Image and Video Browsing with a Cylindrical 3D Storyboard

Klaus Schoeffmann
Klagenfurt University, Austria
ks@itec.uni-klu.ac.at

Laszlo Boeszoermenyi
Klagenfurt University, Austria
laszlo@itec.uni-klu.ac.at

ABSTRACT
We demonstrate an interactive 3D storyboard that take advantage of 3D graphics in order to overcome certain limitations of conventional 2D storyboards when used for the task of image and video browsing.

Categories and Subject Descriptors
H.3.3 [Information Storage and Retrieval]: Information Search and Retrieval

General Terms
Algorithms, Design, Experimentation, Performance

Keywords
Image Browsing, Video Browsing, Interactive Search

1. INTRODUCTION
A storyboard is a grid-like arrangement of images, typically together with a scrolling function, that allows a user to interactively inspect a set of images. Storyboards have been intensively used for many years in the field of image and video retrieval as they provide a convenient way for users to browse through a collection of images or through the results of a query. While already introduced almost two decades ago [1] they are still used by many state-of-the-art image and video retrieval tools. For example, most systems in the 'Interactive Known Item Search' task of TRECVID 2010 [4] used storyboards for interactive browsing. However, storyboards have also some limitations when browsing a large set of images (or key-frames of shots). For example, users can see only an excerpt of the whole set of images, which makes it difficult to visually compare images located in different parts of the list and to remember images that have been seen already. With many images in the list it is also hard for a user to estimate the total number of images (can be deducted from the size of the scrollbar). In addition, when scrolling through the whole collection without finding the desired image, it is quite frustrating to go back in reverse order or to completely scroll up in order to restart from the beginning. More importantly, with common 2D storyboards there is no convenient way of inspecting the current excerpt of images at high level of detail while keeping remaining images in view.

We present a 3D storyboard that is able to overcome the abovementioned limitations of common 2D storyboards. It uses a cylindrical arrangement of images in 3D space that can be controlled by the user through interaction. This cylindrical storyboard provides both flexibility in presentation and convenient interaction. User studies (to be published) have shown that users do quickly understand this simple interaction model and experience interactive search with it as more relaxing than with a common 2D storyboard, while preserving equal search performance.

2. RELATED WORK
There are not many image browsing and key-frame based video browsing approaches in the literature that take advantage of a real 3D environment. Nevertheless, a comprehensive survey of proposed approaches is out of the scope of this paper due to space limitations. In an early work, Manske [3] proposed to use Cone-Trees as representation of key-frame hierarchies. A side-view has been chosen as perspective enabling to see many transformed key-frames at a glance. A user is able to open and close sub-trees in order to inspect specific segments in more detail and to switch to a front-view perspective based on a selected key-frame. Moreover, a feature for an automatic walk through the whole video-tree in its temporal sequence is supported. Divakaran et al. [2] proposed 3D interfaces to improve content navigation, such as the Squeeze and Fisheye layout. Zheng et al.[6] proposed the VisionGo interface for interactive visual search, which follows a cylindrical presentation pattern but is visualized in 2D. Snoek et al. [5] proposed the CrossBrowser that uses a 3D-like visualization of key-frames, but the interface does not provide a real 3D environment, where the user can move/walk around, zoom in/out, change the viewpoint and perspective a.s.o.

3. CYLINDRICAL 3D STORYBOARD
The storyboard-like presentation of images in an interactive cylindrical 3D arrangement provides several advantages regarding flexibility and interaction possibilities. First of all, it works for a reasonably high and variable number of images. The more images in the collection the larger the radius of the cylinder or the taller the cylinder (i.e. the more "rings"). When presenting several categories of content, we can easily show one cylinder per category and enable the user to walk/zoom to a specific cylinder. Secondly, images in focus are presented at high level of detail while a large
amount of the remaining images is still visible, although at a lower level of detail. Third, when scrolling through the whole set of images until the end of the list is reached, the user can immediately restart from the beginning. Moreover, the user can see a large amount of images in the collection and e.g. quickly zoom to a different location in the cylinder. Last but not least, the cylinder can be automatically rotated, which gives a nice animated presentation of all images without any interaction.

Figure 1: Center view (with 100 images).

Fig. 1 shows an example of our implementation of a cylindrical 3D storyboard where the observers’ viewpoint is inside of the cylinder (in the center). The user may rotate the cylinder in either direction by using the mouse-wheel, which perfectly fits with its affordances. It is also possible to zoom to a specific area in the cylinder (even while rotation) in order to quickly see more details of that area. Furthermore, the user is allowed to change her current position by moving around or to change the direction of view. As this might be too much flexibility for a user, our implementation provides a viewpoint switching feature that enables a user to immediately jump to predefined reasonable viewpoints. Examples of such predefined positions are frontal-view of the cylinder (Fig. 2), right-side view (Fig. 3), left-side view a.s.o. Please note the missing “row” at the bottom back of the cylinder in Fig. 3 that indicates the start/end of the list.

Figure 2: Frontal view (with 300 images).

4. CONCLUSIONS
We have presented a 3D storyboard that resolves certain limitations of conventional 2D storyboards and provides convenient features like: (i) rough overview of all images in a large collection, (ii) quick zoom/jump to different parts in the list that attracted the user’s interest (due to peripheral perception), (iii) continuous scrolling through the list over several times, (iv) animated presentation/rotation. Although not presented in this paper, user studies have shown that users like this concept of interaction and feel more relaxed at search tasks than with a common storyboard.

5. REFERENCES