a new plot is generated by past plots stored in the situation database. The current situation is generated by the combination of the situation database and the constraint database. The constraint database is used as restrictions on the modification of situations.

The situation database is a collection of past stories. Unlike simple events, it is an hour long stream of relevant events interconnected. These data of situations are restored, gathered and updated into the situation database. This is the kernel part of the story generation system that generates virtual stories based on situations.

The use of constraint database is a novel approach. It generates storylines by applying restrictions on a certain similar situation. It also plays an important role in making an approach to the goal. In addition, the constraint database, even if making a certain scene, offers very important keywords. One of its roles is to lead out the current situation close to the goal.

4. Story Generation Process

The process of story generation consists of the following four steps: initialization step, retrieval and adaptation step, story generation step, and finally director step. The details of each module are explained in the next sections

4.1. Initialization Step

In this step, the values of initial states such as time, location and persons are defined randomly. In other words, it is the beginning of a story. The starting situation contains

data based on 5W and 1H (who, when, where, what, why, how). It contains important values in the context of 5W and 1H and the data are used as an index in the next step. Moreover some other variables can be added depending on the user's disposal.

4.2. Retrieval and Adaptation Step

The core in this step is the selection of the most matched situation with the current situation in the situation database. In this step, the elements of the current situation are compared with story elements in the situation database. Retrieving a situation from the situation database is comparable with people's remembering of a situation from their memory. Therefore the situation database acts as a memory, whereas remembering is retrieving a situation. The retrieval of matched situation for the current situation is based on 5W and 1H in the situation database. The combination of each keyword, element and core are compared between the current situation and situations in the database. Situations retrieved from the situation database are ranked based on the similarity factor. The top of the rank is finally selected for the next situation

When the previous retrieval step has no preferential situation selected, this step is executed. When there is no similar and exact match situation, this step modifies the most matched selected situation. The core of this step is modifying and evolving a new story. The new situation is stored into the situation database. There is a new situation and accordingly the situation database will grow in volume. This plays an important role in the size (elements, stories) of the database.

4.3. Storyline Generation Step

This step generates future development situations using the constraint database. Since the selected situation alone cannot compose a new storyline, the constraint database, which contains sets of rules, is used in this main process of storyline generation. In this step, plausible values and probability are used to select proper rules. Each element constructing a case has an important value, and the constraint database also has probability in every next situation. A new story is generated based on the probability and randomness

4.4. Director Step

In this final director step, the system decides whether the story will continue or not. In some case, if the story approaches its end, the director module will finish the storyline. In other words, it acts like the director in a movie production process. If the generated plot is not the final one, the new situation goes back to the indexing and retrieval step, in which it finds the best matched plot.

6. Conclusions

We proposed a new situation-based storyline generation system in this paper. Different from the previous character-based or story-based systems, this system generates a new plot by modifying situations stored in the situation database. The new plot is generated based on the current plot through the application of rules in the constraint database. By this way, the number of possible plots will be enormous. This system can be applied to various interactive surroundings such as virtual reality, games and movies. After the generation stage, the director module checks if the plot is the end of the story.

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