DCT BASED FADE DETECTION OF COLOR VIDEO USING VARIANCE OF DC IMAGE

[1] MR. R.I.TRIVEDI , [2] PROF. M.B. SHAH , [3] PROF. L.K.PATEL

[1]M.E.[Communication Eng.] Student, Department Of Electronics and CommunicationEngineering,G.H.Patel College Of Engineering And Technology, Vallabh Vidhyanagar,Gujarat
[2] Asst.Professor , Department Of Electronics and Communication Engineering, , G.H.Patel College Of Engineering And Technology, Vallabh Vidhyanagar,Gujarat
[3] Lecturer, Department Of E & C Engineering, Government Polytechnic,Gandhinagar

ritrivedi1008@gmail.com, mehulshah@gcet.ac.in,patellaukikkumar@yahoo.com

***ABSTRACT*:** *In current scenario of digital communication video is important parameter for interactive multimedia. Present digital world demands video for communication, broadcasting, military and processing. In recent video technology video segmentation and shot boundary detection are major research area. This paper proposes an algorithm for finding gradual transition like fade for color video using variance of DC image. Concept of DCT of higher level is used for analysis. Detection of fade effect uses calculation of variance of DC image for selected frame range of color video of different type like action movie, animation, wrestling video etc. Results shows that this algorithm is capable of detecting fade regions using variance of DC image very fast.*

Keywords— Shot Boundary Detection (SBD), Key Frame Extraction (KFE), DCT, D.C Image, variance.

I: INTRODUCTION

Now a day Digital environment demands video for entertainment, communication, and broadcasting. Nowadays 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.. 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.

First process starts with video segmentation in which video is divided into smaller parts (sections) called "shots". For finding transition we need to find boundary of shot which is known as Shot Boundary Detection (SBD). These shots are assembly means sequence of frames and from these frames we have to do key frame extraction.

These papers presents an algorithm for detecting fade effect in color video sequences using higher level DCT. During a fade, images have their intensities multiplied by some value X. During a fade-in X increases from 0 to 1, while during a fade out X decreases from 1 to 0.In general in fade in effect that multiplied factor increased value from low to high and same way for fade out that factor decreased from high to low.

Here we have taken RGB video which is converted into gray scale video. DCT is used for compression. After applying DCT on selected frame range video is compressed .it is desirable to find gradual transition in compressed domain [1].

II: SHOT BOUNDARY DETECTION

In order to find gradual transition we need to find starting and ending of shot means we have to find boundary of shot. That is called Shot Boundary Detection.

There are two types of transitions in shot boundary detection.

A. One is abrupt (sharp) transition.
B. Second is gradual 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 black picture to some scene called fade in and second in which transition from scene to total black screen. Both effects are shown in fig.1. This paper is more concentrated on two effects first is fade in/out.

Fig 1 .Fade out and Fade in effect in shot

In gradual transition there are two different section based on effect of transition on pixel values. In one type the values of pixels are changing gradually and simultaneously while in other Group of pixels are affected abruptly [1].

Concept of DC image is used for analysis. For example, consider one frame as group of 8*8 blocks or group of 16*16 blocks, this concept of dividing image in number of block is called macro block concept [2]. 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.

III: 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 [2]. 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 detection concept of macro block frame and DC image are used.

IV: ALGORITHM DESCRIPTION

In detection of gradual transition like fade of colour video, 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 (1) that is applied on each 16*16 block of frame. [3]

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

Where $Cu = 1/\sqrt{2}$ if u = 0

$= 1$ Otherwise

$Cv = 1/\sqrt{2}$ if v = 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 gradual transition can be detected. In this algorithm DC image of current frame is calculated and compared with DC image of next frame or frames. By using following formula (2) DC image of frame can be calculated by following formula. [4]

$$DC(i,j)=\frac{1}{256}\sum_{x=0}^{15}\sum_{y=0}^{15} DCT(x,y) \quad (2)$$

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 frame, 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(3).

$$\text{Avg. (DC image)} = \frac{\sum DC(i)}{m} \quad (3)$$

In this equation $\sum DC(i)$ is addition of all the values in DC image representation and m represents total number of values in DC image. In other algorithm for detection of fade effect, apply following operation. This calculation is of variance of D.C image, and here in this algorithm variation in variance of frames is tracked.

$$\text{Variance (D.C image)} = \overline{m}^{2} - \overline{m^{2}} \quad (4)$$

In the above equation $\overline{m}^{2}$ represents square of mean of D.C image and $\overline{m^{2}}$ represents the mean of squared D.C image means first D.C image is

multiplied with itself and then mean of that squared D.C image is taken.

$$m^2 = m \times m \quad (5)$$

$$\overline{m^2} = \frac{m^2}{m1} \quad (6)$$

m1=total pixels in DC image Summary of algorithm can be written as following steps.

Step 1: Divide colour video into frames.
Step 2: Select frame range for fade detection.
Step 3: Divide frame into 16*16 blocks.
Step 4: Find variance of each block.
Step 5: Find overall variance by combining all blocks.
Step 6: do the same for all frames of selected range.
Step 7: Plot graph of frame range versus variance of DC image.

For detection of fade effect, threshold must be nearer to 0 for deciding if there is fade effect or not, several continuous frames are observed, if it has transition from some value to threshold then there is transition and fade is detected. In the graph of variance when there is transition from higher to lower value of variance then it is treated as fade out effect, and when there is transition from low value to high value then it is treated as fade in effect.

V: SIMULATION AND RESULTS

The algorithms for detecting fade effect are applied on various type of video and implemented on the platform of MATLAB 7.6.0.and obtained various useful results which shows the detection of fade. These results are as follows.

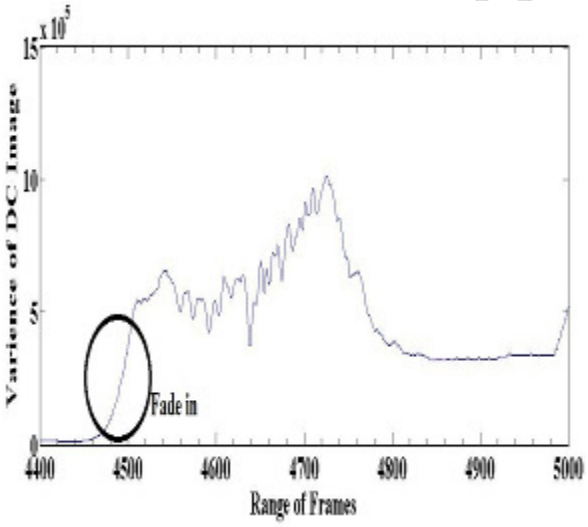

Fig 1 .Fade detection for movie jodha akbar between 4400 to 5000 frame range using variance of DC image.

Fig.1 shows fade detection using variance of DC image for movie jodha akbar for frame range 4400 to 5000.here low to high transition (fade in) starts from Frame no 4450 to 4510.there is now high to low(fade out) transition.so,there is one fade in and no fade out.

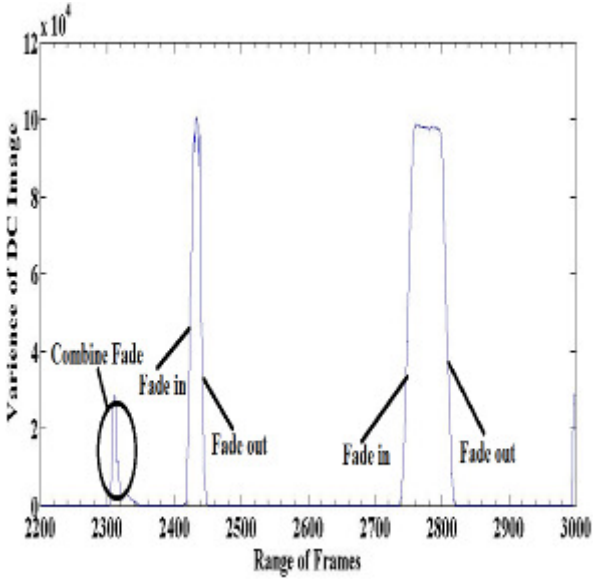

Fig 2.Fade detection for range 2200 to 3000 for movie gangs of wasseypur using variance of DC image.

Fig.2 shows fade detection using variance of DC image for movie gangs of wasseypur for frame range 2200 to 3000.here there are three low to high transition (fade in) and three high to low(fade out) transition.so total 6 fade detection.

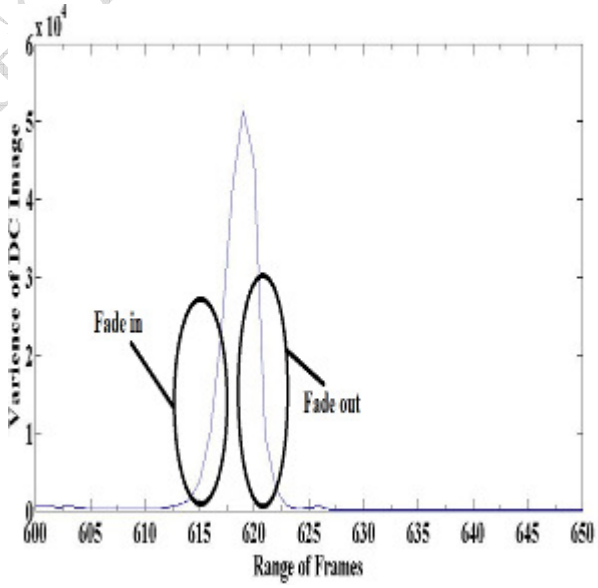

Fig 3.Fade detection for range 600 to 650 for movie gangs of wasseypur using variance of DC image.

Fig.3 shows fade detection using variance of DC image for movie gangs of wasseypur for frame range 600 to 650.here fade in starts from frame no.605 to 618 and fade out starts from frame no.618 to 623.so, there is one fade in and one fade out. Total fade detection is two. So, for this range of frame this video movie contains only one fade in and one fade out which is as shown in figure. in this figure high to low transition is called fade out and low to high transition is called fade in. both are combined called fade effect.

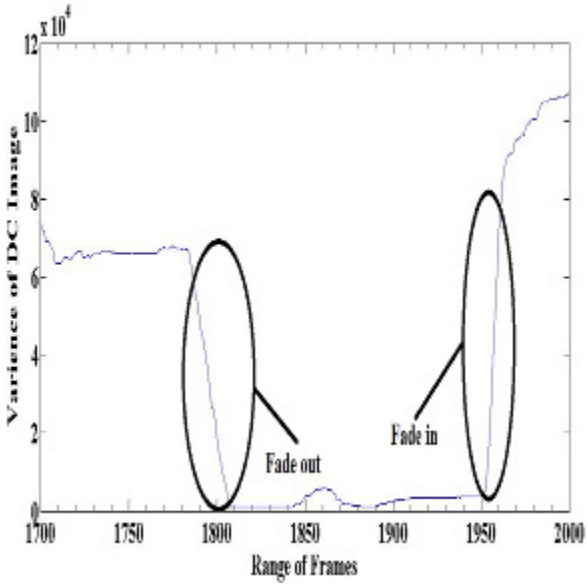

Fig 4.Fade detection for range 1700 to 2000 for movie main hu na using variance of DC image.

Fig.4 shows fade detection using variance of DC image for movie main hu na for frame range 1700 to 2000.here fade in starts from frame no.1950 to 1960 and fade out starts from frame no.1790 to 1810.so, there is one fade in and one fade out. Total fade detection is two.

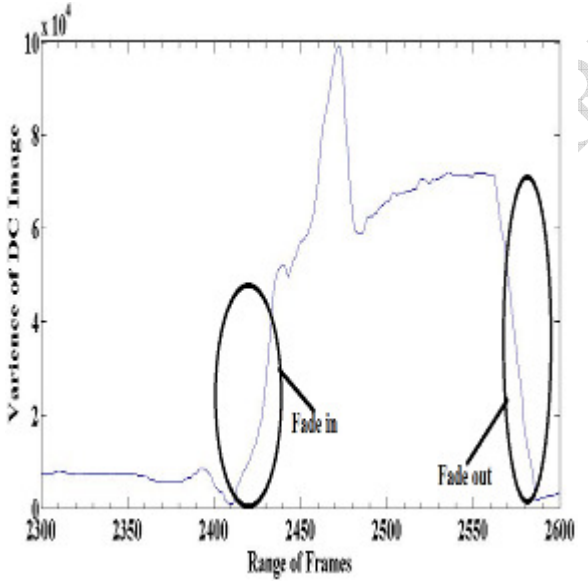

Fig 5.Fade detection for range 2300 to 2600 for movie main hu na using variance of DC image.

Fig.5 shows fade detection using variance of DC image for movie main hu na for frame range 2300 to 2600.here fade in starts from frame no.2410 to 2440 and fade out starts from frame no.2461 to 2598.There is only one high to low transition and one low to high transition. so, there is one fade in and one fade out. Total fade detection is two. so, for this range of frame this video movie contains only one fade in and one fade out which is as shown in figure.

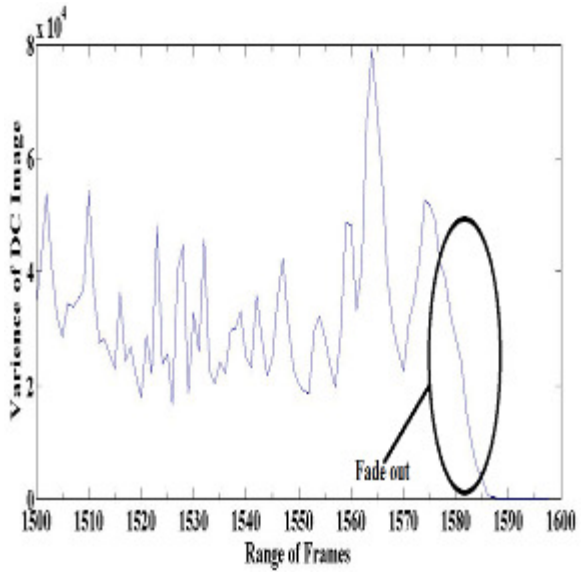

Fig 6.Fade detection for range 1500 to 1600 for movie jodha akbar using variance of DC image.

Fig.6 shows fade detection using variance of DC image for movie jodha akbar for frame range 1500 to 1600.here fade out starts from frame no.1574 to 1587.so, one fade out. Total fade detection is one.

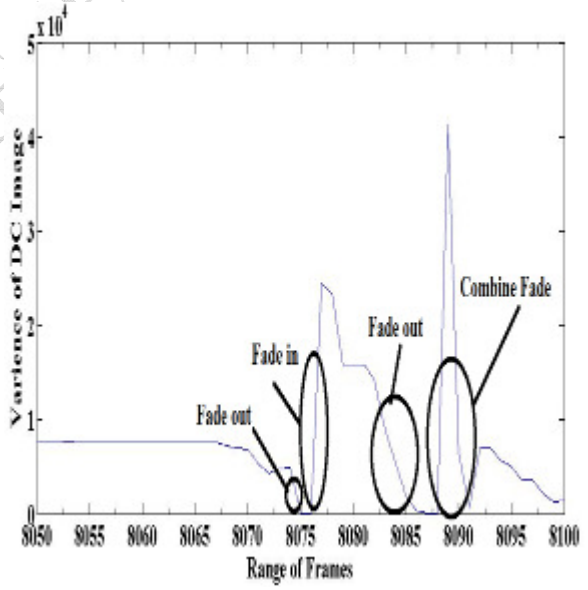

Fig 7.Fade detection for range 8050 to 8100 for movie the lion king using variance of DC image.

Fig.7 shows fade detection using variance of DC image for movie jodha akbar for frame range 8050 to 8100.here there are two low to high transition and three high to low transition .so, there are two fade in and three fade out. Total fade detection is five.

Tabular results at the end shows fade effect detection for various movies using variance of DC image. Here input video is color video and this algorithm is applied for various types of video. Table shows Fade effect detection for list of movies.

VI: PERFORMANCE ANALYSIS CRITERIA

The quality of performance of these algorithms can be observed from various parameters like precision, recall and F1. Recall is ratio of correct detection to correct and missed detection. [5]

$$\text{Recall}=\frac{correct}{correct+missed} \quad (7)$$

Precision is ratio of correct detection to correct and false positives (FP) detection. [5]

$$\text{Precision}=\frac{correct}{correct+falsepositives} \quad (8)$$

To find out overall performance of algorithms that combines both recall and precision one most important parameter used is F1 which is defined as follows [5]

$$\text{F1}=\frac{2\times recall\times precision}{recall+precision} \quad (9)$$

F1 will decide efficiency of both algorithms.

Tabular results shows fade and dissolve effect detection for various movies using mean of DC image. Table shows Fade effect detection for list of movies.

VII: CONCLUSION

In these algorithms the mean of D.C image of frame shows satisfactory results for finding fade effect for colour video. Also use of D.C image concept reduces the processing time because algorithms are operating on the D.C image of frame that is spatially reduced version of original frame. In these algorithm only fade detection are detected efficiently. The quality of work can be seen from table prepared based on algorithm applied on various movies and it is measured with content of recall, precision and F1.

REFERENCES

[1]*Robert A Joyce, Bede Liu, "Temporal segmentation of video using frame and histogram space" ,IEEE Transaction on multimedia,vol.8 no.1,February 2006.*

[2]Boon Lock Yeo Bede Liu, "Rapid scene analysis On compressed video*" IEEE Transaction on circuits And System for video technology, vol.5, no.6, December 1995.*

[3]Vijay Kumar Ganapathi Bhramara Deepthi Chundi "*DCT base motion estimation" available at* http://www1bpt.bridgeport.edu/sed/projects/ cs597/ Sp ring_2004/ vganapat.

[4]Ramin Zabih, Justin Miller, Kevin Mai A feature-Based algorithm for detecting and classifying the Production effects, *Multimedia Systems 7: 119–128 (1999).*

[5] Rainer Lien hart, "Comparison of Automatic shot Boundary Detection Algorithms", *Microcomputer Research Labs, Intel Corporation, Santa Clara, CA 95052- 8819.*

TYPE OF VIDEO	RANGE OF FRAME	FADE IN	FADE OUT	CORRECT	MISSED	RECALL	FALSE POSITIVE	PRECISION	F1
ANIMATION	1-1000	1	0	1	0	1	0	1	1
	3100-3200	1	0	1	0	1	0	1	1
	7800-8000	0	1	1	0	1	0	1	1
	8050-8100	2	3	5	0	1	0	1	1
WRESTLING	1-100	4	5	9	1	0.9	1	0.9	0.9
	160-200	1	1	2	0	1	0	1	1
FIGHT	1-500	1	1	2	0	1	0	1	1
	500-1000	1	1	2	1	0.66	0	1	0.8
	1700-2000	1	1	2	0	1	0	1	1
	2300-2600	1	1	2	0	1	0	1	1
	4900-5000	2	1	3	0	1	0	1	1
	7800-8000	3	3	6	1	0.85	1	0.85	0.8
COMEDY	1500-1600	0	1	1	2	0.33	1	0.4	0.5
	4400-5000	1	0	1	1	0.5	0	1	0.6
	5200-6000	1	2	3	0	1	0	1	1
	6001-6400	0	1	1	1	0.5	1	0.5	0.5
	7900-8400	1	0	1	1	0.5	0	1	0.6
SOCIAL	450-550	1	1	2	0	1	0	1	1
	600-650	1	1	2	0	1	0	1	1
	2200-3000	3	3	6	0	1	0	1	1
	6900-7300	3	3	6	2	0.75	1	0.85	0.8