Hierarchical Video Browsing with a 3D Carousel

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ABSTRACT

We present a video browsing tool that combines advantages of the hierarchical browsing concept with 3D projection and multi-threaded programming in order to provide a convenient and efficient interface. The tool allows for instantaneous hierarchical browsing of video and uses a dynamic approach (i.e., tree of playable video segments instead of static key frames) that also supports parallel playback.

Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentation]: User Interfaces

General Terms

Design, Experimentation, Human Factors.

Keywords

Video Browsing, Video Navigation, Video Exploration

1. INTRODUCTION

Hierarchical browsing is a simple method for video content exploration that was introduced almost two decades ago[6]. A hierarchical video browser decomposes a video into segments that may be decomposed again until a specific level of detail is reached. For example, the top level could show semantic scenes while the second level may show subsegments of a selected scene. Furthermore, the third level could show all shots of a selected subsegment. This hierarchical navigation should facilitate interactive search in videos. However, as already mentioned by Jansen et al. [4] the most challenging part of hierarchical browsing is the visualization that should allow a user to inspect every detail without getting lost. The user study of their 2D VideoTree approach revealed that it is too confusing for novice users, which they lead back to the fact that users weren’t able to see the duration of one node in their tree. I.e., every node was visualized with a static image of the same size regardless of the duration of the corresponding video segment.

We propose a more flexible approach for hierarchical video browsing that takes advantage of 3D graphics and multi-threaded programming in order to provide a novel and flexible interface that allows for both good screen estate utilization and navigation context preservation.

2. RELATED WORK

Many approaches for video browsing have been proposed in the literature, a recent review is given in [7]. However, only a few of them concentrate on hierarchical browsing. Most of them are static approaches that visualize a tree of static images. For example, Guillemot et al. [3] and Jansen et al. [4] propose a key frame based video browser that allows for browsing on three levels (scenes, shots and key frames). A cone-tree representation of key frames has been proposed by Manske [5]. This approach provides already a simple 3D interface for navigation through a hierarchy of key frames. A more dynamic video browsing tool is described in [2]. On each level of the browsing hierarchy a RSVP carousel interface [8] can be used to scroll through the key frames. Another tree-based dynamic video browsing tool is presented in [1], which also supports parallel playback of tree nodes. However, so far no one has concentrated on hierarchical video browsing with 3D graphics support that provides a flexible and intuitive way of content navigation in a video.

3. INTERFACE

The proposed tool uses a 3D visualization for hierarchical video browsing, where every node is represented as a 3D carousel that can be rotated by user interaction with the mouse-wheel. The 3D carousel allows a good utilization of screen estate through 3D projection and provides a flexible and intuitive way of interaction and navigation, which conveniently preserves the navigation context. The position and the radius of the ring is selected according to its parent. Each ring consists of a specific number of entries that contain linear sampled segments of its parent ring. We have chosen linear sampling instead of decomposition into scenes, subscenes, and shots for several reasons: (i) it overcomes the duration problem mentioned in [4], (ii) it allows for instantaneous use with any video file (i.e., without preprocessing), (iii) it supports browsing of single-shot videos that are common in non-professional areas. The user starts browsing with a top level view that shows all available videos in a row. The user can navigate forward and backward in this street-like view (see Fig. 1) with the mouse-wheel and start playback for a specific file with a left mouse click. A right mouse-click will open the first hierarchy level and show a 3D carousel directly below the selected video, consisting of k linearly sampled segments of equal duration (see
Figure 1: Top level – shows all videos in collection

Fig. 2: the missing segment indicates begin/end of the samples). The mouse-wheel can be used to rotate the carousel in either direction in order to focus on a specific segment. A left mouse click starts playback for a segment, whereas parallel playback is also supported. Any further right mouse click on a tree node/segment will open another sub-tree and increase the level of detail until frame level granularity is reached. Moreover, the user may switch between different levels/sub-trees or close a sub-tree. It is also possible to switch to an outer view that provides a good overview of the currently created tree (Fig. 4).

Figure 2: First hierarchy level of selected video ($k = 12$), each node represents 140 secs. of the video

Figure 3: below: second hierarchy level of selected segment ($k = 12$), each node represents approx. 12 secs. of the segment

4. CONCLUSIONS

We have presented a tool that combines advantages of hierarchical content browsing and 3D graphics in order to provide a novel and flexible user interface that is expected to efficiently support users at the task of interactive search in video. In further work we will evaluate its usefulness through several user studies and compare it with other approaches.

5. REFERENCES


