The International Journal Of Engineering And Science (IJES)
|| Volume || 5 || Issue || 7 || Pages || PP -77-82 || 2016 ||
ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805

Comparative Study of Various Algorithms for Detection of Fades in Video Sequences

Miss. Mikhal Rakshaskar[1], Prof. Salim Chavan[2]
[1]*Department of Electronics Engineering, S B Jain Institute of Technology, Management and Research, Nagpur, Maharashtra, India*
[2]*HOD, Department of Electronics Engineering, S B Jain Institute of Technology, Management and Research, Nagpur, Maharashtra, India*

----------ABSTRACT----------
In the multimedia environment, digital data has gained more importance in daily routine. Large volume of videos such as entertainment video, news video, cartoon video, sports video is accessed by masses to accomplish their different needs. In the field of video processing Shot boundary detection is current research area. Shot boundary detection has vast impact on effective browsing and retrieving, searching of video. It serves as the beginning to construct the content of videos. Video processing technology has crucial job to provide valid information from videos without loss of any information. This paper is a survey of various novel algorithm for detecting fade-in and fade-out used by renowned personals with different methods. This survey also emphasizes on different core concepts underlying the different detection schemes for the most used video transition effect: fades

Keywords: *Video analysis, video segmentation, fade in/ fade out detection, shot boundary detection.*

Date of Submission: 17 May 2016 Date of Accepted: 25 July 2016

I. INTRODUCTION

Presently, due to large amount of capturing devices, storing capacities and processing techniques, huge amount of videos are stored. To analyze this large amount of videos, shot boundaries should be detected.Shot boundary detection is a very useful tool for shot classification and story summarization**.** Transitions are hard to detect, due to camera and/or object motions within a shot**.**For proper retrieval of video, finding shot boundaries is necessary.

Shot boundary transitions are categorized into two type: abrupt transition and gradual transition. Gradual transitions are of three types fades, dissolve and wipe. Fade is a gradual decrease (fade-out) or increase (fade-in) in consecutive frames intensity. Fade is a type of gradual transition. In gradual shot transition intensity of consecutive frames is gradually increase or decrease or one shot is replaced by another shot in gradual manner. It is often known as soft transitions.

Fades are widely used in TV programmes, Cinematic videos, documentary video, cartoon videos etc and their manifestation points a shot or story change**.** This survey tries to show the few core concepts underlying research work on shot boundary detection. It mainly focused on shot boundary detection algorithms dedicated for detecting fade in, fade out. It is not a complete listing of all relevant work but to help engineers and researchers who are new in the field to get a general idea of the current state of shot boundary detection**.**

II. TYPES OF TRANSISTIONS

Types of transition are describes as follows

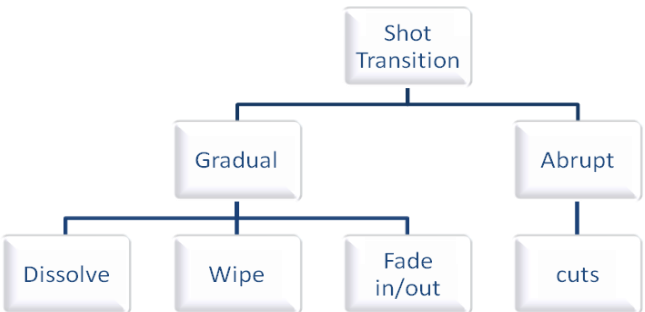

Fig. a Types of transition

Fig. b Hard cuts

Fig b Fade-out effect

Fig. c Fade-in effect

Fig. d Dissolve effect

Fig. e Wipe effect

Above figures shows different transition effect. Hard cut is shown in Fig. 2.Fade is shown in Fig. b and Fig. c and dissolve and wipe is shown in Fig. d and Fig e respectively.

III. LITERATURE REVIEW

3.1 Shot Boundary Detection Based On Mutual Information (MI) and the Joint Entropy (JE)

Zuzana Cˇ ernekova[1] proposed method for detecting shot boundaries and extracting shot transition frames in video sequences with the help of metrics based on information theory. Mutual information and the joint entropy between the frames is a base for shot boundary detection. Experiments are performed on TRECVID2003 video test set. This algorithm can accurately detect both fades and abrupt cuts. An information theory measure gives good results as it utilize inter-frame information in compact way. It can capture satisfactorily the visual content of the shot. Block colour histogram is computationally heavier than global colour histogram but it can be used when one has to give more weightage to some area of image as compared to others.

Recall measure, corresponds to the ratio of correct experimental detections over the number of all true detections is calculated by

$$Recall = \frac{|Det \cap GT|}{|GT|}$$

Where *GT* denote the ground truth,

Det the detected (correct and false) shots cut using our methods.

|*GT*| denotes the cardinality of set *GT*

Precision measure defined as the ratio of correct experimental detections over the number of all experimental detections is calculated by

$$Precision = \frac{|Det \cap GT|}{|Det|}$$

Fade detection with the help of joint entropy cleverly differentiate fades from cuts. Comparison between Combined Color histogram, MI method, and histogram method **is** shown experimentally**.**

3.2 Shot Boundary Detection Based On Luminance and Chrominance Signals

W.A.C. Fernando [2] proposed a novel algorithm for detecting fade-in and fade-out with the help of statistical features that is luminance and chrominance signals. For fade-in and fade-out detection, ratio between incremental changes in the mean of the luminance signal to the chrominance is considered. In the beginning of fade-in process zero variance and at the end of fade-out process variance is zero is considered. Mean of the video signal is given by equation

$$|E[S_{n+1}] - E[S_n]| = \begin{cases} \Delta_n & 0 \le n < L_1 \\ \left[\left(\frac{1}{F}\right).(C - m_{n+1} + (L_1 - n).\Delta_n)\right] & L_1 \le n < (L_1 + F) \\ \Delta_n & (L_1 + F) \le n \le L2 \end{cases} \quad \text{where, } \Delta_n = |m_{n+1} - m_n|.$$

Even in presence of special effects in video sequence algorithm can easily detect fade in and fade-out very efficiently is shown in results. This algorithm is only limited to uncompressed video to detect fade region. It is not helpful of fade detection in compressed video.

3.3 Shot Boundary Detection Based On DCT and DC Image

Ankit Gajera, Ravi Mehta [3] proposed shot boundary detection based on Discrete cosine transform and DC image. Two algorithm presented for fade and dissolve transition detection. An algorithm applied on compressed domain data. For transition detection video is converted in frames and frames are divided into block of size8*8 and calculated DCT of each block. DCT of image is found by formula as given below

$$F(x,y) = \frac{C_u C_v}{2\ 2} \sum_{x=1}^{7} \sum_{y=1}^{7} \cos\frac{(2x+1)u\pi}{16} \sin\frac{(2y+1)v\pi}{16}$$

$$\text{Where } Cu = \begin{cases} \frac{1}{\sqrt{2}} & \text{if } u = 0 \\ 1 & \text{otherwise} \end{cases}$$

$$Cv = \begin{cases} \frac{1}{\sqrt{2}} & \text{if } v = 0 \\ 1 & \text{otherwise} \end{cases}$$

For fade detection mean of DC images is calculated by

$$Avg(DC\ Image) = \frac{\sum DC(i)}{m_1}$$

Where, $\sum DC(i)$ addition of all the values in DC image representation. m1 total number of values in DC image.Threshold is set to zero. Fade is detected if transition from some value to threshold is present. For fade effect F-measure is 0.90 and dissolve effect F-measure is 0.75.Reduction in the quality of original frame due to the use of D.C image.

3.4 Fast Video Shot Boundary Detection Based On SVD And Pattern Matching

In this method author zhe-ming lu and yong shi[4] suggested singular value decomposition (SVD) scheme for feature extraction and removal of non-boundary frames is the main concept for shot boundary detection. Video is segmented with segment length 21.Distance between first and last segment is calculated. After grouping of

consecutive ten segments into one group it is compared with adaptive threshold. Adaptive threshold is calculated by

$$T_L = \mu_L + a\left(1 + \ln\left(\frac{\mu_G}{\mu_L}\right)\right)\sigma_L$$

μG denotes the global mean value of all *d*20*(n)* in the
whole video. μL denotes the local mean value of all *d*20*(n)*in one group,
σL is the local standard deviation in one group.
Candidate segment is refined by comparing with adaptive threshold. Depending on the length of candidate segment gradual and cut transition employed distinguishingly. For each frame refined feature vector is obtained with the help of SVD and inverted triangle pattern matching method is used. Finally with the help of pattern matching method gradual transition is identified.

3.5 Shot Boundary Detection And Classification In Uncompressed MPEG Video Sequences

In this method author [5] suggested that organization of frames are in GOP form. I frames and its DC images had main role to play.Rough scan between successive intra coded I frames had done to detect abrupt and gradual changes and then effective method carried out to detect accurately first and last frame of shot boundary. Difference value between two successive DC images of I frame is given by

$$HD(I_i, I_{i+1}) = \sum_{k=1}^{N} \frac{\left(H_i(k) - H_{i+1}(k)\right)^2}{\left(H_i(k) + H_{i+1}(k)\right)^2}$$

Where I is I frame and H is the histogram of DC image.
Depending on the ratio of forward and backward predictive-coded MBs in all B frames in a *GOP* abrupt change is detected. Based on ratio change of intra-coded MBs in P frames gradual change is detected. The number of intra-coded MBs in P frame reaches peak value at the end of fadeout change during fade-out detection and reaches a peak value at the beginning of fade-in change during fade-in detection.This method has precision rate of 90%.Recall rate of 91.8% and F-measure of 90.9 detection results for gradual changes. Also comparison made with other method in that shown operational speed is fast and it is limited to MPEG uncompressed video sequences**.**

3.6 Shot Boundary Detection For Uncompressed Videos

In this Novel framework Abdul Hameed [6] exploits correlation, maximum histogram difference and running average difference as the classifiers and winner take-all selection scheme is employed. Feature measurement with the help of YUV Histogram Difference, Correlation Coefficient, and Running Average Difference has done. Output of these feature extraction are used as an input to the module. For these three features different threshold is set. Output of threshold selected features became input to winner take all selection schemes if shot is not detected by these features.Shot boundaries cannot be detected only on the basis of YUV Histogram Difference, Correlation Coefficient, and Running Average Difference. So it is a robust method for the videos which has extreme use of camera movements, has same background, motion of dissimilar objects and dull shot transitions such as sports videos.

3.7 Shot Boundary Detection Based On Progressive Bisection Strategy

For gradual shot detection author [7] suggested progressive bisection strategy wisely used adaptive threshold based on inter-frame difference histogram. Because of use of progressive bisection strategy large number of frames has been skipped. Start and mid, right, left frames are compared individually with the threshold to detect the shot boundaries. It increases recall rate. Another New-style Boolean weighting algorithm supports two features affecting visual effect that is color and edge is used to detect shot boundaries. It increases Precision rate. Due to motion in object and camera error rate is quite high.

3.8 Shot Boundary Detection Using Histogram Differences

Author [8] proposed shot detection technique based on Histogram difference in that video is read and extraction of video frames had done. Colour image is converted into gray scale. From each frame removal of illumination is performed. For removal of luminance change 2D Inverse Discrete cosine transform is employed. As luminance change is great obstacle to detect correct shot boundary.
General equation for a 2D DCT is given by

$$F(\mu,\vartheta) = \left(\frac{2}{N}\right)^{\frac{1}{2}} \left(\frac{2}{M}\right)^{\frac{1}{2}} \sum_{i=0}^{N-1}.\sum_{j=0}^{M-1} A(i).A(j).\cos\left[\frac{\mu.\pi(2i+1)}{2.N}\right]$$

Inverse 2D DCT transform is given by

$F^{-1}(u, v)$, i.e. where

$$A(i) = \frac{1}{\sqrt{2}} \quad for\ \xi = 0$$

$$1 \qquad otherwise$$

Where, f(i,j) is the intensity of the pixel in row i and column j. F( ) is the DCT coefficient in row k1 and column k2 of the DCT matrix. Then histogram of each frame is taken and histogram difference of consecutive frames is calculated with the help of Correlation equation given by

$$d(H_1,H_2) = \frac{\sum_I (H1(I)-\overline{H1})(H2(I)-\overline{H2})}{\sqrt{\sum_I (H1(I)-\overline{H1})2 \sum_I (H2(I)-\overline{H2})2}}$$

Where,

$$\bar{H}k = \frac{1}{N}\sum_J \mathrm{Hk}\,(\mathrm{J})$$

Where, N is the total number of histogram bins. H1 and H2 is the histogram of first image and second image. Shot boundary is detected when difference in the frames is higher than the threshold value. This technique has limited to gray scale images (video).

3.9 Shot Boundary Detection based on Dynamic Texture

Peng Taile and Zhang Wenjun[9] proposed algorithm is based on video Dynamic Texture. In this, frames are divided into sub domain and then calculation of average gradient direction of sub domain to form dynamic texture. Lastly dynamic texture of adjacent frames is compared. If there is difference then two shot is detected. This proposed algorithm has downside that how to select δ and ε .Sub-domain size has limitation of frame size that is 13×13. Smaller size increases running time and larger size will not accurately describe the change of gradient of frame. This experiment has done only on colour video data not for gray video data. Average recall rate =92.8% and average precision rate =84.88%.

3.10 Shot boundary detection performance evaluation in presence of motion in video.

Author [10] in this performance evaluation method fades and dissolve effect in presence of motion is calculated on the basis of mean and variance of DC images and threshold. Prior discrete cosine transform is obtained of an image and then each frame is divided into fixed size. For every block DCT division is obtained. DC images of nearby frames is calculated and compared. Fade effect detection is obtained by mean of DC image pointing on either side of minimum value.Dissolve effect detection is obtained by calculating variance of DC image and variation in variance of frames computes mean of DC image of all frames.Result obtained show that for fade in, fade out detection, F-measure is 85% in term of recall and precision and for dissolve detection, F-measure is 90%.

3.11 Shot Boundary Detection Based on SIFT using Divide and Rule scheme

Author [11] proposed Scale Invariant Feature Transform (SIFT) matching algorithm based on SVM. In order to reduce cost and make algorithm fast, shot boundaries which are clearly not shot boundaries skipped from original video.(SIFT) algorithm consist of four stages. Detection of Scale-Space Extreme, Accurate Key point Localization, Orientation Assignment, key point descriptor, extracts distinctive features which act as descriptors. Different features and algorithms are used to capture the different characteristics for various types of shot transitions. Block color histogram difference method is considered for transition frames extraction. Cut transition is detected by number of the SIFT keypoint matching .Wipe is detected in combination of proposed technique and SIFT. Dissolve transition is detected by the similarity score variance between two frames with time distance is shown.Proposed optimization approach compared with another method shown that for different kind of transition. Gradual transition recall rate=70.61%, precision rate=67.38%.

3.12 Shot boundary detection based on Video shot meta-segmentation with multiple criteria.

In this paper author[12] proposed gradual transition technique in which video shot meta segmentation based on multiple criteria and is independent of threshold selection instead SVM classifier is used by learning from the training set to separate hyper plane. It is based on features which are less sensitive to global and local motion**.** Proposed algorithm is also compared with four other algorithms.The detection technique had recall rate =78% and precision rate= 67%. It is time consuming method as it requires more time for training the sets and experimental assessment.

3.13 Shot boundary detection based on entropy and local descriptor

Author [13] proposed an algorithm for shot boundary detection based on entropy and local descriptors. This algorithm mainly helpful for detecting shot boundaries in cinematic movies. It can detect abrupt as well as fade-in, fade-out transition very efficiently. Algorithm considered analysis of change in entropy of the gray scale intensity over consecutive frames as well as correspondence between Speeded up Robust Features over consecutive frames. For testing the shot boundary detection method TRECVID-2007 shot boundary test set, action movies, cartoons, and video lectures is used. SURF feature is not capable in very low and high lighting hence causes lost of edge information **.**Precision of 97.8% and a recall of 99.3% is stated.

IV. CONCLUSION

This survey is just a brief overview of some proposed methods for study in the area of shot boundary detection. To develop shot boundary detection technique in conjunction with the advantageous feature of predefined method robust algorithm is needed which will produce favourably good result compared to existing approaches. Robust algorithm is necessary to withstand camera motion, object motion and illuminance change in effective manner.

ACKNOWLEDGMENTS

Sincere thanks to the guide for supporting in every way and shared valuable knowledge.

REFERENCES

[1]. Zuzana Cˇ ernekova´, Ioannis Pitas, Senior Member, IEEE and Christophoros Nikou Member, IEEE "Information Theory-Based Shot Cut/Fade Detection and Video Summarization".
[2]. W.A.C. Fernando, C.N. Canagarajah, D.R. Bull Centre for Communications Research, Department of Electrical and Electronic Engineering, University of Bristol, 1999 IEEE "Automatic Detection of fade-in and fade-out in video sequences"
[3]. Ankit .C. Gajera, Ravi G. Mehta Electronics and communication department, Shantilal Shah Engg. College, Bhavnagar, Gujarat technological university Gujarat, India. journal of information, knowledge and research in electronics and communication engineering November 12 to October 13 | volume – 02, "Detecting fade and dissolve transition in compressed domain".
[4]. zhe-ming lu and yong shi IEEE transactions on image processing, vol. 22, no. 12, December 2013 in "Fast Video Shot Boundary Detection Based on SVD and Pattern Matching"
[5]. Chunmei Ma1, Jiguo Yu1,2 and Baogui Huang1
[6]. School of Computer Science, Qufu Normal University, Rizhao Shandong, 276826, China
[7]. Key Laboratory for Intelligent Control Technique of Shandong Province, Rizhao, Shandong, 276826, China .IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 5, No 2, September 2012
[8]. " A Rapid and Robust Method for Shot Boundary Detection and Classification in Uncompressed MPEG Video Sequences"
[9]. Abdul Hameed, Department of Computer Science, COMSATS Institute of Information Technology, Islamabad, Pakistan ,2009 International Conference on Emerging Technologies "A Novel Framework of Shot Boundary Detection for uncompressed Videos"
[10]. Yi Huo a; Pengzhou Zhang b; Yanfeng Wang c; Communication University of China, Beijing 100024, China b) New Media Institute, Communication University of China, Beijing 100024, China c) Graduate School, Communication University of China, Beijing China. Journal of Information & Computational Science 11:2 (2014) 391–403 January 20, 2014 "Adaptive threshold video shot boundary detection algorithm based on progressive bisection strategy"
[11]. Ms. Sonal P. Waghmare, Prof A. S. Bhide **,**International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 3, Issue 11, November 2014 ISSN in " Shot Boundary Detection using Histogram Differences"
[12]. Peng Taile School of Communication & Information Engineering, Shanghai University,Shanghai, 200072, China and3 School of Computer Science and Technology, Huaibei Normal University Huaibei, Anhui, 235000, China.
[13]. Zhang Wenjun School of Film and TV Arts & Technology, Shanghai University, Shanghai 200072, China Sensors & Transducers, Vol. 167, Issue 3, March 2014, pp. 104-109 IFSA Sensors & Transducers, Vol. 167, Issue 3, March 2014 "Robust Shot Boundary Detection from Video Using Dynamic Texture"
[14]. Pradip Panchal, Research Scholar,2)Shabbir Merchant, Professor, Department of Electrical Engineering Indian Institute of Technology, Bombay, Powai, Mumbai, India. 2012 1st International Conference on Emerging Technology Trends in Electronics, Communication and Networking "Performance evaluation of fade and dissolve transition shot boundary detection in presence of motion in video."
[15]. Jun Li , Youdong Ding, Yunyu Shi 2) Wei Li
[16]. School of Computer Engineering and Science, Shanghai University, Shanghai, China
[17]. School of Communication and Information Engineering, Shanghai University, Shanghai International Journal of Digital Content Technology and its Applications
[18]. Volume 4, Number 3, June 2010 "A Divide-And-Rule Scheme For Shot Boundary Detection Based on SIFT"
[19]. Efthymia Tsamoura, Vasileios Mezaris, Ioannis Kompatsiaris
[20]. Informatics and Telematics Institute / Centre for Research and Technology Hellas, 1st Km Thermi-Panorama Rd, Thessaloniki 57001, Greece in 2008 IEEE " Video shot meta-segmentation based on multiple criteria for gradual transition detection".
[21]. Junaid Baber, Nitin Afzulpurkar, Matthew N. Dailey, and Maheen Bakhtyar School of Engineering and Technology Asian Institute of Technology Pathumthani, Thailand.in "Shot boundary detection from videos using entropy and local descriptor"