Automatic Storytelling Visualization

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***Abstract*—When you are reading a story, sometimes its hard to understand "What is going on?" , "Who is triggering the event?". In order to deal with this issue, we present a system - Automatic Storytelling Visualization (ASV), which includes various ideas from natural language understanding. The main purpose of this project is to describe some story effectively (showing main events in details) and attractively (giving the user some control over the story). The first task is performed by extracting the main actors in a body of story, actions they perform and the objects of the actions. Further, using this information we describe the story by: generating multi-dimensional interactive graph which captures out all individual actor-action, actor-object relations (from most to least used objects are associated with different colors) and time series which refers to the structure the story flows, associated by the number of sentences.**

***Keywords*—Text mining, semantic triplet, parse.**

I. Introduction

Stories have been served as one of the important sources in developing our memorable, interesting knowledge. When we encounter reading some stories, our main goal is to first understand what that story is about. In fact, story includes series of events each typically consist many actions affecting many characters etc. accordingly it is not always easy to determine their key characters, it is sometimes hard to observe what kind of significant events were performed by certain characters and when they occurred. When we think of stories that are bigger in size it is easy to convince ourselves that they should be more complex and detailed to be meaningful (to being time consuming, it is also prone to human error). The truth is however, that simpler a story the more likely it will stick.

This article presents a new tool which is automatic story telling system that can generate stories in details making large stories more simple. If we want to analyze a story or narrative, we can use who, what and where questions to look at the content of the story, and examine the structure with How and when questions. An event then a story, where someone does something in favor of or against someone else.

In linguistic typology, all events can be described in Subject-Verb- Object(SVO) semantic triplet form. Subject can be expressed as a character role, verbs in the form of activities or actions performed by that character and lastly object of the action in that sentences. (e.g., Scientist(S) Published(V) a paper(O)). Identifying triplets allows not only analyzing the certain events but also the roles played by different actor in them (e.g., Doctor help friend is different from friend help doctor). We can easily predict specific relations between two characters (e.g., the SVO Trump help Obama can reveal good relation between them).

For this reason, our approach builds on the Stanford Natural Language Processing group that extracts SVO out from the data by means of a parser. From the extracted information, it generates a multi-dimensional interactive graph that describes story structures and relations in a text. From this information, we can investigate further. We can identify the most important characters by comparing their number of actions performed and related objects within other characters, by analyzing the type of actions we can detect what kind of events are triggering the whole story etc.

The system we developed is suitable to narrative text in which some events or stories describes about characters in chronological order. We illustrate all this work by analyzing story called Dr. Heidegger's Experiment, by Nathaniel Hawthorne, 1804-1864.

A. Related Works

Our Automatic Story Telling approach is influenced by several different systems in the area of text understanding and visualization. (Deli, et al., 2009) they presented question answering system where SVO triplets have been referred as a list of facts. They extract SVO for each sentence in the document collection, and at the same time they extract SVO from the question. Further, these were matched with each other in order to find answers.

Triplet extraction from sentences (Delia Rusu, et al., 2008) presented several algorithms to extract subject-predicate-object triplets from English sentences. Their aim was to extract sets of form SVO with four parsers including Stanford Parser. As they have mentioned for their future work use triplets as an input for applications such as text summarization.

The studies described above, their similar part to our system is in extracting triplets. But their purpose is not same as ours, because triplet extraction does not contain visualization parts for constructing important meanings, meaning of SVOs in those studies are used for different aims. We try to understand a story with visualization from the triplet information.

(Gregor Leban, et al., 2014) they provide a system that can identify groups of articles that describe same event, even in different languages. From articles in each event they extract main information, such as location, data and what is about. An event according to them is the main subject. In our project, we differ from this work by considering events in SVO triplets, where we extract different relations such as subject/object etc. (Hendrik Strobelt, et al., 2008) their similar part is key term extraction, listing all the keywords. By machine learning they identified headlines. And they count every term for each

section separately, so they took a term which was above some threshold. Their goal was to express important key terms, and important images. Our work is same in using most occurred words in frequencies.

B. Experiments

In our system, all nouns are defined for subjects or objects and all verbs are defined for actions that have been seen within a triplet. Parser is a program that automatically works out which words are referred to subjects or objects of a verb.
By using Stanford Parser, we have extracted a list of all SVO triplets in a story but one of the main problem with the parser is to recognize identical triplets. To be more specific, in the sentence "I voted for Mr. Trump because he was most aligned with my values" she said. Here I, my and she refers to the same person where Mr. Trump, he to another. In order to solve this problem, before extracting the triplets we prepared by hands rewriting in a correct form. From the Stanford Parser output we extract words tagged with S (subject), V (verb), and O (object of the verb) relations. A SVO triplet is formed out of these words if the S, V, O relations have been found in the sentence in this chronological order. We chose "Dr. Heidegger's Experiment" for our implementation; it is a short story by Nathaniel Hawthorne, about a doctor who invites friends to participate in an experiment, in his mysterious study. As a result, we were expecting from our system to catch important events and key actors, providing user a guidance to better understand a story.

C. Results

Figure 1 provides a general context for understanding the data-set. It reveals all the subjects, verbs and objects in a time series (time is represented on the x-axis by the number of sentences in the story). Respectively all the characters are represented on the y-axis, the actions performed by each character and the object of each action are shown as a small rectangle with different colors (the most occurred from red color to least occurred in green colors). When the user hovers the mouse over the screen all SVO triplets will be displayed automatically as shown in (1) together with displaying the actual sentences within in the story, and these sentences are enumerated for time entity . In addition, for removing unnecessary information from the view and for further investigation system provides zoom-in operation by excluding unimportant aspects of the representation (2). It is easy to see and identify the key characters of the story from figure 1; since, characters Dr. Heidegger, Mr. Medbourne, Colonel Killigrew and Widow Wycherley have large domination in SVO triplets over other characters in the list. From this perspective general overview can provide assistance in understanding the stories
Figure 2, is displayed after clicking on one of the characters/subjects from the y-axis in Figure 1. As you can see this window gives all the objects which have been used by selected character in this case Dr. Heideggers.
Figure 3, is displayed after clicking on VERB in Figure 2. This graph reveals all the verbs/actions performed by selected character. From these figures, we can easily detect some important actions performed by key characters and the objects of actions as they have higher values.
Figure 4 is displayed as a result of clicking on one of the rectangles from Figure 1. Which shows all subjects together that has used same object word. In this case Dr. Heidegger, Mr. Medbourne, Colonel Killigrew and Widow Wycherley, all of them used an object glass.This representation allows user to view relationships between important actors where comparisons could be made among the actors and their objects. All in all, users can easily return to previous states in the data representations. Comparing current state and previous states may give better understanding the story

II. Conclusion and Future Works

We have shown our project and it has its own limitations. It is not sensitive enough; errors may occur respectively the most frequent triplets may not pick up the interesting actions and important actor roles or there might be overlapping in Anaphora, Co-reference resolutions. To be more specific, Co-reference resolution is the task of finding all expressions that refer to the same entity in a text (The Stanford Natural Language Processing Group) For instance, in the sentence "Barak Obama" and "Obama" refers to the same person. So, our work has certain drawbacks in this area, it is not able to pick important words for every story. Scalability issue arises when the story is so huge. The results of our project suggest that narrative analysis an important tool for understanding the stories, even it is not actual same what storytellers say our method provides important events for certain stories. It can easily be adopted as a useful method to provide the reader with some guidance about how to understand the story.
There are many things that could be done as a future work in this project. We could improve our SVO extraction algorithm by extracting extra information about locations, data and time, in this way each event can be described more accurately, we could improve SVO extraction by using Anaphora and Co-reference resolutions which can recognize same triplets. And use as a text summarization visualization tool

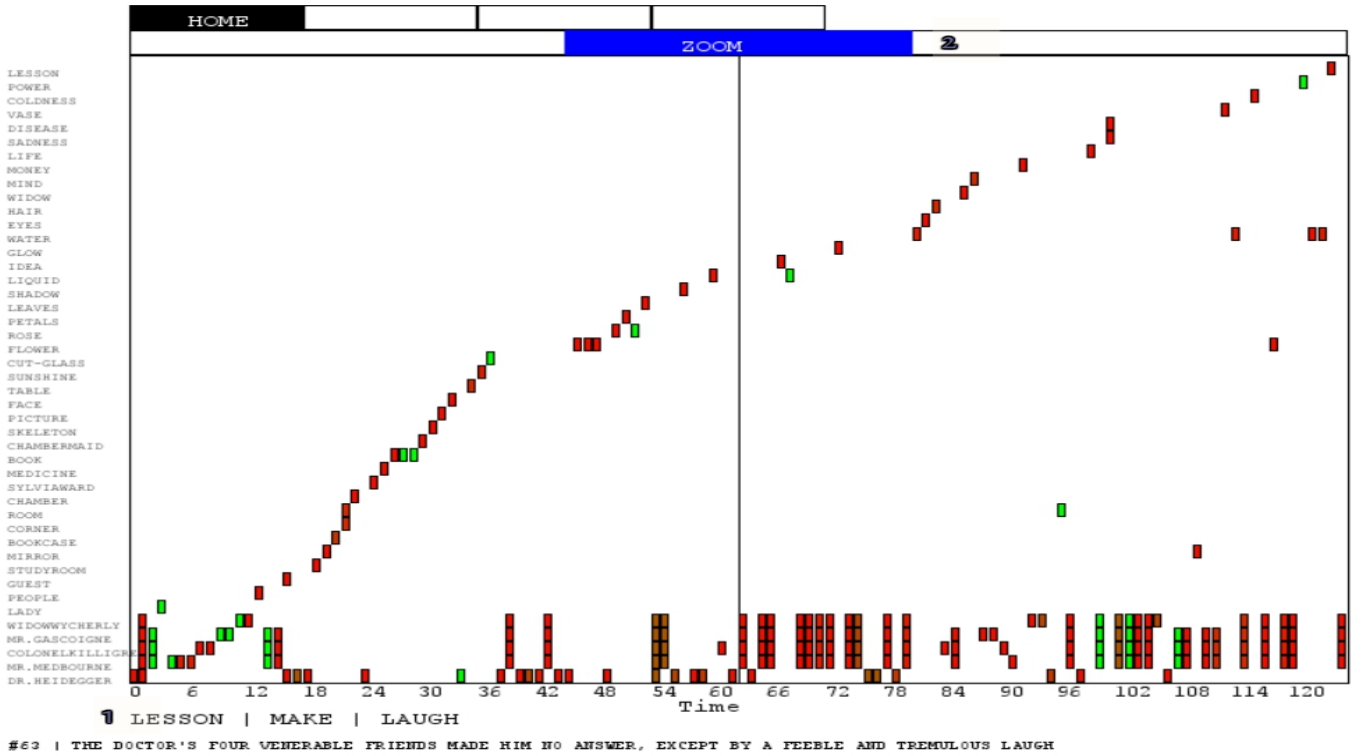

Fig. 1. (General overview)

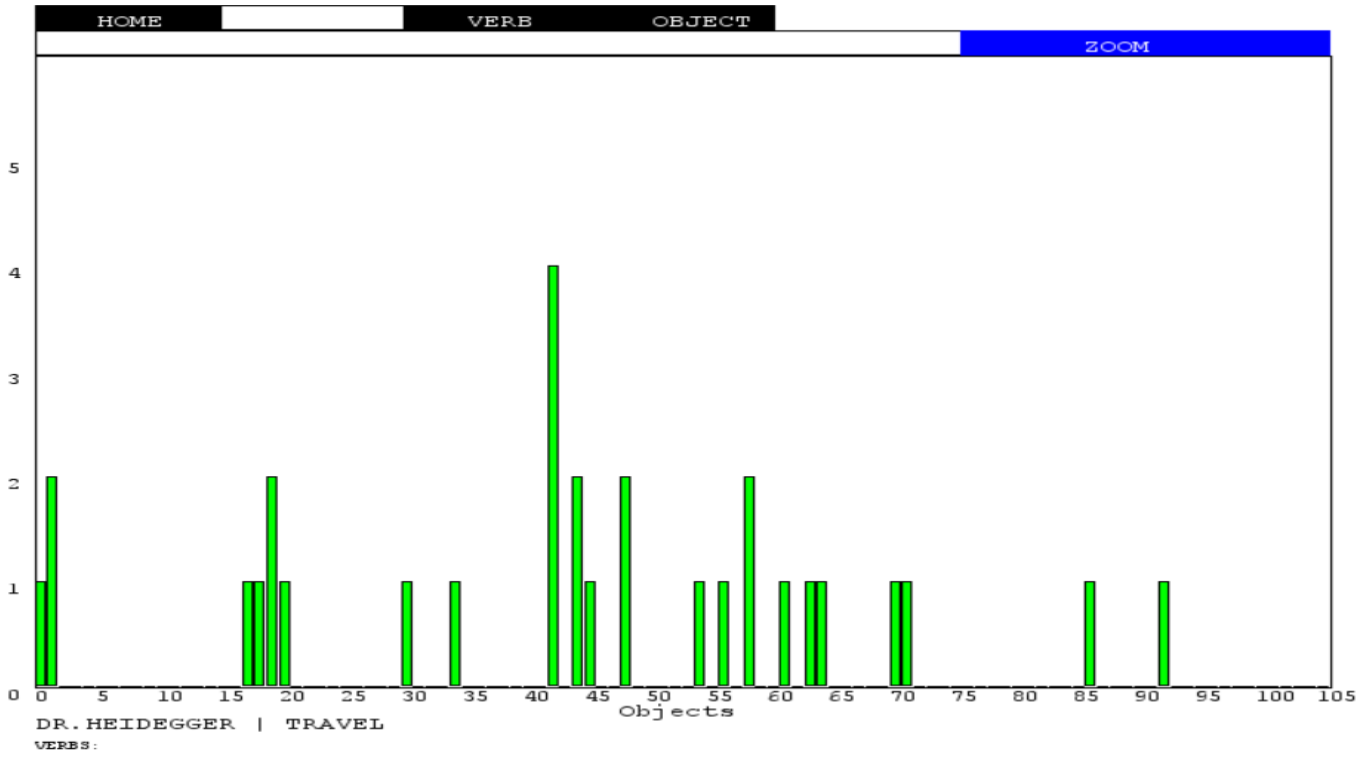

Fig. 2.

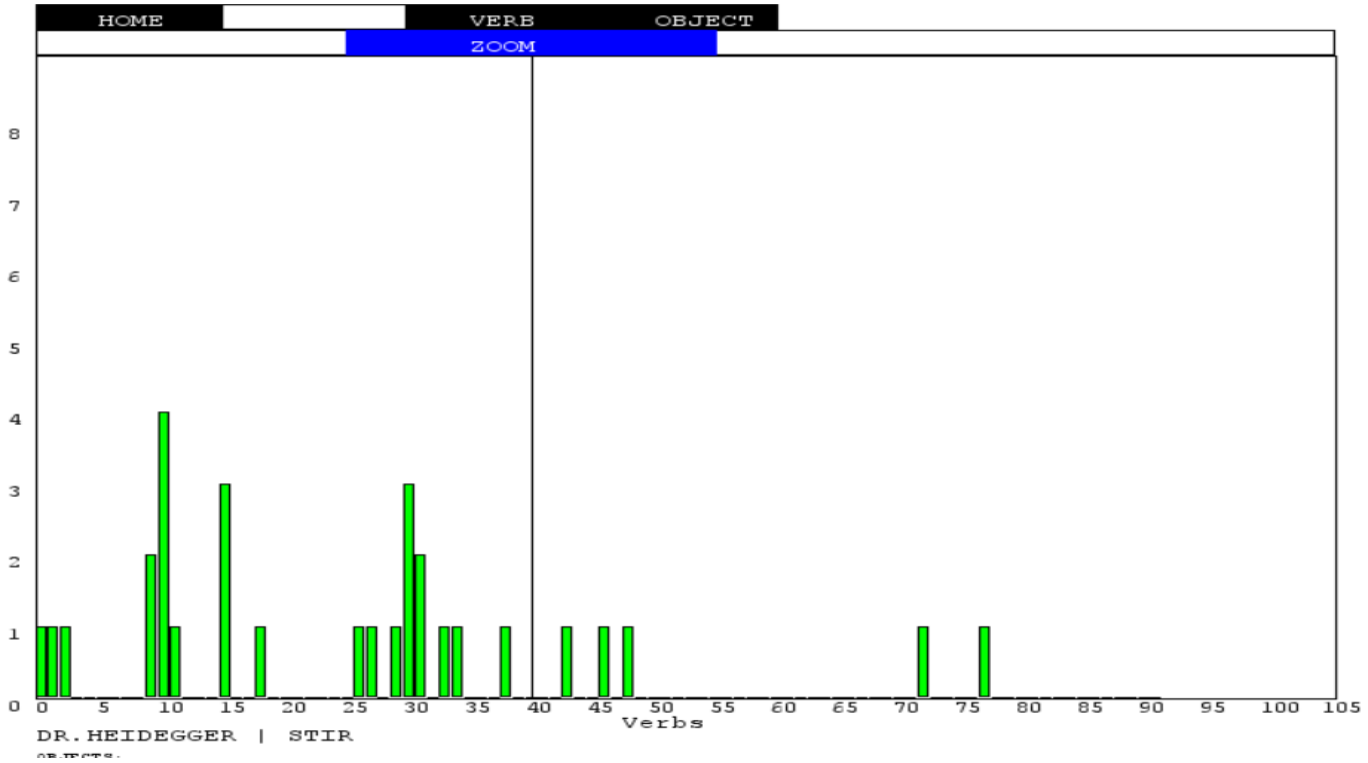
HOME
VERB
OBJECT
ZOOM
0 1 2 3 4 5 6 7 8
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105
Verbs
DR.HEIDEGGER | STIR

Fig. 3.

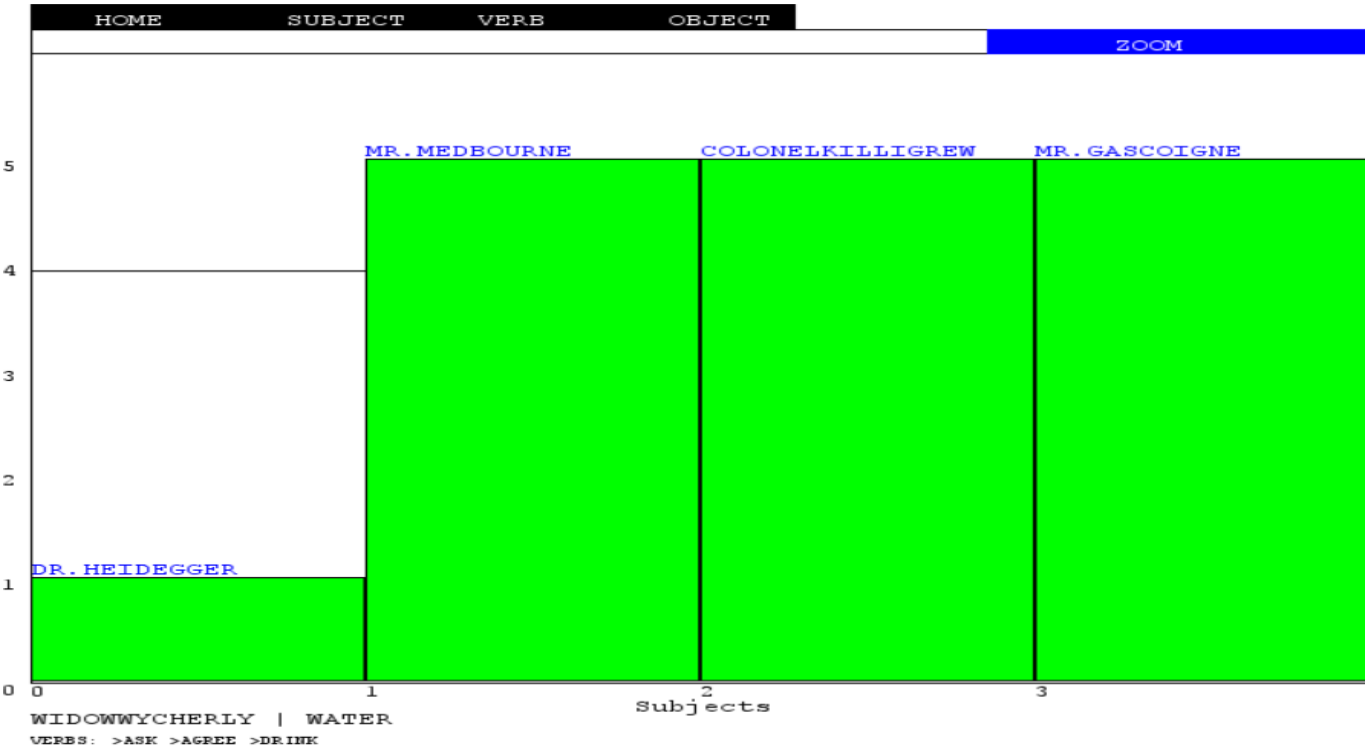
HOME
SUBJECT
VERB
OBJECT
ZOOM
MR.MEDBOURNE
COLONELKILLIGREW
MR.GASCOIGNE
DR.HEIDEGGER
0 1 2 3 4 5
0 1 2 3
Subjects
WIDOWWYCHERLY | WATER
VERBS: >ASK >AGREE >DRINK

Fig. 4.

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