

Recommender Narrative Visualization

Amirsam Khataei
School of Computer System
Engineering
Carleton University
IBM Qradar Software Developer
akhataei@ca.ibm.com

Diana Lau
Research Staff Member at IBM
Canada Software Laboratories,
Center for Advanced Studies
dhmlau@ca.ibm.com

Affiliation CAS Research, IBM Canada Software Lab

Abstract

Growth and trends in recent data visualization research show that fact that after maturity of the tools allowing the end-user to explore through data, the next logical step is to focus on data analysis and presentation. The main criterion of setting up a presentation is to balance the relevancy level of data exposure and interaction within the story arc. Commonly, this is the author's role to write a single story and make it memorable and effective for the targeted audience. Considering the existing level of personal information that can be extracted from social networks, a unique opportunity is to get to know the audience before developing the story. Applying this theory in a system creates the possibility of crafting separate personalized visualization for each targeted individual. In this paper, we propose a foundation to a framework to generate the ultimate recommender story based on the given objectives and balanced level of detail in the visualization using the extracted user's information from social networks. This will be the next rational step towards enhancing the tools to assist the critical role of aiding decision making and education processes using visualization.

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1 Introduction

In the majority of visualization publications scholars consider the topic of visualization as the main method to overcome the issue of data exploration. With that being said, evaluation of papers in this field and comparison of the rising techniques have recently become one of the main research topics [1]. On the one hand exposing users to the maximum level of data in a presentation using the best visually appealing and interactive visualization, does not necessarily result in delivering the author's objective and message. On the other hand, applying other presentation techniques such as the martini glass system [2], does not grantee that the author is able to reach the maximal possible audience. Building an effective story with the most effective, memorable message requires a good set of skills and tools. Although the taxonomy of tools that support building fluent interactive and flexible visualizations, such as Tableau, and GeoTime, are mature [3] and mostly focus on user-end data exploration, they lack the story-telling feature. Gershon and Page note that effective story-telling "require[s] skills like those familiar to movie directors, beyond a technical expert's knowledge of computer engineering and science." [4]. The main characteristic of a director, just like an author, is to know his/her audience, setup the settings and the environment accordingly to deliver the message to a large audience. This paper is an attempt to envision this new concept

in the field of narrative visualization. Unlike, author driven narratives, the goal is to introduce an approach - a recommender narrative system based on information exists on social networks for each individual. Imagine that we would like to inform people about an economic crisis, and suggest the best possible strategies to protect our investments. However, the audience may vary from young students, to stay-home moms or professional brokers. They do not share the same background, so why they should all look at the same visualization or story? If we decide to setup the presentation for the novices, we may lose the brokers' attention, and if it is too complex, the visualization may not be comprehensible for less educated ones like young students. Results from recent studies in the field of analyzing social network data, prove that places such as Facebook is where we could obtain information about personality, education, interests and profession [5]. This creates a unique opportunity for story designers to become familiar with the listeners and distinguish them from each other. After reviewing and evaluating related works in the field of narrative and storytelling in different contexts, we identify the pros and cons of each of the method. Furthermore, we describe how we can use the existing research towards building the foundation of a recommender narrative system. In particular we describe the purpose of each section and its subsection of the framework by focusing on potential applications. Finally, we draw conclusions and present a vision for future research.

2 Background

As the fourteenth century Persian poet, and spiritual, Jalaluddin Rumi said, "A tale, however slight, illuminates truth". Storytelling has been a part of our life within different formats. As Kosara and Mackinlay noted [1] the next logical step in visualization research is presentation (storytelling) or at least it should be a focus of equal importance with exploration and data analysis. A rational approach is to analyze the foundation of storytelling techniques in past. Storytelling is an art, of passing a memorable moral/educational message through a story. One of the oldest and traditional storytelling systems using some sort of visualization is "Naghali" or "Pardeh-Khani". It begins by showing story curtains (Pardeh) and base on the audience,

setting, and the environment the storyteller (Naghal) tells the stories derived from the visualization painted on the curtains. [6] He is in charge to make the story memorable by exposing the listeners to the sufficient level of details, so they do not become overwhelm with information or distracted from the main points of the story. This demonstrates the importance of the visualization/presentation and how extracting information and telling a story can become even a professional job which is being replaced with an intelligent system to generate the narrative by itself.

2.1 Visualization Strategies

Heer and Shneiderman focused some of their research on developing a framework by systematically reviewing existing visualization designed by journalist from news media. [2] They broke down the framework into small categories base on the level of control by the author and reader. In order to balance the influence by the author and the reader, they introduced the following layout and sematic story structure to design an applicable visualization: 1. Martini Glass Structure, 2. Interactive Slideshow 3. Drill-Down Story. While they identified a set of strategies that can be used to build a story, their framework developed only through a review on newspaper stories. On the other hand, beside the recommended framework, we can find extensive research on possible field to improve the effectiveness of the visualization such as considering the insight, rhetoric, collaboration. For instance, Jessica Hullman and Nick Diakopoulos explored the role of rhetoric in narrative visualization and how it frames the presented data [7]. We have seen works in the field of the requirements to generate story based on general audience, such as developing narrative for a specific group of audience. However, all the existing researches do not address the possibility of creating individual story based on analyzing the audience before developing the story. Thus, applying the given strategy in a smart system to pick the appropriate design by itself using a given set of criteria can be the next logical step to peruse.

2.2 Effective Visualization Tools

The available solutions and libraries to develop advance visualizations indicate how mature this area is. One of the best examples is IBM RAVE. Rave is a visualization Grammar developed by Leland Wilkinson and uses IBM patented methods to render a range of visualizations from line graphs to heatmaps, other advance visualization, and provide the ability to create our own personalized visualization [8]. In addition to RAVE, D3js, Javascript Infovis Toolkit (JIT), Sigma.js, Arbor.js and KeyLines are just few other examples in this field. Most of these canvas tools cover the majority of practical interactive features. Besides, the open source community, Tableau [9] and Spotfire are two commercial examples to support advanced visualizations with some extra features. One of the extra features is, allowing users to share and publish visualization dashboards as interactive Web pages. Although, the available tools allow generating advance visualizations such as visualization with tooltip, zoom-in or allowing rapid response to human input, they are missing built-in features like enabling the user to add a rule or a filter for the visualization. The filter allows us to modify the presentation design or contents based on a given criterion.

2.3 User Profile Analyzer

Social network is a place where people present themselves and revealing information such as level of education, personality and insights into their lives [5]. These networks have different purposes. For socializing, Facebook, Twitter or Google+ are few examples and LinkedIn [10] can be named as a social network with the purpose of establishing professional networks. We are starting to realize how some of this information can be utilized to improve our understanding of user needs. In our research, we are interested in following three main factors. The reliability of the users' data in the social networks, the existing tools to extract the data, and best practices on how to analyze the data. It is questionable whether people like to present a different face for themselves in social networks rather than their actual personality. "The results were consistent with the extended real-life hypothesis and contrary to the idealized virtual-identity hypothesis. Observer accuracy was found, but

there was no evidence of self-idealization, and ideal-self ratings did not predict observer impressions above and beyond actual personality" [11]. Several studies have been developed to allow us to extract user related data in a social network. Some works offer strategies to integrate multiple user profiles from different social networks. Besides current social networks available dedicated APIs to access user profile data, we found other approaches such as a semi-automatic approach to extract schema information from instance data [12]. People are presenting their personality while interacting with social networks; Studies with Facebook [5], Twitter [13], or other social networks show that it is feasible to get a better sense of the users' life style by analyzing the users' social network profiles with the existing tools. The results from studying social network contents become a popular method to apply and use in recommender systems. One of the common and main applications is advertising a product by targeting the right group of users on the web [14]. However, introducing some contents or products does not replace the job of crafting the story and a proper interactive visualization.

3 The System Foundation

Although, it is debatable what model is best suited to become an effective method to leave a memorable message followed by an enjoyable experience, benefiting from interactive storytelling tactics is becoming widespread. As shown in Figure 1, the main challenge in our system is to set the three wheels of our system:

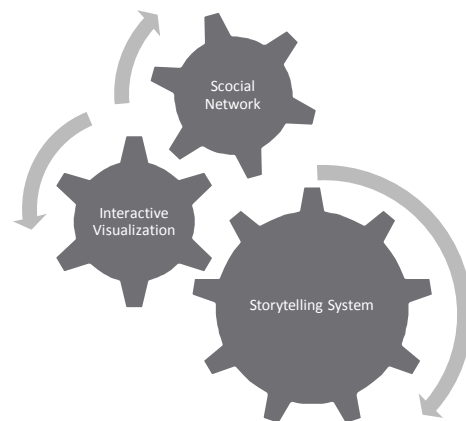


Figure 1 - System Conceptual Look

users' information from social network, the interactive visualization and storytelling system, so that they do not only turn but also they turn in the correct direction and work as a system.

To extract user profile information, we rely on options from common social media API to access a source extensible framework for social network analysis such as Mitando [15]. This does not mean we have to cover all the possible social networks. Instead, in this framework, it is the author's task to specify what type of personality or characteristic is required for a potential story listener or educator. The second piece of the puzzle is to develop the story using interactive visualization enhanced by filters based on the contents extracted from social networks. This is possible with rich visualization libraries such as IBM Rave and D3js. They are excellent examples from the family of products that are flexible, portable, and easy to use. The last piece of the puzzle is presenting the results in a pleasant and appealing way. Naturally products such as impress.js [16] are strong candidates to become a foundation to host the story for the system.

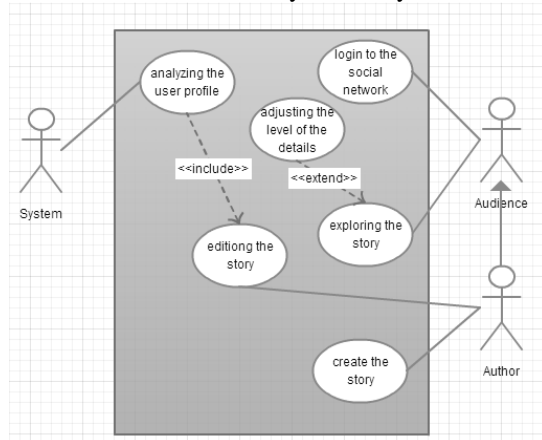


Figure 2 – Recommender System Use Case Diagram

The system consists of six main use cases (Figure 2). It begins by creating a story from scratch or editing the story by the author. To create a story, the system allows the author to select the type of the presentation based on the story's goals. The story designer can select from traditional single slide presentation frame to a dynamic wide-open canvas on which we can draw the visualization for the audience to pan and zoom through the

presentation. Authors can add objects to the story and new contents become publicly available, unless the author specifies a custom rule or filter. Users are prompted to login with the required social network accounts. The system obtains the user information using the third party API, and applies the required modification on the visualization or the story based on the custom rules specified by the author or the general rules that is given to system initially. In addition to presenting the recommended story, we should consider the case where our prediction about the users' interests is not accurate and the user should have the power to explore and adjust the level of the details in the story to some degree. The constraint on how much flexibility we should provide users to explore defined by the author and can be stored in the system as a general rule. After all, some information can be interpreted as offensive, or some information is age inappropriate. The modification by users can be captured, recorded and used as a feedback to the system for a better user analysis in the future. As a result, this allows our system to improve over time by knowing its users gradually.

4 Future Vision

A comprehensive study is needed to identify the requirements for the recommender storyteller interactive visualization system within different contexts such as, health, e-commerce, or scientific data. The requirements may vary from attributes of the user profile and other social network related data, specification of the visualization itself and the variation points of the interactive visualization system, and how they relate to each other. Based on the given requirements, we need to do a comprehensive study on benefits and limitations for available tools in the fields of building presentation, creating visualization and analyzing user profiles. Ideally, the next step is to implement a prototype by breaking the implementation phase into small iterations. This allows us to design, develop, validate and verify the features within an agile fashion. After completing a prototype, it is useful to design and conduct an experiment to evaluate the effectiveness of the system. Typically, visualizations are evaluated in controlled studies that measure user performance on predetermined tasks or using heuristics and expert reviews. [17] However, due to the educational nature of the

presentations, we should measure memorability and persuasively power of the story. Besides the traditional evaluation methods, as Jeffrey Heer and Michael Bostock outlined; understanding of users' perception is a critical part of designing an effective visualization [18] which is applicable in our case. The next logical step is to improve the system based on results from the experiments, re-run the experiments and study the differences extracted from them. The results will lead us towards completing and finalizing the system.

5 Conclusion

The recommender system for storyteller can be the rational step towards a new era of education and information visualization. Visual analytics has gained attention recently, but with insufficient focus on personalization. The opportunity of drawing an application by following a similar concept to what we introduced in this conceptual paper is very exciting. The recommender system allows us to stop sharing a single presentation/story for a group of people and instead, the system will generate and suggest separate individual stories based on their personality, background, education level and other characteristics. Applications of this approach extend from health information systems to political campaigns or the real estate industry where an educator probably looks at different attributes when they are looking at the same demographics data. The existing open source tools from developing the presentation to generating interactive visualization and analyzing user profiles are highly beneficial. Connecting these three concepts will result in a smart method of presenting the story for every individual separately. By developing such a system, we can prove that the customization based on the provided user data will result into a better and more effective interpretation of data.

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About the Authors

Amirsam Khataei is a UX designer and front-end developer at IBM where he excels at presenting complex information with clarity. He is fascinated by design ethnography, and welcomes opportunities to research further about User Centered Design. As a PhD student, his research focusses on data visualization and storytelling systems.

Diana Lau is a Research Staff Member at IBM Canada Software Laboratories, Center for Advanced Studies. She manages fellowship projects and leads technology incubation teams to design and develop proof-of-concepts for technology problem spaces coming from academia and IBM product development teams. Her interests include smart interactions, mobile development, analytics and social technologies.

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