

Detail-on-Demand Hypervideo

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ABSTRACT

We demonstrate the use of detail-on-demand hypervideo in interactive training and video summarization. Detail-on-demand video allows viewers to watch short video segments and to follow hyperlinks to see additional detail. The player for detail-on-demand video displays keyframes indicating what links are available at each point in the video. The Hyper-Hitchcock authoring tool helps users create hypervideo by automatically dividing video into clips that can be combined in a direct manipulation interface. Clips can be grouped into composites and hyperlinks can be placed between clips and composites. A summarization algorithm creates multi-level hypervideo summaries from linear video by automatically selecting clips and placing links between them.

Categories and Subject Descriptors

H.5.1 [Information Interfaces and Presentation]: Multimedia Information Systems – video. H.5.4 [Information Interfaces and Presentation]: Hypertext/Hypermedia – navigation, user issues.

General Terms

Algorithms, Design, Experimentation, Human Factors.

Keywords

Hypervideo, video summarization, link generation, video editing.

1. INTRODUCTION

Detail-on-demand [1] video is a type of hypervideo where a single button press reveals additional material related to the currently playing video. This is similar to certain DVDs that provide links to other video. When a link is active, an icon appears on top of the playing video. The user can push a button to jump to the alternate video. For example, in *The Matrix* and other movies, links take the viewer to video segments explaining how the scene was filmed. Afterwards, the original video continues from where the viewer left off.

Detail-on-demand video is well suited as training video because it allows users to easily navigate to the parts of interest. The top level of video provides an outline of the material, with links to

additional material on the current topic. The user can remain at the top level, or follow a link for more detail. Unlike hierarchical keyframe navigation [2] that allows the user to control playback from a separate window, detail-on-demand video allows the user to navigate between levels of detail while the video is playing.

Detail-on-demand video is also suitable for video summarization. In a typical video summarization, the user must decide a level of detail *a priori* [3]. With detail-on-demand, the user can watch a multi-level video summary that includes summaries of different levels of detail. The user can dynamically control the level of detail by choosing or not choosing links.

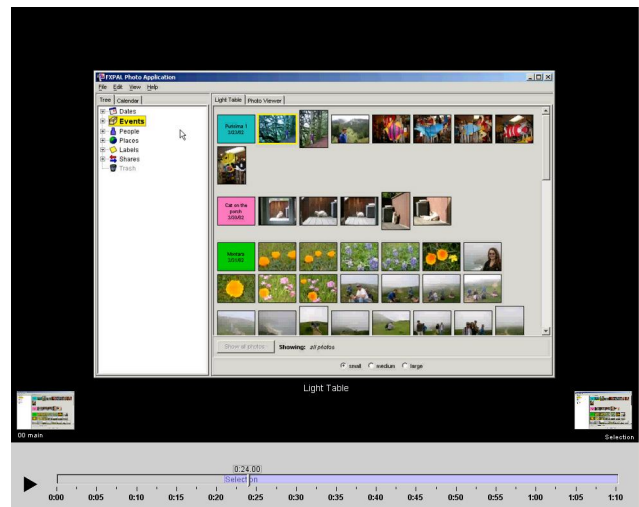


Figure 1. Detail-on-demand hypervideo player.

2. HYPERVIDEO VIEWING

We have developed a player for viewing detail-on-demand video that combines the characteristics of browsing the Web and changing channels on TV. As the viewer watches a video, the player indicates that a link is available from the currently playing clip by showing a keyframe and label for the link in the lower right hand corner of the application, as seen in Figure 1. The timeline of the player also indicates where links are available. It shows the labels for all available links to give the viewer a quick overview of the possible link destinations.

The user follows a link by clicking on the keyframe. When a link is followed, the keyframe animates into the video and the video clip corresponding to the link begins to play. At the same time, another keyframe and label appear in the lower left hand corner of

the application. This keyframe represents the video clip that the link came from, and allows the user to return to it.

There are several possible behaviors when returning from a link. One is that the video plays from the point in time where the link was taken. Another is that the playback is from the start of the clip where the link was taken. This is good in situations where the link video provides detailed information that is a prerequisite for the higher-level video. A third is to begin playback after the end of the source clip. This is good for situations where the link video simply provides a more detailed explanation.

3. HYPERVIDEO AUTHORIZING

The editor for creating detail-on-demand video is called Hyper-Hitchcock. It is a direct manipulation environment that allows users to author sequences of video and create links between the segments. Hyper-Hitchcock has three sections: a selection pane in the upper left to find video clips, an authoring workspace at the bottom, and a tree view of the workspace contents in the upper right (see Figure 2).

To author a detail-on-demand hypervideo, the user drags video clips from the selection pane into the authoring workspace. The length of the clip can be changed by simply resizing its representative keyframe. Links are created between clips using a menu panel, where the link return behavior and label are also specified.

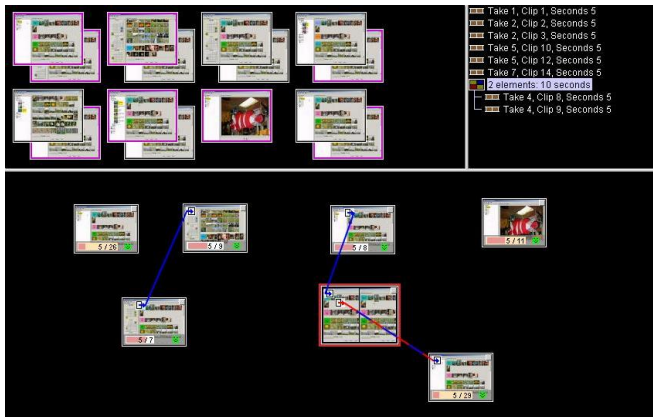


Figure 2. Authoring a hypervideo using Hyper-Hitchcock editor.

An important element of the Hyper-Hitchcock authoring environment is the composite. A composite is a group of video clips that is represented by a mosaic of keyframes for the component clips. The tree view (top-right of Figure 2) provides another view of the composite containment hierarchy. A composite is treated like a single video clip in that it can be dragged and resized in the workspace, and on playback all component clips are played in sequence. However, links can originate from and terminate at both the individual component clips and the whole composite.

4. AUTOMATIC SUMMARIES

Detail-on-demand video is a good format for creating interactive hypervideo summaries. The summaries should be created so that an overview of the material is given at the higher levels, with links to more detail at the lower levels. Viewers can choose what

parts of the video they want to see more detail on and follow links accordingly. The interactive player presents links and their labels, and aids the user in navigating the video. While Hyper-Hitchcock provides an easy-to-use authoring environment, creating detail-on-demand video is still a difficult task. Thus, we support the automatic generation of detail-on-demand summaries of a linear video [4].

The summary is created by first segmenting the video into takes (for un-produced video) and scenes (for produced video). Takes and scenes are then segmented into clips. For the top-level video, the algorithm selects the best clips based either on video quality or a measure of importance. For subsequent levels, the next best clips are taken. The lowest level is the entire video. Links are generated between levels according to the take or scene that the clips belong to. Figure 3 shows part of an automatically generated summary for a home video.

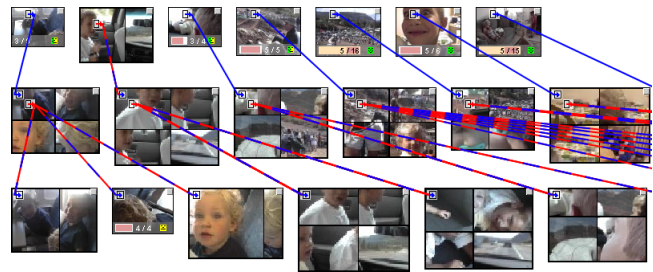


Figure 3. Automatically Generated Summary of Home Video.

5. CONCLUSIONS

The video demonstrates how detail-on-demand video is used in a training video for a digital photo management application. The user can jump to and from sections of interest in the video by simply clicking on representative keyframes in the player. It shows how hypervideo is authored in the Hyper-Hitchcock environment using direct manipulation. Finally, an example of an automatically generated hypervideo summary of a home video is shown.

6. ACKNOWLEDGEMENTS

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7. REFERENCES

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