

Using Long Term Memory for Bookmark Management

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Abstract. When using the bookmark or “Favorites” function included with most web browsers, it is difficult to retrieve a target bookmark if it is not properly categorized or tagged with meaningful keywords. For this project, we propose using a method of human-like long term memory (LTM) rather than directories or keywords for searching and managing bookmark data. This experimental model takes into account the user’s browsing experience (i.e. the bookmark’s added date, number of visits, and last date visited) to create and manage bookmarks. A pilot study of the model shows that the new system is significantly more efficient at retrieving information from large collections of bookmark data.

Keywords: Bookmark Management, Information Filtering, User Interface Design.

1 Introduction

Ever since the development of the Internet, the World Wide Web (WWW) has become an important platform for providing information. Because there is so much information on the Internet, it has become common task for many web users to find, record and keep track of important web pages. Most users use their browser’s built-in bookmarks or “Favorites” function to record, organize and retrieve the web pages they’ve visited in the past. One survey [1] indicates that 58% of all web pages a user visits will be re-visited by the same user sometime in the future.

Currently, the bookmark function provided by most browsers relies on the user’s categorizing and tagging abilities to make the information easily retrievable. Though this might be an easy task for experienced users, others may find it is difficult to categorize or tag every single website they visit. When it comes to retrieving dated information, even experienced users might find it a difficult and time-consuming task to use the current technology. This is because traditional bookmark management systems rely heavily on directory or keyword (tagging) mechanisms for labeling bookmarks. If the directory or keywords are not properly organized or, even worse, the directory or keywords are forgotten, the retrieval of the information can be a very daunting task. To solve this problem, we propose a new method which makes use of a human-like long term memory (LTM) instead of

using short term memory (i.e. remembering directories and/or keywords) for managing bookmarks. This new method also utilizes visualized information to increase information retrieval efficiency.

2 Background

2.1 Related Works

Deficiencies of Traditional Bookmark Systems

In the past, several attempts have been made to improve upon the deficiencies found in most traditional browser bookmark systems. Ying Feng (2002) [2] created a system that automatically analyzed the semantic similarities of web pages and then grouped those web pages according to those similarities. The system improved the efficiency by auto-grouping the bookmarks. In another study, Data Mountain [3] used 3D space to help the user memorize and organize large amounts of information. PowerBookmarks [4] integrates auto bookmark categorizing, bookmark sharing, and a user-friendly interface to solve many of the problems associated with traditional bookmark systems. John Roberts (2005) [5] also improved bookmark metadata by integrating a new bookmark system that increased the usability of traditional bookmark systems.

In these studies, many researches proposed various solutions to the problems inherent in traditional bookmark systems. Unfortunately, all of the suggested solutions were still based on using directories and keywords to manage bookmarks. This mechanism requires the user to memorize directory or keywords when retrieving the information. This generally isn't a problem when the bookmark is accessed on a regular basis or if the bookmark collection is not too large but this is often not the case.

In this study, we propose a new method which uses a human-like LTM mechanism to enhance the efficiency of bookmark information retrieval. This new method reduces the amount of information (e.g. clutter) appearing on the screen and, as a result, decreases the amount of time required to scan through and retrieve the necessary information. The purpose of this paper is to propose a method by which to effectively locate the wanted bookmarks from a large number of bookmarks. This new method uses a human-like long-term memory mechanism to create an intuitive interaction for organizing bookmarks.

2.2 Long-Term Memory

Types of Long-term Memory

Long-term memory is memory stored as meaning that can last as little as 30 seconds or as long as decades [6]. Human memory is divided into short-term (STM) and LTM. The important characteristic of LTM and, consequently, the focus of this project, is on how long the memory "sticks" in the human brain. As an example, when asked to memorize a new telephone number, the telephone number would normally be stored in the STM of the individual being asked to memorize it. On the other hand, if the number is used and/or repeated regularly, it might not be forgotten for some time.

This process would require that the user repeat the number several time in order for it to be “transferred” into LTM.

This project asks the question, “Are there new methods by which to remember information other than by repetition?” The answer to this questions lies within a sub-category of LTM. LTM is typically divided into Declarative memory and Procedural memory. Declarative memory can be further divided into Episodic Memory and Semantic memory. Episodic memory is the recollection of events. It includes time, place and associated emotions [7]. Episodic Memory does not require the user to rehearse the event in order to memorize it. For example, if someone were to be having a conversation with a friend and in that conversation he tells his friend, “Last night I went to a good restaurant!” he would be recalling information stored in his Episodic memory. This type of memory is often what eye-witness testimony is compromised of and is especially susceptible to subsequent events like questioning, reading the newspaper, talking to others about an event, etc[8].

Currently, users must rely on the directory or keyword mechanisms to manage the ever-increasing amount of bookmark information they need to store. These two methods require the user to manually place bookmarks into a well-organized folder or tag it with the proper keywords. If the information is not stored in a well-organized directory or tagged with meaningful keywords, once some time has past, the information will most likely be removed from the user’s STM and lost. He simply won’t remember how he organized it. On the other hand, Episodic memory lasts longer and does not require the user to memorize information via repetition. For this project, we propose the use of this characteristic of Episodic Memory to manage large amounts of bookmark data and to improve upon retrieval efficiency.

Using Long-term Memory for Bookmark Management

It is often the case that a web page is visited only once or twice when a user adds it to his bookmark collection. For those bookmarks that are not used often, it is difficult to memorize their location and position in the bookmark directory. The only pieces of information the user has to help him locate the bookmarks are directories and keywords. Experienced users often name the directories and keywords with meaningful words which help them to recall where they placed the target bookmark.

In this study, we propose using LTM to help users organize and search large amounts of bookmark information. As an example of how the system works, let’s say the user remembers that he adopted his pet dog three years ago and he remembers adding several pet-related web pages to his bookmarks during the period he was researching dogs. The user remembers that he has not visited those web sites for some time and that he visited them only a few times. This information alone is used in the development of our new bookmark system. In particular, the approximate date the bookmarks were added, the approximate number of times the bookmarks were visited and the most recent date the bookmarks were visited are all very useful.

The new bookmark system doesn’t require the user to remember the exact date he added the bookmark, rather, he only needs to know “about” when he added it. All the information gathered is used to filter out the unnecessary information and highlight only the useful information that will guide him to his target bookmark. The more information the user is able to recall, the more accurate the search becomes. The new bookmark system can be used to increase the efficiency in searching bookmarks

within a large number of bookmarks. From a management point of view, the new system can also be used to organized bookmarks according to personal life experiences.

3 Bookmark Management System

Many researchers have suggested various solutions to the difficulty inherent in managing a large number of bookmarks using traditional bookmark systems. All the previous solutions, though, use directories and keywords as the primary method of searching and managing bookmarks. With our new bookmark system, we take a new approach at organizing bookmark information which greatly improves on the efficiency of searching a large number of bookmarks.

3.1 Bookmark Metadata

The goal of this project is to improve bookmark metadata collection so as to provide users with a more meaningful and personal interaction with their bookmark management system. The new system will work in the background to automatically save and categorize the user’s bookmark metadata. In fact, the user is normally not even aware of the background processes.

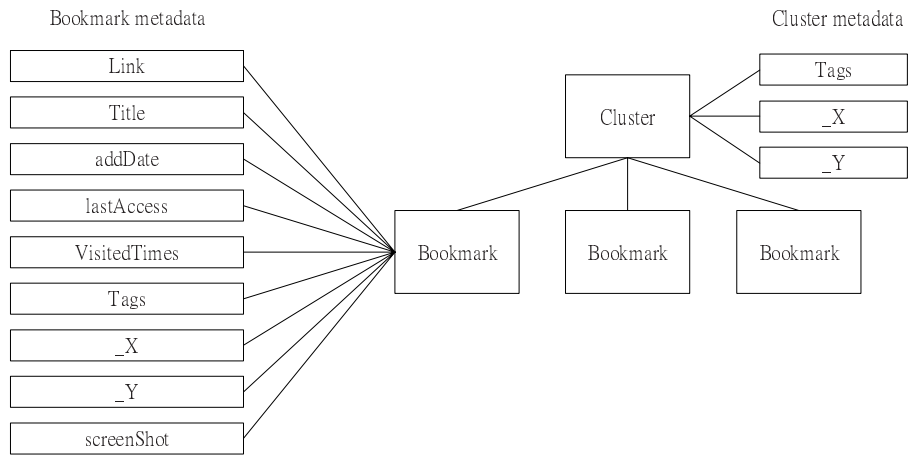


Fig. 1. Document Metadata, All the captured metadata will be saved as a XML format document on the local disk. The XML format is used to keep the cross platform capability of the bookmark information.

3.2 The System Model

The system model describes how the metadata is generated and updated. Using the interface, the user can actively manipulate the bookmark’s 2D location and its parent cluster or he can passively change the metadata via his online browsing activities.

Using the 2D graphical user interface, the user can leverage the browsing parameters to dynamically change the information that appears on his screen, thus, avoiding wasted time reviewing irrelevant information.

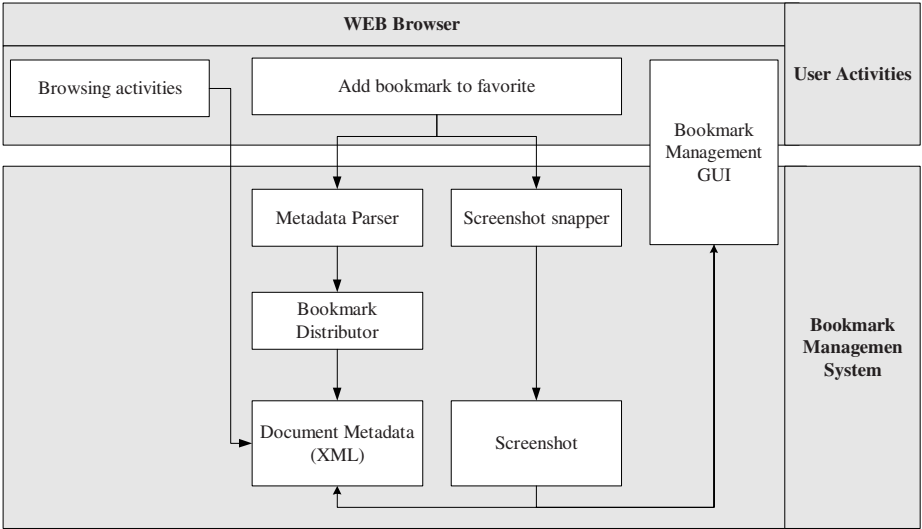


Fig. 2. The System Model

The user’s activities such as browsing, adding bookmarks and using the 2D interface to modify the bookmark’s metadata, are considered the “input” side of the system. When the website is added to the bookmark collection for the first time, the information is processed by two modules – the Screen Snapper module and the Metadata Parser module. The Screen Capture module takes a screenshot if the bookmark is new to the system. The Metadata Parser module parses the keyword information contained in the HTML code and then sends that information to the Bookmark Distributor. The Bookmark Distributor then suggests to the user where to place the new bookmark based on a comparison between the parsed keywords and the keywords in the collection. Finally, the XML metadata is generated in the local computer. When the user visits the bookmarked website again or uses the GUI to change its attributes, the document metadata is automatically updated to the system. Our system does not include all of the components illustrated in the Fig. 2. For this study, we implemented only the most essential system modules including the bookmark management GUI module and the Metadata module.

3.3 Visualization of Bookmarks and Folders

One of the problems associated with managing large amounts of information is dealing with the amount of time it takes to find the target information. Data Mountain [3] utilizes a semi-3D space which helps the user quickly locate the target information. It functions like human memory in that it helps the user to remember the

location of everyday objects in real life. The problem with Data Mountain is that it uses screen shots as visual representations of the bookmarks. When there are hundreds of bookmarks appearing on the screen all at once, the user might find it difficult to locate his target information because of the visual “chaos.” Our system utilizes the user’s own browsing activities as a parameter for coding the bookmark’s visual representation. This method allows large numbers of bookmarks to be shown on screen while still providing useful information about each individual bookmark.

Our system utilizes two parameters to represent each bookmark icon. The two parameters are 1) the last date the website was visited and 2) the total number of times the website was visited. In the first process, all the bookmarks are sorted and then divided into five groups according to the last date the website was visited. Each group is represented by a different icon opacity value, those being 100, 70, 50, 30, and 15 respectively. At the same time that the first process is taking place, the bookmarks are also being sorted by the second parameter - the total number of times the website was visited. This second parameter is represented by different color tones. The folder’s visualization is based on the average value of the bookmarks contained within that folder.

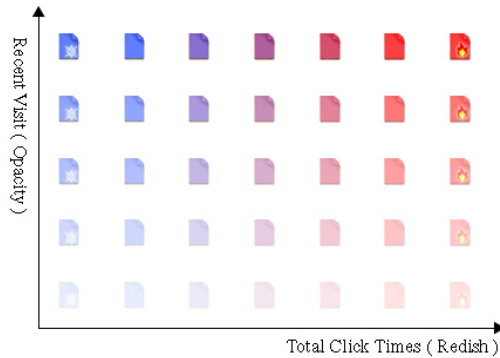


Fig. 3. Bookmark Icon Visual Representation

3.4 Information Retrieval

The new bookmark system does not require the user to input precise information in order to view the search results. The filters include the date the bookmark was added, the last time it was visited, the relative total number of times visited and traditional keyword information. The system allows its user to combine any number of filters to help him effectively eliminate unwanted information and reduce the amount of time it takes to find the target information. As an example, for the user who has 200+ bookmarks to search, a forgotten directory or keyword could lead to an extremely time consuming ordeal. With our system, though, much of the irrelevant information is filtered out within seconds.

To further strengthen the connection between the user’s bookmarks and his personal life experiences, he is able to add a “Memory Mark” to a time line which represents an important event. Memory Marks, can be used to reference when the website was added and/or when it was last visited. This information search model greatly improves the efficiency in searching a large amount of bookmark information.

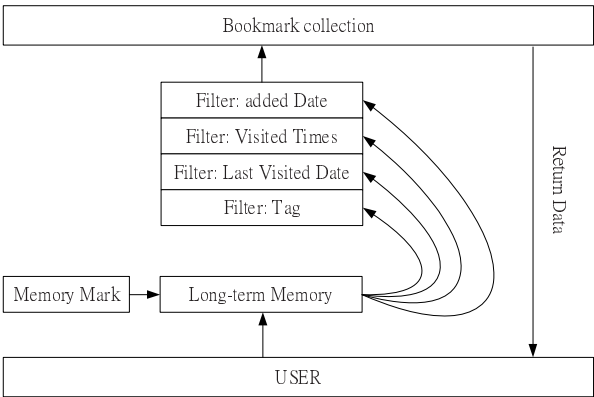


Fig. 4. Bookmark Searching Process

3.5 Graphical User Interface

To increase the usability of the new bookmark system, we incorporated a 2D graphical user interface (GUI). The user is able to use this GUI to get a rough idea of the number of bookmarks he has and how they are organized. The bookmarks are represented by small icons which are coded by the metadata. Another benefit of the 2D interface is that it allows the user to use space memory to organize his bookmarks.

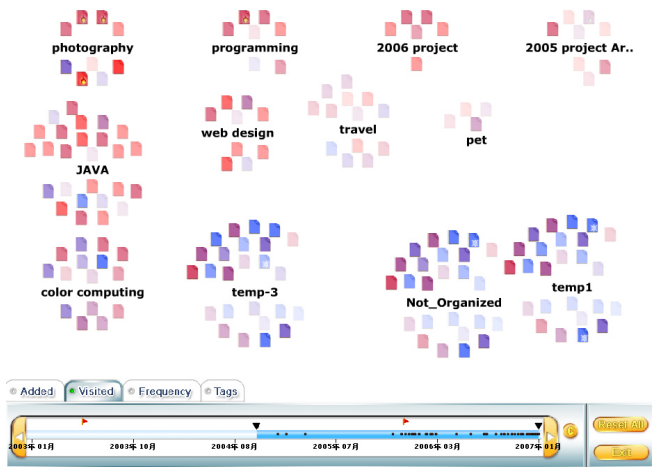


Fig. 5. System Screen Shot

By default, all the bookmarks belonging to the same cluster will gather around a main cluster name (Fig. 5). With the organized bookmark layout, it is very easy to distinguish one cluster from another. The user can also use the drag-and-drop technique to manipulate the position of the bookmarks and clusters.

The timeline contains many black dots which represent the bookmarks on the screen. This allows the user to understand the distribution of the bookmarks along the time line and use it as a reference for adjusting the time threshold. The little red flag above the time line is the Memory Mark which is used to strengthen the connection between time and personal life experiences.

4 Pilot Study and Results

We conducted a pilot study to compare traditional bookmark systems with our new system. In order to conduct neutral experiment, the two bookmark systems used the same bookmark collections and the same directory structure. In the experiment, the users were asked to look for a target bookmark within a specific directory. The users were asked to perform several different searches. They were tasked with searching 5, 10, 15, 25, 45, 65, and 190 bookmarks respectively.

All of the users in this experiment had prior experience with using traditional bookmarks and in using directories to organize bookmarks. There were five male and five female participants. They ranged in age from 25 to 35 years old. For the first experiment, the participants were asked to perform seven different tasks using traditional bookmark systems. The time needed to complete each task was recorded. Before the second experiment, there was a short tutorial on how to use the new bookmark system. The users were given some time to familiarize themselves with the new interface. After they had become familiar with how the new system works, they were asked to perform similar tasks they had performed in the first experiment.

The results of the experiment showed that when the number of bookmarks to be searched were few, the traditional bookmark system slightly outperformed the new bookmark system. Conversely, when the total number of bookmarks to be searched were many, the new bookmark system significantly outperformed the traditional bookmark system in that the users were able to locate the target information much more quickly.

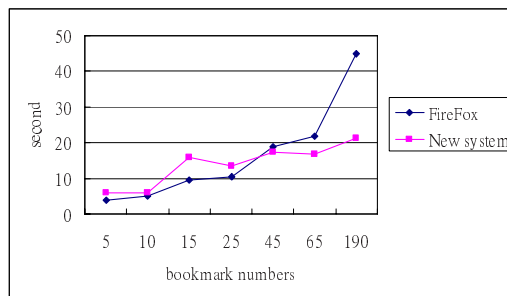


Fig. 6. Average Task Completion Time

5 Discussion and Future Development

In this study, we propose using a form of human-like LTM for managing bookmarks. The new system reduces the amount of information shown on-screen, thus, enhancing search performance. With the new system, users spend significantly less time scanning directories and bookmarks and are, therefore, able to find the target bookmarks more efficiently and quickly. With the new system, there is an increase in mouse movement due to the utilization of the 2D GUI. Also, the new system does require the user to spend additional time adjusting the filters. For these reasons, when searching a small number of bookmarks, the traditional bookmark system had better performance than the new system.

Fig. 6 illustrates the average amount of time it took users to find the target bookmarks using the traditional vs. the new bookmark systems. When using the new bookmark system, there is no direct relationship between the number of bookmarks needed to be searched and the time it took to find them, thus, the participants were able to locate the target bookmarks more quickly. In the pilot study, we also discovered that when a user is searching a large bookmark collection, he is much more likely to bypass the target information when using a traditional bookmark as opposed to using the new system.

In the future, the new bookmark management system's GUI will be further enhanced. Also, our bookmark management method will include document management. The traditional hierarchical directory structure and keyword management will be further incorporated into the user's personal life experience and LTM in order to enhance the overall performance on information search and management.

Acknowledgments. We would like to acknowledge and thank our colleagues at the NCHC for their help during the experimental stage of this research.

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