H.264 비디오 스트림의 히스토그램 및 헤더 정보를 이용한 장면 전환 검출에 관한 연구

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Changing Scene Detection using Histogram and Header Information of H.264 Video Stream

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요 약

본 논문에서는 H.264 비디오 스트림의 히스토그램 정보와 헤더 정보를 이용한 장면 전환 검출에 관한 연구이다. 비디오 데이터에서 장면의 변화를 검출 하는 가장 일반적인 방법으로 히스토그램을 이용하고 있다. 그러나 히스토그램 정보를 이용하기 위해서는 비디오 데이터를 압축 해제 하여 각각의 장면에 대한 히스토그램 차이를 계산하기 때문에 연산 시간이 많이 소요된다. 반면에 H.264 비디오 헤더 정보를 이용하면 이러한 연산의 과정 없이 실시간 검출이 가능하다. 히스토그램을 이용하여 장면 전환을 검출 하고 헤더 정보를 함께 이용하였을 때 동일한 프리시전 및 리콜을 수행하면서 검색 속도에서 향상을 확인할 수 있었다.

ABSTRACT

A scene changing detection using histogram and header information of H.264 video stream is presented in this paper. The method using histogram is normal to be detect the changing scene. But this technique results in a lot of processing time because video data is compressed and decompressed to video stream and calculated the difference of histogram between scenes on the each frame. The method using H.264 header information is available to detect the scene change at real time without the process of calculation. Histogram and header information is more rapid for scene change detection with being the same performance in precision and recall.

Keywords

Scene changing detection, H.264, histogram difference, header information, macro block, DCT

I Introduction

Today VOD(Video on Demand) and digital video is easier and convenient to utilize them has been much indebted to the popularization of the superhighway internet and the development of video data compression and transmission technology. However, this method makes the effective processing very difficult because these video data needs huge storage generally, and has a unstructured feature to be searching and indexing. In order to solve a defect, there has been studying a lot of the structural building for video data before a few years ago. This structural works are composed of the shot continuing camera action for video data. The shot consists of group that scene is pictured the consistent contents, and episode is organized with various stories. In particular video data unit is based on the shot. Thus, the processing of shot boundary detection automatically is very important and basic work

to develop the system. A boundary detection method of shot has been studying today. The conventional method is used the histogram difference on video images, difference pixels, motion vector analysis, neural network and etc. Miller and Mai uses the edge searching for the various scene changing like a cut, fade, dissolve and wipe. Zabih detects a dissolve, fade and wipe using the pixel distribution to the edge information of decompressed image. Like this, the conventional shot boundary detection method enables to detect the changing scene clearly in comparison with the detection method based on the compressed video data because of using the special value on the frame like histogram. However it take a much time to calculate the operations for detecting of the changing scene. A objects and camera moving fast, and variation of illumination instantaneously, and the gradual scene changing is not sensitive.[1-8] Therefore this paper is proposed the method that is the effective scene changing detection using the histogram difference and scene changing detection method based on compressed video data by the H.264 format.

II Changing Scene Detection

2-1 Shot detection using header

The regulations of H.264 frame has I P B sequence. I frames are coded independence of other frames to be encoded DCT without motion compensation. I frames contain all the information necessary to reconstruct the image. P frames are coded the difference between the current frame and a previous frame I or P, and are encoded DCT in referring motion compensation. P frames contain about half the information of an I frame. B frames are coded the difference of motion compensation based on the preceding and following I or P reference frames as shown in fig. 2-1. B frames contain about one fourth the information of an I frame.

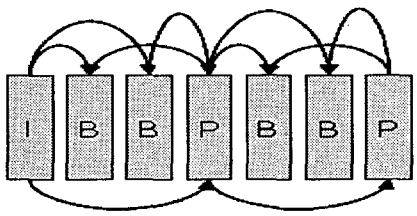

Fig. 2-1 MC of video frames

H.264 video data is processed the encode by macro block unit that enable to be an adequate value depending on the each frame condition. The frame that is a number of macro block θ encoded in intra-mode is quite possibility occurring scene changing, and that frame is detected as the proposing shot of a changing scene. The proposing shot detected θ contains a important information. The proposing shot detection requirement depends on equation (1).

$$MB_{\min} \leq \theta \tag{1}$$

where critical value $MB_{\min}$ is the number of minimum macro block encoded in the intra-mode. That is placed about 40% of the amount of macro block on the assumption.

2-2 Shot detection using histogram

The proposing shot detected in comparison with $MB_{\min}$ for the information of macro block is hardly a absolute criterion. Because in fig. 2-1 macro block is coded in intra mode about 40% over on the reference frame like P frame in terms of motion compensation feature for B frame in occurring a changing scene at the B frame. Fig. 2-2 is shown the processing for the shot boundary detection proposed in this paper. The proposing shot is detected by using macro block of header information on the video stream inputting, whether occurring a shot boundary or not. A shot occurring a changing scene get detected, if the critical value set by using the histogram difference for luminance information Y component detected among the proposing shots, and variance and mean of pixel characterizing value is satisfied. The changing scene is tested, whether it occurs or not, by finding the histogram difference H_d between the preceding detected shot for the detected proposing shot from macro block information. In order to decide the definite shot occurring a changing scene, the proposing shot is tested the histogram difference of the frame being between the reference frame to be used at the motion compensation and the current proposing shot. The critical value of histogram difference depends on the number of macro block θ of the proposing shot to has been testing, and the condition of the critical value applied is substituted in equation (2).

$TH_{\max}$: if $MB_{\max} \leq \theta$
$TH_{\min}$: if $MB_{\min} \leq \theta \leq MB_{\max}$ (2)

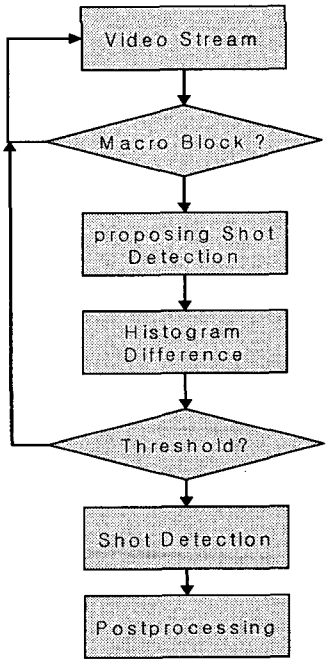

Fig. 2-2. Processing of shot detection

The minimum critical value $MB_{\min}$ gets the number 40% of macro block for the proposing shot, The maximum critical value $MB_{\max}$ gets the number of 70% of macro block for the proposing shot. $TH_{\max}$ is the critical value applied if the number of macro block θ is over $MB_{\max}$, and in order to detect the preceding changing scene occurring, the critical value is given low. And also In order to detect the changing scene similar to the preceding changing scene $TH_{\min}$, the critical value is given high.

III. Evaluation of performance

The test program is realized by c++6.0 to be evaluated the performance of the changing scene method using histogram and header information. H.264 transport stream is used the test stream. video data has 15 fps, and GOP consists of IPPPPIPPPPIPPPP form, and is used a drama 1, 2 and news according to a genre. Fig. 3-1 is shown the detected proposing shot and the detected shot in the changing scene for the drama 1. Though A and B is the continued shot, the proposing shot is detected because the macro block variation is large. And also C and D is the same. Because histogram variation is large in C and D, the changed scene shot D is detected. The number of macro block get standardized the changing scene become occurred is created a variation for I or P frames. That is , In case of the moving variation is occurred much in the continued shot, enables to recognize the number of macro block is increased.

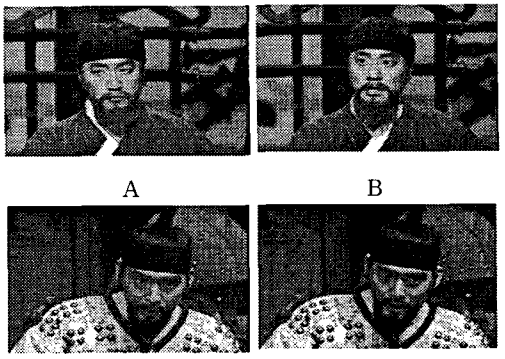

Fig. 3-1 The proposing shot and detected shot of the changed scene

Table 3-1 is shown the experimental results for applied method, T are presented the number of the detected shot, and F are shown the number of an error shot. The histogram method is detected the shot to be corrected in comparison with macro block, but a shot change may not be corrected. The proposed method are detected the shot changing sensitively in contrast to histogram method, the number of a detected error shot is reduced against the macro block method are shown.

Table 3-1 Results of changing scene

Genre (shot/frame)	Histogram difference		Macro block		Proposed method	
	T	F	T	F	T	F
Drama1 (72/4530)	70	11	75	19	75	8
Drama2 (68/4544)	64	14	79	24	72	10
News (86/4786)	72	15	102	37	91	14

IV Conclusion

The changing scene detection using histogram and header information of H.264 format is proposed in this paper. The method are histogram difference is used in the video stream, and the header information is used in the macro block. The method become detected the changing proposing shot using macro block information of video stream, and the changing scene correctly using histogram difference on the proposing shot. The header information makes the proposing shot changing without decoding for video frames. This method leads to desiring scene is able to be searched for faster be reduced the calculations on the video data. And the correct changing scene is realized by using histogram.

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