An Event-Based Interface to Support Personal Lifelog Search

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Abstract. A Personal Lifelog (PL) archive gathers together digitally captured data taken from the real life events of an individual. These can include for examples details of computing activities and capture of other digital artefacts such as photos. Personal information management (PIM) research is focused on making use of personal digital content. We believe that findings from studies of personal episodic memory can be used to assist the development of search tools for PLs. We exploit the temporal associations among the PL items, and present an interface for search of personal archives. This displays personal landmarks on a timeline, including items such as captured digital photos and keywords from information accessed on computing devices during corresponding periods. This enables users to search and browse their PL archives based on recall of significant events or items, rather than needing to remember explicit temporal features such as date and time.

Keywords: timeline, episodic memory, re-finding

1 Introduction

As a generally possessed feature of all the files or logs, timestamp have been utilized as a means for desktop file searching almost since the emergence of desktop searching tools, e.g. search by last visited date. Since some studies have claimed that 'date' is not a well remembered feature, it is not a good search feature, since queries usually generated from recalled content. However, in practice instead of date, people may actually remember some other types of information about time. For instance, the time period of the day, the day of week, etc. In this paper, we examiner the cognitive theories of how we perceive time and what does this actually tend us about the recall to time features. We then present some related works which utilize some features of users' temporal memory. In section 3, we present our browsing interface for personal desktop search developed within our iCLIPS project on searching personal lifelogs, and focus on introducing its timeline features.

2 Background

Often users cannot recall or sometimes are just too lazy to enter all the correct details into the fields of a interface to search efficiently for information. The latter case often does not matter in practice since using only a few correctly recalled keywords frequently achieves very good search results. In such cases there is no need for the user to spend time and energy recalling and filling in many more details just to get a slightly better initial result. In this situation users can browse the results of a simple search query to find the desired target, and only occasionally need to re-search by entering a refined query. Unlike many other desktop searching interfaces, which present previously used searching fields again for result refinement stage and require users to refine their recall of the same type of information as they have already used, our prototype interface presents 'suggestions' and 'searching criteria' in a chronological way, and lets users 'recognize' relevant features. This tends to involve less effort on their part than trying to recall distinctive search features. In this section we examine the psychological background to our approach.

Temporal memory is a key component of human episodic memory [1]. As such, people with normal memory function will generally have some recollection of the "time" associated with an event. However, people often have bad memory for exact dates, the reason for this is that "date" is conceived rather than perceived, it is known symbolically by a name, such as June, 15th [2]. This means that the calendar date and clock time is explicitly learned semantic knowledge, and are tagged to episodes in one's memory, rather than naturally perceived and thus stored in the episodic memory. So when one intends to retrieve the specific 'date' or 'hour', he or she tries to recall the knowledge acquired from a clock, calendar, or other source. However, we do not always attend to a clock or calendar to gain such exact information. What people usually do when they recall details of the date or time, is to recall details of the closest points in surrounding events for which they do have the knowledge about the calendar date or clock time.

One well established theory about temporal memory is the reconstructive theory. This proposes that the memory of time is accomplished by using fragments of information associated with remembered events to infer the time from general knowledge of time patterns [2]. According to Friedman [3], there are three modes to retrieve temporal information: 1) *Distance* – time elapsed since the event occurred (e.g. I had last meeting on Wednesday). 2) *Absolute Location* – when exact date is known, or can be inferred by the event itself (e.g. the even was on a friend's birthday). 3) *Relative Location* -Time can be inferred from events that occurred before or after the target time (e.g. I was working on that document before the last weekly meeting, after coming back from a holiday in Paris). Cognitive psychologists refer to these events as *temporal landmarks*. To be effective temporal landmarks should be both salient and well remembered. [4] concluded that good temporal landmarks are ones that the person was personally involved with, are of great personal importance, and act as points of reference in the user user's personal history. They also suggested that events on calendars are suitable points since they are usualy the most salient.

This idea has been well expressed by "Memory Landmarks" [5], a personal information searching interface prototype developed by Microsoft Research. It predicts landmark events from a collection of manually added personal calendar

events based on a model built using their user study. The interface displays the results on a timeline augmented by these events, both public and personal, either in the form of photos or text. Their selected landmarks are generally real life events, as suggested in Tulving's theory [1] of episodic memory that people organize memory by episodes, including elements such as location of an event, attendees, and surrounding events.

However, since our activities involve increasingly greater interaction with the digital world, we assume that there might be a change to the components of our episodic memory, since sometimes our activities in the computing world are not as constructed or related to what's in the physical world, or sometimes the related physical world information that we tend to know may not provide good cues for information retrieval. For example, information such as the geo-location or the weather may become less important or distinctive within a search query for someone sitting in front of their computer for 8 hours each day. We assume that some computer related activities may lend substantial support in addition to the physical life landmark events, especially for individuals whose physical life does not contain many distinctive features.

As part of our iCLIPS project, we are developing an interface which presents landmarks items/events on a timeline from both the user's physical and digital worlds. To relieve users from the burden of manually adding events and reduce the likelihood of omitting some potentially important events (e.g. unexpected event), we are also collecting richer sources to automatically segment real life events as well as computer activities, and detect landmarks events from them.

3 Data Collection

We are currently doing an exploratory investigation using three subjects, and plan to evaluate the interface based on logs of their activities in the digital world and real life, including:

- Full content of files or web pages in windows comes to foreground, corresponding timestamps and duration, and the attributes including title of the window, path, etc.
- Phone logs from mobile phones, and text messages
- Digital photos of the individual and passively captured images of one's life captured using a Microsoft Sensecam[1].
- Geo-location obtained using GPS and signal tower data from a Nokia N95 phone
- Surrounding objects or people with Bluetooth devices.

4 iCLIPS Browser Interface

The iCLIPS Browser Interface is shown in Fig 1. Apart from a traditional searching panel for editing current query and a result browsing panel, this interface also boasts a timeline with landmark items. This includes photos from real life, text extracted to digitally marked events (e.g. on calendar), keywords representing computer activities

[1] http://research.microsoft.com/en-us/um/cambridge/projects/sensecam/

and thumbnails of computer items. The range of time on the timeline is determined by the previous searching range previous timestamp results or queries. It allows users to select the types of items to be presented as an indication of time. By clicking any two of these items (or points on the timeline), it narrows the results to the time range between these two points. Right clicking on any items activates a side menu, where the user can select which exact actions they want to do with that item, e.g. by clicking on a keyword, the user can either choose to add it as a keyword from the document in searching query, or a keyword for a surrounding computer activity. Since we have more detailed episodic memory (and temporal memory) of the more recent encountered events or items, we assign lower thresholds for selecting 'important' items/events for recent period.

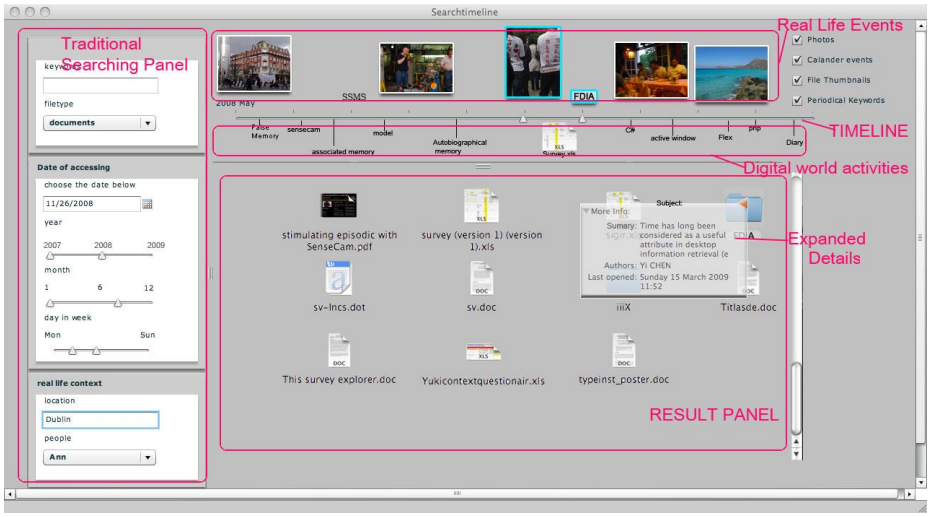

Fig 1. iCLIPS Browser Interface

The result can either be presented as single files/links or as folders (cluster of items for the same tasks/event) and depends on the number of results to be listed and the capability of clustering certain files. More details of the item in the result list can be displayed with mouse over it.

Selecting and presenting real life events. According to the cognitive theories on memory landmarks, important events should be selected by their salience and likelihood of being well remembered. Our algorithms determine salience using the following factors:

- Unusual location, e.g. not in the city on is living in
- A burst of digital photos, since people generally only take pictures when they feel the content is worth recording.
- Sensecam images which are different from general routine according to[6]
- Other manually added events extracted from applications such as calendar.

We select key frame photos by their likelihood of being recognized:

- Most recent/frequently visited digital photos x content representativeness

- Manually taken Sensecam images with good images quality
- If the above two are not available, select from SenseCam images according to [7].

Also, by placing the mouse on any key frame the surrounding images can also be rapidly played like a video stream. This provides the user with more cues to recognize the event. Events can be extracted from third party applications such as calendars.

Presenting landmark computer activities. Computer activity is represented either thumbnails (and file name or title) of the most frequently visited items, or keywords which most frequently appeared across applications (including SMS on mobile phones) during that period . The main factors that determine the selection of keywords are: the frequency (= count of that term in document x document's overall active time duration), the importance of their location, and the subject's effort while using them (a word typed in for searching should be more important that a word appeared on a webpage).

5 Conclusions

We developed a personal information searching interface which focuses on presenting temporal cues for refining searching results. It utilizes human temporal memory of landmark events and items to get more exact time points which match the timestamp of the access target. User studies are planned to test its efficiency based on the PL data collections of three subjects.

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