Lifelogging: New Challenges for Information Visualization on Mobile Platforms

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Abstract

Lifelogging offers a lot of promise in the realm of self-monitoring and reflection. The advent of personal devices with the potential for supporting self-tracking, such as smartphones, has resulted in large amount and multi-faceted data being created. Meanwhile, the consumption of collected lifelog data takes place within a wider mobile environment. These diversifying devices opened up new challenges for designers to create rich interactive visualizations under such context. In this workshop paper, we introduce SenseSeer, a web-based lifelogging application that passively tracking individual daily experience through built-in sensors from users' smartphones. We present our approaches from the stage of data collection to visualization of personal lifelogs on different mobile platforms.

Author Keywords

Lifelogging; Information Visualization; Quantified Self; Human-Computer Interaction

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous. See:

Introduction

Self-tracking our daily life is now easier than ever. We can take advantage of the fact that people carry their mobile phones wherever they go. Intelligent device like smartphones today are equipped with a few sophisticated sensors. These sensors, together with advanced computing power and network connectivity, offer opportunities to track everyday experiences accurately and automatically. The generated lifelogs have great potential in providing valuable information about us, which can be further investigated to discover insightful understanding of ourselves through means of visualization techniques [1].

On the other hand, the platforms and devices from which we interact and explore on our own lifelogs are quickly diversifying: smartphones, tablets PCs, game consoles connected to home TV screens, large interactive walls and many other embedded appliances are offering very different ways to consume individual digital lifelogs. These mobile media hubs open up new challenges on constructing and visualizing lifelog data.

Main objective of our work is to combine several sources of lifelogging data to reveal interesting facets and patterns of users' lives through interactive visualizations techniques [2], thus providing user with dynamic overview and direct feedback with data that may otherwise be difficult to see in other forms, helping achieve greater user experience by adapting the visualization to mobile usage context.

System Description

SenseSeer is a web application that provides a scalable and extensible platform to lifelog large volume of personal data by utilizing sensors provided with smartphones. Dynamic web-based interfaces are automatically generated to assist user in interacting with data. The framework is consisted of three main parts: (1) A smartphone that tracking users contextual information, passively capture photos that users engaged with (2) enriched data stored in cloud servers (3) web-based interface with visualization for real-time access of users' lifelog data. The design process (see Figure 1) can be seen in the following diagram.

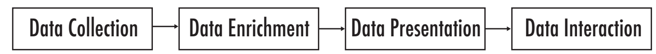

Figure 1. Information visualization design process for lifelogs

Data Collection

We can use the various sensors embedded in smartphones to better log user's daily lives. A modern smartphone is typically deployed with a series of sensors: accelerometer for physical movement recognition, to analyze if the wearer is sitting, standing, walking, or running; camera for passively capture photos that user engaged with; GPS for outdoor location detection; WiFi for indoor location detection; Bluetooth for gathering social present information [3]; microphone for recording environment noise level. These sensors collect data and are logged with its corresponding timestamps.

Data Enrichment

Captured sensor logs often are extremely detailed and voluminous. Thus, it requires data reduction, compression and rendering on raw datasets. Additional visual analysis is also applied to enrich the data into semantically meaningful "life streams".

An embedded camera can passively capture about 3,000 images per day. By grouping sequences of

Figure 2. Overview on smartphone

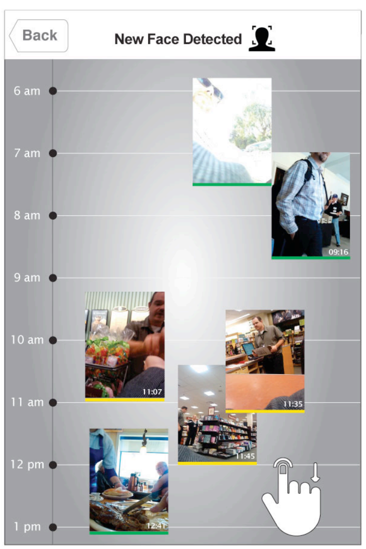

Figure 3. Detailed view interaction

related photos into "event" segments [4], we can reduce visual complexity. By applying series of image processing technologies such as face detection, concept extraction, the system establishes ranking list for detected events. By aggregating the time-stamped sensor logs, additional annotations are generated as supportive metadata information cues.

Data Presentation

Existing studies [5] have found that, among a variety of lifelogging contents, photo is most often the main focus and interest to users. Images provide rich resource for reviewing individual's everyday life experiences. Thus, effective visualization should focus on visual lifelogs. Secondly, mobile devices are more often used in disruptive environments such as in a busy subway train or on the street. Under such context, presentation should display lifelog in a more graphical and glanceable way, to support explorative browsing and memory recall purposes [1].

Data Interaction

Finger-based interaction affords a direct and rich interaction paradigm. The limited display size of mobile devices makes it important to prevent information overload. Implication of these is that summarization of data should be done as much as possible to minimize the user's cognitive burden. One simple but very effective design guideline for the data interaction followed for our work is Shneiderman's information seeking mantra [6]: overviews first, zoom and filter, then details on demand.

Now, we present interaction designs for two mainstream mobile devices: smartphones and tablet.

Lifelog Interaction for Mobile

Through previous study, we observed that the user interest of visual log is twofold: gain an overview, and find most important moments. In order to better utilize limited display space, a compact view of whole day's visual lifelog is displayed to fit on the full screen size, and avoids having to scroll through long list. On this screen (see Figure 2), the user is presented with an overview summarizing a day through photos selected by preprocessed algorithms (i.e. 'most appeared face', 'most social active moment', 'most important shot' and 'new face detected'). Each photo is encoded with color border, indicating the type of physical activities associated with the photo when it was captured. The number of unique events, and the number of unique faces detected are also displayed, with comparison to previous day's data.

There are four types of views available, i.e. today, week, month, and year. Each provides global view of lifelog within a specific time period. Users can request for more details by tapping an interested grid. Then, they can easily trackback and browse detailed information required. For example, in Figure 3, all photos containing new detected faces are shown on the screen, with X-axis indicating the photo's importance score, Y-axis indicating time progression. By shaking the mobile phone, the interface will be 're-shuffled' with an alternative selection of photos.

Lifelog Interaction for Tablet

Another way to present time depended lifelog data is to use special visual metaphors such as timeline. In our design for a tablet device (see Figure 4), the screen is divided into two main parts. The bottom half summarizes a day/week/month/year through a set of

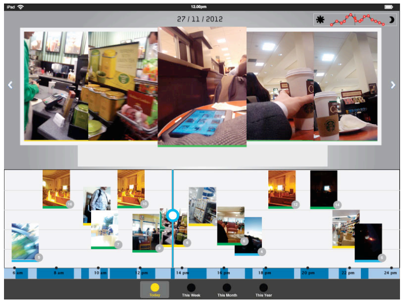

Figure 4. Visualization interface for tablet devices

representative photos. X-axis represents time progression, while Y-axis is for event importance score. To make it salient to users, the higher the event ranks, the higher it is positioned. The upper half is for all photos within each event on a carousel display. At the upper-right corner, a mini sparkline indicates the social activity level among returned timespan. At the bottom of screen, duration of each event is reflected on a timeline chart. Color-coded borders indicate type of physical activities the user has performed, mapping the physical activities to visualization in an intuitive way.

If the user is interested in a specific event segment and want to see more. Tap over the event representative photo. Then, he can flip through all the photos from the upper carousel panel. A short text annotation is generated automatically from other sensor logs. This acts as memory cue for user to achieve better user experiences on reliving through their lifelogs.

Future Work

We will be investigating more novel usage scenarios and visualizations for other types of interaction platforms and combining various modalities such as voice, haptic, sound, gesture, augmented reality, and so on. For example, a visualization that can stand in the background of the environment that will not require users' full attention, but can be perceived unconsciously while they engage in their other activities.

We plan to deploy the system on users' smartphones to understand their interaction behavior over time, conduct user evaluation, and ultimately find answers to these questions: What is the best way from an HCI perspective for visualizing digital lifelog archives? How should we adapt interfaces so that they can support people under different mobile context environment?

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