Volumetric Representation for Interactive Video Editing

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Abstract

Video editing can be a complex and time-consuming task. Commonly an editing session involves the review of a substantial quantity of video material which may be poorly labelled, lengthy compared to the final edited sequence and repetitious. The key problem is the effective visualization of the temporal axis of any given video sample. Here we investigate the potential of volumetric rendering to overcome this issue via a novel user visualisation interface for interactive video editing.

Keywords: Video Visualization, Editing, Volumetric Video

1. Introduction

Digital video editing is commonly performed using an interactive editing interface which allows the operator to review multiple video samples and down select an ordered series of sub-samples to form the final edited sequence. This methodology, albeit digital, has is origins in the editing of analogue cinematic tape-film sequences and the fabled concept of the *"cutting room floor"*. The approach is inherently 2D in the presentation of the video data to the user and relies upon review of the temporal nature of this data using traditional video playback.

Several authors have investigated the use of *"video volumes"*as methods for both video sequence analysis [1] and the post-event visualization of complex event sequences [2]. Here we present the issues around the use of this technique for *interactive* video editing where such real-time processing constraints have received limited attention [1,2].

2. Video Volume Rendering for Interactive Use

Using the established volume rendering approach [3] and building upon the pior work of [2] we develop an interactive interface for video editing using a 3D volumetric visualization for video display (Fig. 1A). The approach of [3] is used to create an efficient and interactive 3D rendering from video by considering each video frame as volume slice akin to an image slice in conventional volume rendering for medical visualization [3]. The key difference between the interactive application of this approach in medical use is the volume of data.

Whilst a medical scan may number hundreds to a few thousand volume slices a video sequence will generally have $25t$ where t is the length of the video in seconds (assuming 25fps video). This creates a data management issue for long sequences (e.g. 25 min. video of colour PAL resolution ≈ 2 Gb data). In order to maintain our goal of interactive volume-based editing we exploit the data redundancy in terms of visual perception of the video content and employ both temporal and spatial sub-sampling. This provides effective volume management within the interactive constraints at the expense of full spatial (image size) and temporal (frame count) resolution. The perceived reduction is quality to the operator is negligible (for content review purposes).

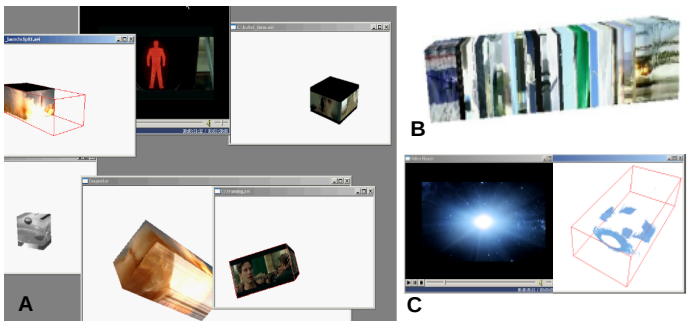
Data management is less of an issue for conventional video editing tools where the on-screen rendering of a video sample is restricted to a single frame at a time rather than all frames as a volumetric (and hence additional temporal axis) view.

3. Video Editing using a Volumetric Editor

Volumetric video editing is implemented within an interactive tool (Fig. 1A) that additionally supports the use of volume playback, 3D volume manipulation (Fig. 1B), common editing operations upon volumes, 2D full quality playback and the use of user-selectable opacity as an additional video volume visualization tool (Fig. 1C). This work used an Intel Core Due 2-core 1.8GHz workstation.

Figure 1: Volumetric video as an video editing interface

A unique temporal axis view of video samples (Fig. 1A) and



edited sequences (Fig. 1B) is presented with user trials reporting high interactive responsiveness and negligible perceived editing limitation due to volume sub-sampling.

5. Conclusions and Further Work

A volumetric representation can be used for effective temporal visualization of video within an editing tool although spatial/temporal sub-sampling must be employed. This has a limited impact on user perception. Future work will look at recent advances in volume rendering for this task.

References

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