Webified Video: Media Conversion from TV Program to Web Content and their Integrated Viewing Method

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ABSTRACT

A method is proposed for viewing broadcast content that converts TV programs into Web content and integrates the results with related information retrieved using local and/or Internet content.

Categories and Subject Descriptors

H.2.4 [**DATABASE MANAGEMENT**]: Systems – *multimedia databases,* H.5.1 [**INFORMATION INTERFACES AND PRESENTATION**]: Multimedia Information Systems – *video.*

General Terms: Algorithms, Management, Documentation, Design.

Keywords: Next-generation storage TV, media conversion, fusion of broadcast and web content, topic segmentation, metadata generation, scene search

1. INTRODUCTION

The recent introduction of hard-disk (HD) recorders for home use has greatly increased the amount of TV programming that can be recorded. The latest HD recorders have a capacity of 600GB, enabling the recording of more than 1070 hours at a certain quality. Since users do not have an unlimited amount of time to view such a great amount of content, there is a great need for functions that enable users to efficiently explore for particular video segments from a huge amount of recorded data, that present an overview of the content in a compact form, and that can provide a digest of the content in a limited amount of time.

In addition, although television programs are created by professional programmers, so that they have excellent quality and are extremely realistic in general, they suffer from time restrictions (on-air time) and an obligation to accommodate popular tastes. That is, programs must serve the public interest and appeal to a mass market. They are thus limited in the amount of detail and scope of information they can provide. The need to access information related to TV programs that provides more detail or presents multiple perspectives will become more and more important as people's lifestyles become more diversified. Thus, there is a great need for functions that can efficiently access and present related information not provided by television programs.

While various viewing methods have been proposed for easy scene exploration from a multitude of videos or for gaining a quick understanding of the content[1][2][3]. They are based on simply summarizing the content. Few are based on augmenting the information presented or consolidating the accessible information by associating the related information in the local and/or Internet content

A method is proposed for viewing broadcast content that converts TV programs into Web content and integrates the results with related information retrieval retrieved using the local and/or Internet content. Conventionally, Web pages are browsed on a PC (active browsing) while TV programs are being watched on TV (passive watching). By converting the programs into Web pages, our method enables programs to be viewed using active browsing. That is, the user can skim over the programs to get an overview of them and can easily explore for particular scenes. By integrating related information, it enables programs to be viewed efficiently with value-added content. In addition, an intuitive, user-friendly browsing interface enables the user to changing the level of detail displayed for the integrated information by zooming. An implemented prototype demonstrates the validity of the approach taken by the proposed method.

2. CONCEPT OF WEBIFIED VIDEO

Webified video provides a new method for viewing broadcast TV programs and is expected to be applied mainly for next-generation storage TV. As shown in figure 1, TV programs are converted into Web content and integrated with related information retrieved using the local and/or Internet content. Conventional TV programs are recorded as a single piece of data without any association with related information, whereas the webified TV programs are structured hierarchically at different levels of detail and hyperlinked to various positions inside the program. Moreover, the webified video is also linked to related information outside the program, enabling the original program to be augmented with value-added content.

Webified video has three major characteristics:

➢ TV programs are converted from broadcast media to Web content, i.e., webification.

➢ The Web content is augmented with related information in the local and/or Internet content.

➢ The browsing interface uses zooming operation.

The webification enhances the browsability of the TV program and provides a basis for augmenting information. The retrieval of related information enables viewing of information not provided

by the original program. The zoom-operation interface enables the user to control the level of detail displayed, providing intuitive and easy-to-understand browsing.

The processing overview of the proposed method is shown in figure 2. First, a TV program is recorded and hierarchically segmented into topics using information in the program's closed captions. The segmentation may be achieved using semantic analysis of video, if necessary. The segmented closed captions and corresponding scenes are grouped into pairs and then presented in the form of a storyboard on the screen. The retrieved related information is integrated at the corresponding positions in the storyboard. The display of the integrated information is controlled using zooming operation, enabling the users to easily explore for specific scenes.
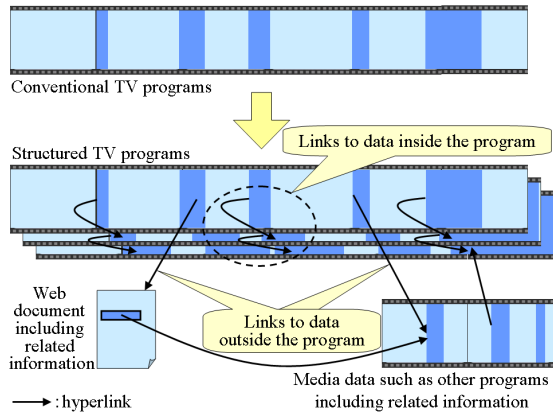

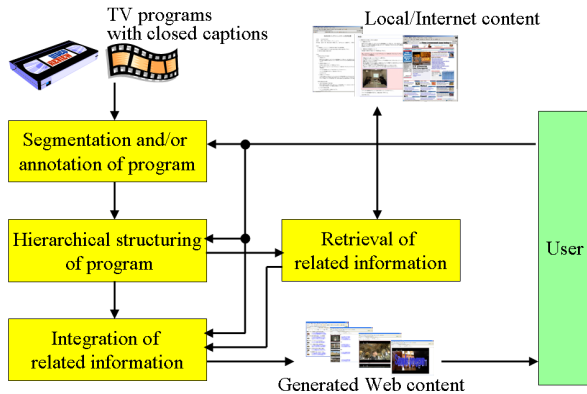**Figure 1. Concept of webified video**

Figure 2. Processing overview of webified video

3. IMPLEMENTATION OF PROTOTYPE

A prototype browser based on the webified video has been implemented. The segmentation uses the closed captions and is based on statistical computation, such as calculation of word distribution[4]. It does not need training data and can be applied to any topic domain. The retrieval of related information uses complementary information retrieval[4], which works by extracting data called topic structures from the information in closed captions, creating several structured queries based on these structures, and performing Web searches using a search engine. An example screen of the implemented prototype is shown in

figure 3. The segmented caption texts and videos are displayed vertically in the form of a storyboard. Hyperlinks to the related information are located below the caption texts, enabling users to access more detailed or broader information than provided by the original program. The transformation of the screen appearance is illustrated in figure 4. By using the zooming feature, the sizes of the displayed images of the segmented scenes can be changed smoothly, and the storyboard can be switched from one to another with a different level of detail. Users can thus seamlessly move back and forth between storyboard screens with different levels of detail and the normal playback screen, enabling them to easily explore for specific scenes. Moreover, hyperlinks to the related information are integrated in each storyboard, so users can efficiently access the related information at different levels of detail or from different perspectives depending on the situation.
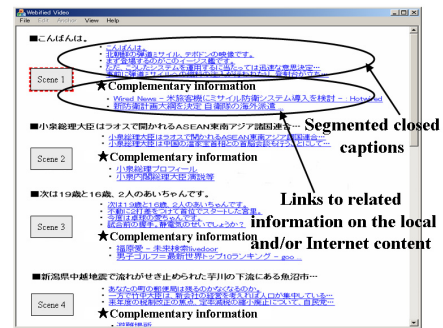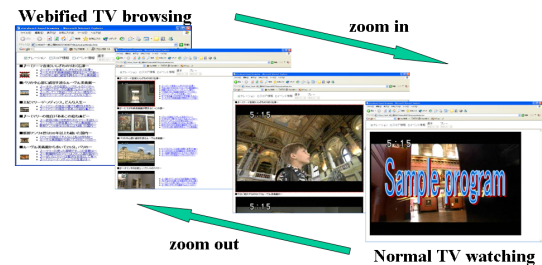

Figure 3. Implementation example of webified video

Figure 4. Transformation of screen appearance by the proposed method

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