

Survey and Comparative Study of Video Shot Boundary Detection with Different Approaches

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Abstract-- The automatic detection of boundaries of a shot in a stream of video called as shot boundary detection. This is deal with the detection of transitions between the shots in digital video for temporal segmentation. As required it is required for purposes like video content analysis and video browsing and retrieval on content based.

Here interrelated consecutive frames taken continuously by single camera which gives continuous action in time and space. The shots are efficient for indexing and may be the purpose of higher level content analysis as well as the classification. Here, in this paper, the review of different approaches for SBD is made.

Keywords – SBD (shot boundary detection), video retrieval, image retrieval.

I. INTRODUCTION

The shot boundary detection has very big history in the area of video analysis. The earlier image retrieval task was based on its contents, which a user can input with the help of different approaches and algorithms. The earlier work suggested many methodologies for the same, that has its own advantages and disadvantages.

The next stage of image retrieval one can quote is, content based video retrieval and its analysis. This can be achieved with detecting shot boundary of the particular shot of a stream. There are many ways for the mentioned work that are already explained. The findings of hard cuts and gradual transitions has its own importance in this task. As it is known, the detection of shot boundaries gives a base for nearly all video abstraction and high level video segmentation approaches. So to reveal higher level video contents, the shot boundary detection is the basic condition.

The video segmentation, setting length of shots and feature extractions are the terms which need to be implemented here for achieving the desired task.

There can be two criterions: 1) the detection to be excellent for hard cuts as well as gradual transitions. 2) consistent performance for any arbitrary sequence, with very less manual intervene for tuning of the parameters.

The paper is structured with various sections, where the work of different techniques and / or methodologies using different algorithms by different scientists are showcased. The section 2 and 3 deals with the methods proposed for the identified problem. It also deals with the various algorithms, its way of implementation and their achievements. This

section will brief the idea of SBD and the video analysis. Section 4 deals with the results of various earlier methods, along with the comparison of their outcomes. For this comparison different parameters have to be taken into account.

II. PROBLEM ANALYSIS

The frames surrounding the boundary generally shows the significant changes. Detection process is nothing but the recognition of considerable discontinuities in the visual-content flow of a video sequence. Firstly, feature extraction is performed, where the features illustrate various aspects of the visual content of a video. Then the feature variation from frame to frame is to be analyzed, with being the inter-frame distance (skip). The difference in the discontinuity magnitude will be the input to the detector. Then the threshold is formed where this values are compared. If the threshold is exceeded, a shot boundary between frames and is detected. Thus the presence or absence of the shot boundary can be recognized or recorded. This means that a clear separation should exist between discontinuity-value ranges for measurements performed within shots and at shot boundaries.

We actually assume that the visual-content differences between consecutive frames within the same shot are mainly caused by two factors: object/camera motion and lighting changes. In the coming sections, let's see the overview of work done to take the solution for the above causes which may give the false result.

In the following sections we will examine the work done for the desired task with different approaches.

III. EARLIER WORK DONE FOR SOLVING IDENTIFIED PROBLEMS

Developing techniques for detecting shot boundaries in a video has been the subject of sizeable research over the last decade. In this section, we give an overview of the relevant literature. The overview concentrates, on one hand, on the capability of features and metrics to reduce the motion influence on discontinuity values. On the other hand, it investigates existing approaches to shot-boundary detection, involving the threshold specification, treatment of different boundary types, and usage of additional and a priori information to improve the detection performance.

The shot boundary detection is a wide area and lot of work has been done over so far. The purpose and the implementation techniques will be mentioned here with their result analysis. As it can be next step of an image analysis, that is, the retrieval of a particular frame of a shot from the video

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stream. The CBIR given with precise outcome for an image which was desired to come as a result from the huge database. For this the feature extraction and the formation of threshold which may depend on the algorithm and / or procedure used.

The same can be done for a video analysis, the feature extraction has to be the basic task. The segmented video can be the platform for this, from which the frame wise feature extraction is required. The same to be inputted to the detector, which then compared with the threshold value. And its magnitude will decide the presence or absence of shot boundary.

Alan Hanjalic [8], et al presented the detail review on shot boundary detection for various approaches.

Here it is suggested to make use of shot-length distribution, visual discontinuity pattern at shot boundaries and characteristics temporal changes of visual features around a boundary. Also this quoted advantages as, robust and sequence independent performance. Also the simultaneous detection of different types of shot boundary detection.

Different steps are mentioned to carry out for the above mentioned included, detector development, hypothesis, false detection, missed detection and the likelihood function [8].

Nitin J. Janwe , Kishor K. Bhoyar [7] et al, suggested the technique for above mentioned based on JND color histogram, which is just noticeable histogram. In this, the two consecutive frames are to be chosen, and the histogram is computed. Then for the pair of histogram the degree of similarity is computed. This can be an indicator, and is adaptive threshold based on sliding window. The performance will be evaluated on precision, recall and the combined measures. JND is the term where colors are defined based on vector similarity. The degree of similarity is computed as,

$$Simi_{JND(x,y)} = \sum_{i=1}^c \min(hx(i), hy(i))$$

Hx,hy = JND histogram for x,y frames

C=no. of color bins in histogram

Simi_{JND(x,y)} gives total pixel count which is present in both frames under comparison

Weidong Yan & Hongwei She & Zhanbin Yuan [6], presented the approach as robust registration of remote sensing image based on SURF and KCCA. In this, firstly the putative set of correspondence based on distance between SURF features descriptors. Then the spatial relationship of matched feature is accomplished based on KCCA. After this the influence function is established by the spatial relationship to figure out the false matches.

SURF – it encodes the distribution of pixel intensities in the neighborhood of the detected rather than the row pixel intensities.

As this is based on four major stages, they are, scale space feature extraction based in a fast hessian detector, extracting the localization of key points, orientation assignment and key point descriptor assignment. Here with this the proposed approach focused on following few steps,

- i) Initial feature matching with SURF.
- ii) Criterion of false match rejection.
- iii) Influence function
- iv) False match rejection procedure.

Youxian Zheng, Yuan Zhang [2], et al, abrupt shot boundary detection with combined features and SVM. In this, the issues like of large objects / camera movements and flash lights, global features are inadequate to detect the abrupt shot boundaries. Therefore, is suggested, the combined features of local and global features can be more robust.

In combine block HSV histograms and SURF to distinguish frames and adopt proposed ensemble undersampling algorithm to process imbalanced data and uses SVM to identify abrupt shot boundaries automatically.

- The frame work proposed as, i) global feature extraction
- ii) local feature extraction
- iii) similarity measurement
- iv) abrupt shot boundary identification

Rachida Hannane, Abdessamad Elboushaki, Karim Afdel, P. Naghabhushan, Mohammed Javed [5], et al, presented work on the above mentioned as an efficient method for video shot boundary detection and key frame extraction using SIFT-point distribution histogram. Here the combination of local and global features is made. In the subsequent steps, using the distance of SIFT-PDH of consecutive frames and adaptive threshold video shot boundary is detected. The difference between each two consecutive frames of the video, difference comparison, comparing SIFT-PDHs. The proposed system for this is as follows,

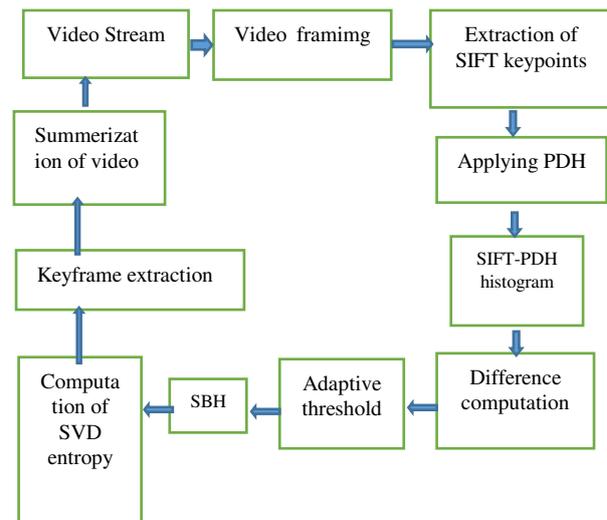


Fig. 1. Proposed approach for SIFT-PDH

Jiyun Fan & Shangbo Zhou1, Muhammad Abubakar Siddique [3], explained Fuzzy color distribution chart -based shot boundary detection, which is used for describing the spatial distribution of colors and avoid the influences of noise, slight illumination and insertions such as words and logos. And based on FCDC one can distinguish the gradual transitions if there are quickly moving objects in the frames. This also helps to suppress some defects of shot boundary detection that remained unsolved somewhere somehow. The model proposed for the same [2] as follows,

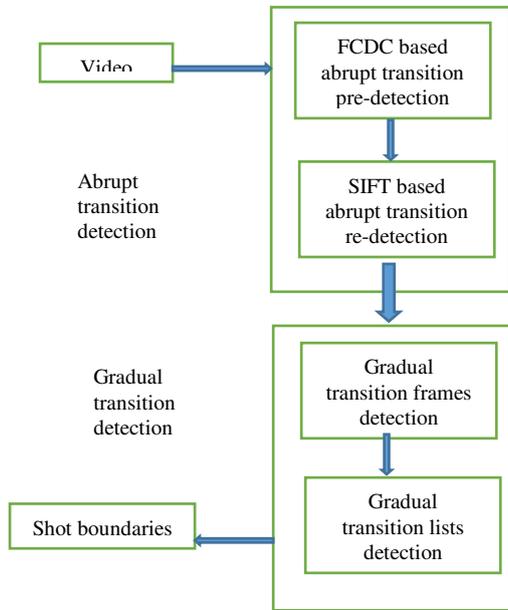


Fig. 2. Proposed approach of FCDC

The sliding window is used to save the running time and the HSV fuzzy color distribution chart (FCDC) is also used.

Ravi Mishra [4] in explained both Non-real time video shot boundary detection and Real time video shot boundary detection using Dual Tree Complex Wavelet Transform. Here it is proposed a method in conjunction with the advantageous feature of predefined method. For non-real time videos, here the use of DTWT and nodal analysis concept is made for efficient result and better accuracy. The method used here for frame difference calculation i.e., histogram difference and standard deviation of pixel intensities using contrast change parameters showed high accuracy in detecting abrupt and gradual transition respectively.

Eman Hato, Matheel E. Abdulmunem [1], et al presented a work on SBD using SURF features. This proposed approach consist of feature extraction, features matching, and similarity calculation. The (SURF) features are extracted from half number of frames of video file to reduce the execution time. The features matching is performed between two features vectors to determine which is the nearest neighbors between features vectors using the distance function. The similarity is computed using a number of matching features and then compared to a predefined global threshold for the abrupt shot detection.

IV. COMPARATIVE RESULT ANALYSIS

From the research work with the discussed approach [8], the result showcased given a high precision and recall obtained using proposed detector. While being 100% for hard cuts, precision and recall for dissolve detection were obtained as 79% and 83%, respectively. Also for dissolve detection, a detection rate of 83% and a false alarm rate of 22% is mentioned.

The experimental results of the method [7] for abrupt cut detection on test data set shows shows detection performance of cut evaluated on Precision, Recall and Combined measure-F1. It is observed that, Recall computes to 95.14 %, Precision is 95.48 % and F1 is 95.22 %. For the detection of dissolves and fades, Recall percentage is 86.48, Precision is

90.93 % and F1 is 87.89 % .

The research done at SURF and KCCA method [6], also given the robust and accurate results.

The approach of combined features and SVM for SBD [2] given a conclusion that it removes outliers of large object/camera movements and flash lights, making this scheme more robust and accurate.

In the method of Dual tree complex wavelet transform [4], the use of frame difference calculation i.e., histogram difference and standard deviation of pixel intensities using contrast change parameters is made which shows high accuracy in detecting abrupt and gradual transition respectively

The algorithm and method described based on SIFT-PDH [5] concluded with efficient detection of shot boundaries for different types of videos, even under different levels of illumination, motion effects and camera as it can also summarize the original video in a concise manner with minimum size and less computational complexity.

CONCLUSION

The survey made in this paper described many such approaches which made the task of SBD very efficient, as far as its accuracy, computation times, running times and solving several issues related with external factor for a video during its formation, such as camera movements, lights, etc.

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REFERENCES

- [1] Eman Hato, Matheel E. Abdulmunem, "Fast Algorithm for Video Shot Boundary Detection Using SURF features", 2019 2nd Scientific Conference of Computer Sciences (SCCS), University of Technology – Iraq
- [2] Youxian Zheng, Yuan Zhang, "Abrupt Shot Boundary Detection With Combined Features and SVM", 2016 2nd IEEE International Conference on Computer and Communications.
- [3] Jiyun Fan & Shangbo Zhou1, Muhammad Abubakar Siddique, "Fuzzy color distribution chart -based shot boundary detection", *Multimed Tools Appl* DOI 10.1007/s11042-016-3604-y
- [4] Ravi Mishra, Dr. S. K. Singhai, Dr. Monisha Sharma, "Real Time And Non Real Time Video Shot Boundary Detection Using Dual Tree Complex Wavelet Transform", 2015 International Conference on Industrial Instrumentation and Control (IIC) College of Engineering Pune, India. May 28-30, 2015
- [5] Rachida Hannane, Abdessamad Elboushaki, Karim Afdel, P. Naghabhushan, Mohammed Javed, "An efficient method for video shot boundary detection and keyframe extraction using SIFT-point distribution histogram", *Int J Multimed Info Retr* DOI 10.1007/s13735-016-0095-6.
- [6] Weidong Yan & Hongwei She & Zhanbin Yuan, "Robust Registration of Remote Sensing Image Based on SURF and KCCA", *J Indian Soc Remote Sens* DOI 10.1007/s12524-013-0324-x
- [7] Nitin J. Janwe , Kishor K. Bhojar, "Video Shot Boundary Detection Based on JND Color Histogram", *Proceedings of the 2013 IEEE Second International Conference on Image Information Processing (ICIIP-2013)*.
- [8] Alan Hanjalic, " Shot-Boundary Detection: Unraveled and Resolved?" *IEEE Transactions On Circuits And Systems For Video Technology*, Vol. 12, No. 2, February 2002.