ScreenTrack: Using Visual History for Self-tracking Computer Activities and Retrieving Working Context

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ABSTRACT

Reconstructing a previous working context (files, websites and software) when resuming a task is inevitable for computer users after switching software or being interrupted. The process of retrieving relevant applications, files, and web pages can be time-consuming; while users may be able to use a "recent documents" feature to resume work in some applications, it is challenging to find relevant information from a text-based history — file names, web page titles, or URLs may not be informative enough. To address this problem, we tested the idea of using a visual history of a computer screen through the development of ScreenTrack. ScreenTrack is software that captures an image of a computer screen at regular intervals. It lets a user watch and navigate a time-lapse video made of computer screenshots to retrieve a previous working context from a screenshot. Through a controlled user study, it was found that participants were able to retrieve requested information more quickly with ScreenTrack than the control condition; this difference was statistically significant. Additionally, participants gave positive feedback on possible future uses for this software. We present the software, our preliminary user study result, and a plan for further validation.

CCS Concepts

•**Human-Centered Computing** → **HCI design and evaluation methods;** *Empirical studies in HCI;*

Author Keywords

Human Computer Interaction; Self-Tracking; Visual History; Mental Context Reconstruction

MOTIVATION

When using a computer, switching software or being interrupted is inevitable. Individuals use computers for various purposes, ranging from writing a document to watching a movie. Users must therefore retrieve previous working contexts frequently, which may decrease productivity. This retrieval process can be time-consuming and challenging; while users may be able to use a "recent documents" feature to resume work in some applications, it is challenging to recognize relevant information in a text-based history — file names or URLs sorted in chronological order, for example. Eventually, users may need to rely on their own memory and may have to open all the documents in the history and see if it is correct.

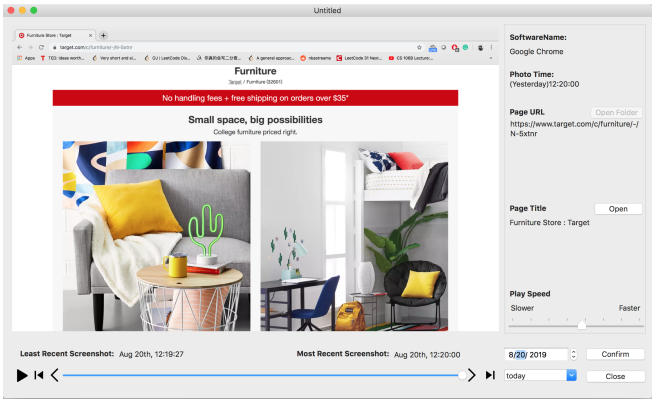

Figure 1. ScreenTrack: Users can navigate a visual history of a computer screen to gain context and to retrieve a past working context. Its design is based on video media player that users are generally familiar with.

In previous studies, one approach to retrieving past working contexts was shown to lie in providing users with memory cues in the form of visual information from the past. For example, writing “biographies” with icons and text [10], recording videos of previous activities in a working environment [6, 16], and using built-in features in software while coding and programming [17] have been shown to be helpful. Based on this previous research, it was shown that individuals can reconstruct their previous working contexts quickly and correctly with the help of a visual history of their computer screen, like thumbnails or a repayable history.

Our approach to address this problem is developing a self-tracking [4, 9] application based on the visual history of a computer screen [1, 2, 5, 7], drawing ideas from previous works [15, 16]. We test this idea through the development of ScreenTrack. ScreenTrack takes screenshots regularly to record current computer activities and associates with them any metadata the operating system makes available — such as the front-most application at the moment and the file path to the opened file. ScreenTrack then provides users with a time-lapse video made of captured screenshots, from which they can reopen closed software, documents, or URLs (See

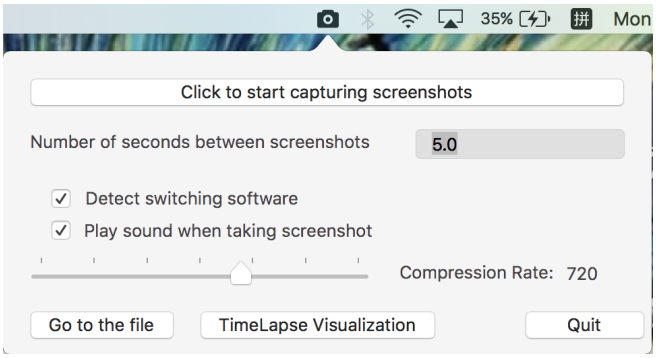

Figure 2. ScreenTrack configuration: Users can configure recording parameters and control how much disk space the software may use.

Figure 1, 2). The software can help users reconstruct previous working contexts [8, 13, 14, 18]. The anticipated research contributions of this work are as follows:

- The idea of associating a visual history of screenshots with metadata helps users retrieve a working context from a screenshot.
- ScreenTrack provides an efficient method for people to track their own computer activities and generate a time-lapse video of past screenshots.
- Quantitative and qualitative evidence exists to show that the system provides an effective way to retrieve working contexts.

This work will serve users' general goals in enhancing their productivity at work by reducing the time it takes to switch contexts and resume interrupted tasks [3, 12, 19].

SCREENTRACK

In ScreenTrack, we considered the following design goals.

1. **(Creating a replayable visual history of a computer screen that works across various programs)**: Unlike existing per-software history techniques, the goal here is to create a unified history across applications.
2. **(Capturing a screenshot with associated metadata and displaying the visual history with the associated data)**: Not only should users be able to see the history of a computer screen, but they should also be able to retrieve a working context from a snapshot in that history.
3. **(Making disk space requirements manageable)**: As maintaining the history of screenshots requires significant amounts of disk space, the software is designed to minimize disk space usage and provide options for users to control the space it is allowed to use.
4. **(Keeping screenshots private)**: The software is designed to store all screenshots locally. It protects screenshots from potential leaks to safeguard the user's privacy.

In short, ScreenTrack captures an image of a computer screen regularly to track tasks. Based on captured pictures, ScreenTrack creates a replayable visual history of a computer screen that works across different applications. Users can browse related information along with screenshots and reopen software, websites, and files recorded in screenshots with minimal disk usage and privacy concerns.

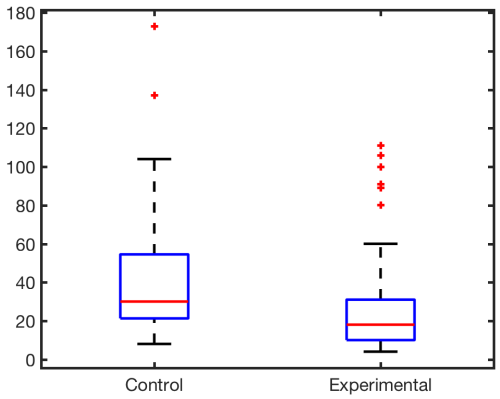

Figure 3. The box plot of user study's result between control condition and experimental condition. The participants were able to retrieve a web page using ScreenTrack (p<0.005)

PRELIMINARY USER STUDY RESULT

We designed and conducted an initial user study to validate ScreenTrack's ability to assist individuals to resume previous computer activities. We used a within-subject design for this user study. Each participant was asked to complete two different web surfing tasks sequentially during the user study. One task was an experimental condition with ScreenTrack; the other task was a control condition without ScreenTrack. Participants were allowed to use the browsing history from a web browser. The order of the two conditions was assigned randomly per participant, to avoid a learning effect. In each web surfing task, participants were asked to surf specific online shopping websites for purchasing furniture. After each web surfing task, we asked users to reopen the website containing the details of their favorite furniture, for each of several kinds of furniture. We measured the time spent on reopening closed websites for both conditions. (N = 21, within-subject)

The result demonstrated the potential benefit of using ScreenTrack in retrieving a previous working context. In the experimental condition (ScreenTrack), the average time spent retrieving a web page was 27.1 seconds ($\sigma = 26.3$). This was shorter than the control condition (42.9 s, $\sigma = 30.8$) and was statistically significant ($p < 0.005$, See Figure 3).

FUTURE WORK

The experimental results confirmed the effect of ScreenTrack in facilitating the efficient retrieval of a previous working context. In conclusion, ScreenTrack can contribute to enhanced productivity for everyday computer users. In the future, we plan to validate the system with a long-term user study: (1) two in-lab studies, with a week-long interval between studies, to validate the software in a task-resumption scenario; (2) a long-term deployment study, in which participants will be asked to use ScreenTrack in the wild and reflect on the experience; and (3) collecting structured information helping users recover previous working context per task as in [11] .

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