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RESEARCH ARTICLE

HD VIDEO FADE DETECTION USING 16 LEVEL DCT

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ABSTRACT

In today's world of digital communication, processing of frames of video requires efficient and effective algorithm which requires least processing time and provides suitable selection of scenes like dance, fight, and flash from HD video. This paper deals with processing of HD video frames to determine fade effect where actually darker scenes are located. DCT of 16 level and block based algorithm is employed to reduce frame processing time. Transition from darker to brighter scene and vice a versa is detected using mean of successive frame. Mean of all frames of successive frame are to be compared and from that transition is detected.

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INTRODUCTION

Compression of video means reduce amount of useless frame which are darker and not useful in video. Now a day Digital environment demands video for entertainment, communication, and broadcasting. Now a day's people got lots of information with the use of internet and it's quite good for network to deal with compressed domain compared to uncompressed domain whenever main application is reduce the traffic of network, reduce data transmission rate, reduce the amount of data required in video indexing, reduce invalid information from data transmission. Compression is possible with the help of reduction (redundancy) in digital audio, image, and video data.

In video processing people are generally concerned about the content of frames and types of transition from one frame to another frame or change in the group of frames and that is all about key frame extraction and shot boundary detection. In current generation most of the videos are in compressed domain so it desirable to detect the sharp and gradual transition directly in the compressed domain. (Robert A. Joyce and Bede Liu, 2006) Bisection of video means separating its frame into smaller parts called "shots". Finding starting and ending of shots called Shot Boundary Detection (SBD).

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Shot boundary detection

To find boundary of shot we needs to find transition between shots. There are two types of transition. One is Gradual transition and other is abrupt transition. Abrupt transitions occurs between two consecutive frames means between only two frames we have abrupt transition and that is called "cut". Gradual transition occurs over multiple frames. So for finding gradual transitions care of data of multiple frames has to be taken. This gradual transition includes dissolve, fade in, fade out, flash effect, and wipe effect. In fade there are two types, first in which change from total white picture to black scene called fade out and second in which transition from black scene to total white screen called fade in. Both effects are shown in Fig.1.

Concept of DC image is used for analysis. For example, consider one frame as group of 16*16 blocks, this concept of dividing image in number of block is called macro block concept (Ramin Zabih *et al.,* 1999). After dividing in block one find dc co-efficient of each block and process on it by combining them for desired work. Also D.C image of actual image can be obtained by above mentioned concept. If operation is done directly on original data then high amount of data must be tested. And it takes much high time. So this process becomes time consuming. For removing more time

consumption problem D.C image concept is used. In this, original image is represented as spatially reduced form.
And formulas are applied on data of D.C image. In these algorithms for fade detection, concept of macro block of frame and D.C image are used.

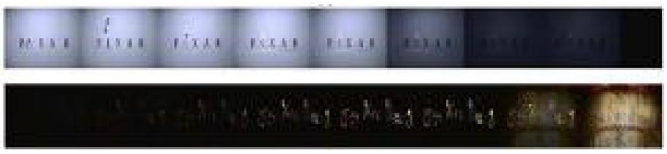

Fig. 1. Gradual transition showing fade out (first picture) and fade in (second picture)

DC Image

In the compressed domain there are various methods to find cut and fade but here paper is concentrated on dc co-efficient and DC image concept. For this DC co-efficient and DC image concept there are some options for calculation of these DC co-efficient value and dc image, for example, consider one frame as group of 16*16 blocks, this concept of dividing image in number of block is called macro block concept (Ramin Zabih *et al.,* 1999). After dividing in block one find dc co-efficient of each block and process on it by combining them for desired work. Macro block is an image compression component and techniques based on discrete cosine transform used on still images and video frames. Also DC image of actual image can be obtained by above mentioned concept. If operation is done directly on original data then high amount of data must be tested. And it takes much high time. So this process becomes time consuming. For removing more time consumption problem DC image concept is used. In this, original image is represented as spatially reduced form. And formulas are applied on data of DC image. In this algorithms for fade and dissolve detection concept of macro block frame and DC image are used. Mean of successive frames are to be plotted for detection of fade in and fade out.

SBD Algorithm

In detection of gradual transition like fade and dissolve, first the calculation of DCT of an image is obtained. In this algorithm, the image (frame) is first divided in the block of size 16*16.after this division in macro block DCT of every block is obtained. So each 16*16 block is having its DCT co-efficient. The definition of finding DCT of image is found by following formula that is applied on each 16*16 block of frame. (Rainer Lien hart)

$$F(u,v)=\frac{Cu}{2}\frac{Cv}{2}\sum_{x=0}^{15}\sum_{y=0}^{15} f(x,y)\cos\left(\frac{[2x+1]u\pi}{16}\right)\cos\left(\frac{[2y+1]v\pi}{16}\right)$$

Where Cu= 1/√2 when u=0
=1 otherwise
Cv= 1/√2 when u=0
=1 otherwise

In each block there will be one DC co-efficient and one or more A.C co-efficient. And by applying various formulas abrupt and gradual transitions can be detected. In this algorithm DC image of current frame is calculated and compared with DC image of next frame or frames. DC image of frame can be calculated by following formula. (Wikipedia.org)

$$DC(i,j)=\frac{1}{256}\sum_{x=0}^{15}\sum_{y=0}^{15} DCT(x,y)$$

DCT(x, y) shows the 256 DCT values of one 16*16 block. And DC (i, j) shows the each component of DC image. After completing the calculation for all blocks one DC image corresponds to one image (frame). Similarly find DC image and its components for all frames for your selected frame range. Now we have DC image and its components. Now find out average (Mean) value of that DC image. That means we have one mean value corresponds to one image (frame). Find out for all frames, if we have selected frame range from 1 to 1000 then we have total 1000 mean value for each frame. Plot graph which shows your selected frame range and mean of each frame. Mean of DC image can be found by following formula

$$\text{Avg. (DC image)} = \frac{\sum DC(i)}{m}$$

In this equation ∑DC (i) is addition of all the values in DC image representation and m represents total number of values in DC image.

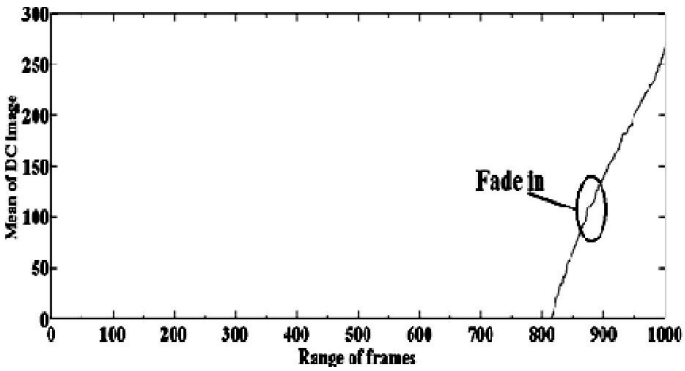

Fig. 2. Fade detection for movie lion king between 1 to 1000 frame range using mean of DC image

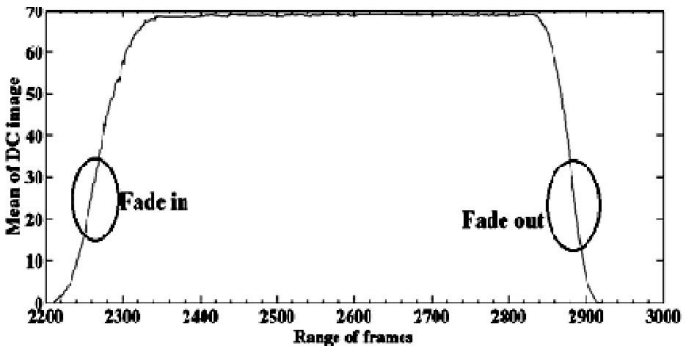

Fig. 3. Fade detection for movie Troy between 2200 to 3000 frame range using mean of DC image

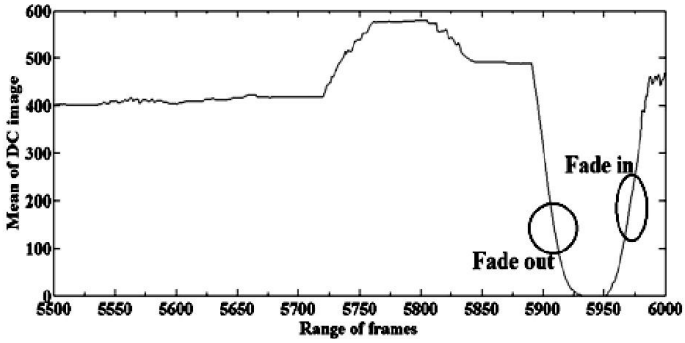

Fig. 4. Fade detection for movie Jodha akbar for from 5500 to 6000

Steps and simulation

Step 1: Find number of frames in given HD video.
Step 2: Take first frame and divide into 16*16 block.
Step 3: Apply DCT to each 16*16 blocks.
Step 4: Find mean of each blocks.
Step 5: Find Overall mean by combining all means.
Step 6: we have one mean corresponds to one frame.
Step 7: Repeat from step 2 to 6 for desired frame range.
Step 8: Plot graph of frame versus mean of DC image

This algorithm is applied to HD video with resolution of 1280*720 frame size. Some of the results are shown here. Simulation is done in MATLAB. Fig.2 shows fade detection using mean of DC image for movie lion king (Animation) for frame range 1 to 1000.here low to high transition (fade in) starts from Frame no 800 onwards. There is now high to low (fade out) transition. So, fade in=1, fade out=0, total fade detection=1.

Fig.3 shows fade detection using mean of DC image for movie Troy for frame range 2200 to 3000.here low to high transition (fade in) starts from Frame no 2200 onwards. There is one high to low (fade out) transition .so fade in=1, fade out=1, total fade detection=2.

Fig.4 shows same result for movie jodha akbar for frame range from 5500 to 6000.fade in starts after frame no.5950 and fade out starts after frame no 5900So, fade in=1, fade out=1, total fade detection=2.

Conclusion and Future work

In this paper detection of gradual transition with help of DCT of DC image is used. Fade in and fade out effects are also determined efficiently. By using same concept, number of darker frames which are inserted between two scene for scene separation can also be find and reduced. Flash effect which determined some explosive scene in video can also be determined.

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