

A New Methodology for Information Presentations on the Web

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Abstract. The rapid growth of on-line information including multimedia contents during the last decade caused a major problem for Web users - there is too much information available, most of it poorly organized and hard to find. To help a user to find proper information, web news search functions are devised and developed. Although those search engines provide some solutions, users still suffer from reading huge amounts of hyperlinks. Also, users of new media now have great expectations of what they can see on the Web. To provide better user satisfaction, we proposed a story model (story structures) that can be dynamically instantiated for different user requests from various multi-modal elements. The proposed story model defines four domain-independent story types. We compared traditional web news search functions and our story model by using usability test. The result shows that our multimedia presentation methodology is significantly better than the current search functions.

1 Introduction

The rapid growth of online digital information over the last decade has made it difficult for a typical user to find and read information [10]. One way to address the problem of information overload is to tailor that information to specific user interests, needs and knowledge base. If there is an approach that responds to individual information requests with an original, dynamically built story, several problems are solved.

First, in today's Web service industry, information presentations and collections of data are static and having limited multi-modal presentations. Critically, there is no capability to dynamically adapt an integrated presentation of information to a user. We believe that a user will engage deeply into a story when a user not only reads text articles but also watches videos and/or listens to audio clips in a coordinated manner. Second, most of current web search engines deliver a huge amount of hyperlinks. Although this helps improve accuracy (recall), an end user has a trouble deciding which results are what he/she wants.

The most similar study related to our work is called "Cuypers" [11]. The system generates Web-based presentations as an interface to a semi-structured multimedia database. The goal of the system is to generate the final presentation by using con-

straints (quantitative and qualitative) and logic programming to process automatic presentation generation. In our approach, each story type was created by using constraints as same as Cuypers, but the story structures are used to deliver high level of abstraction. For example, a summary story type can be chosen by an end user who wants to read brief information. In order to present parallel information (e.g., stories about players of LA Dodgers), a structured collection story type can be chosen by our system.

The core of this paper is to provide a dynamic multi-modal presentation with retrieved results of news search engine. To achieve the goal, the proposed system created story structures that can be dynamically instantiated for different user requests from various multi-modal elements. Also, the proposed system focuses on quality of the results not quantity of results. In order to convey the nature of the information presentation, we devised and developed the precise nature of the dynamic integration of multimedia presentations that will draw upon visual techniques [12, 14], presentation constrains [3, 16], a content query formulation, a story assembly and a structured rule-based decision process.

Within this philosophy, we propose a story model that defines four story types that lay out the appropriate presentation style depending on the user's intention and goal – a summary story type, a text-based story type, a non-text based story type and a structured collection story type. We design the story model to delineate high-level abstractions of general story templates so that the proposed story types can cope with any kind of existing stories. We conducted an experiment to examine user satisfaction of our system comparing with that of traditional web news search functions. The experimental result shows that our system is statistically significantly better in user satisfaction.

To determine a user's intention and goal, a general knowledge-based process will be used. A key to the successful use of story types is the ability to relate and connect the user requests to the Content Database. A domain dependent ontology [2, 7] is essential for capturing the key concepts and relationships in an application domain. For our purposes, we are interested in sports news domain dependent ontologies [8]. Metadata descriptions will connect a modified user request (by using domain ontology) to the Content Database for retrieving proper content elements.

2 Overall Architecture

The overall functional architecture of the proposed system is illustrated in figure 1. The model has two key phases: story assembly and content query formulation. In the story assembly phase, a novel structured rule-based decision process is introduced to determine a proper story type and to invoke a primary search and a secondary search in the content query formulation phase. At the beginning, the story assembly module receives a modified user's request from a query processing procedure. These inputs then invoke a primary search to retrieve multi-modal content objects, along with a constraint-based k-nearest neighbor search. These results are sent to the story type decision module to determine a proper story type and then fill in the chosen story type with multi-modal elements (content objects). If it is necessary, this decision module also invokes a secondary search to get extra elements.

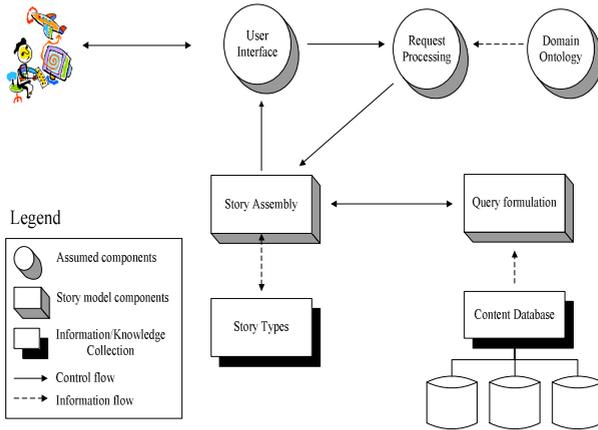


Fig. 1. Overall functional Architecture

3 Story Model

The proposed story model defines four story types that lay out an appropriate presentation style depending on a user’s intention and goal. In order to provide an efficient presentation, the story model needs quantification for the size of each icon based on ranking in the retrieved content objects. Furthermore, the story model employs visual techniques that solve layout problems such as combining and presenting different types of information and adopts presentation constraint specifications to abstract higher levels of presentation so that lower levels of presentation can automatically generate a story that meets those specifications.

A visual technique depends on traditionally accepted visual principles to provide an arrangement of layout components [1]. This conventional arrangement, called a layout grid, consists of a set of parallel horizontal and vertical lines that divide the layout into units that have visual and conceptual integrity [12].

According to Vanderdonckt et al. [14], there are five sets of visual techniques: physical techniques (e.g. balanced vs. unbalanced layout), composition techniques (e.g. simple vs. complex layout), association and dissociation techniques (e.g. grouped vs. splitted layout), ordering techniques (e.g. sequential vs. random layout), and photographic techniques (e.g. round vs. angular layout). We focus only on balance and symmetry of physical techniques because balance is a highly recommended technique evoked by many authors [4, 6, 9]. Balance is a search for equilibrium along a vertical or horizontal axis in layouts. Symmetry consists of duplicating visual images along with a horizontal and/or vertical axis [5, 9]. Thus, achieving symmetry automatically preserves balance.

Presentation constraints are typically expressed in terms of a timeline, screen layout, or navigation structure. In most constraint systems, only certain aspects of the presentation are adapted to satisfy each constraint. Multimedia presentation structures consist of multiple dimensions, primarily including space, time and navigation [13, 15, 16]. Our approach is only concerned with a spatial constraint because time and navigational constraints are not relevant to our presentation goal. Our presentation

goal is to deliver an integrated multi-modal presentation with a balanced layout in response to a user's objective. Thus, timeline and navigation constraints are not considerable constraint specifications of our approach.

Graphical icons, including a scrollable box for a text, a fixed size window for images, and control boxes for audio and video clips are containers of elements in story types. In spatial constraint specifications, each container has a fixed size to be filled in by an element. This higher level of abstraction allows a consistent final presentation for the user.

4 Experiments

4.1 Evaluation Plan

To examine the usability of our system, we designed a controlled experiment. In our experiments, the total 25 students from the engineering and journalism schools (17 and 8, respectively) were selected and asked to fill up a questionnaire after experiencing the system. Appendix A shows the sample questionnaire and the figure of our system used in the experiment. The subjects were provided by an experimenter with a brief instruction about the experiment and asked to have experience with two sites - the traditional news search functions such as CNN, LA Times, and Washington Post and our systems. 13 subjects began with the traditional news search function site and then our system site, while the other 12 subjects started with our system site and then the traditional web news search function site in order to avoid any possible order effect. At the end of each site, the subjects were asked to fill out an online questionnaire, which was hyperlinked from the last page of each site, with radio-button scaled responses and some open-ended questions which asked him/her to evaluate the four categories - Overall satisfaction; Functionality and capability; Learnability; and Interface design. Finally, all subjects were debriefed and thanked.

4.2 Statistical Analysis

The Cronbach's alpha was used to estimate if the items in the same category are measuring the same underlying construct. We assume there is high reliability if the alpha value is over 85%. Cronbach's alpha measures how well a set of items (or variables) measures a single unidimensional latent construct - it is a coefficient of reliability (or consistency). Cronbach's alpha can be written as a function of the number of test items and the average inter-correlation among the items.

4.3 Results and Discussion

The online questionnaire was composed of based on the Cronbach's alpha showing that the questions in each category are highly reliable (Table 1). All questions are included in the results.

The paired t-tests were performed at each category, and the results were showed in Table 2. In the all categories, our system is statistically significantly better than the traditional web search engines (all p-values are less than 0.05). Our system's overall satisfaction, functionality and capability and interface design were more than one level up than the traditional ones'.

Table 1. Cronbach's alpha value of two sessions

	Cronbach's alpha	
	Session 1 ¹	Session 2 ²
Overall	.8690	.9150
Functionality and Capability	.7747	.6941
Learnability	.8027	.7829
Interface Design	.8392	.8056

Table 2. Paired t-test value

		Mean of Paired Differences	t (df = 16)	Sig. (2-tailed)
Pair 1	Q101 - Q111	2.35	6.305	.000
Pair 2	Q111 - Q131	-2.29	-5.376	.000
Pair 3	Q102 - Q112	1.71	3.237	.005
Pair 4	Q112 - Q132	-1.88	-4.157	.001

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¹ Traditional Web Search Functions.

² Our system.

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