SHOT BOUNDARY DETECTION: AN IMPROVED ALGORITHM

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ABSTRACT
This paper explores the problem of video shot boundary detection and examines a novel shot boundary detection algorithm by using explicit QR-algorithm with shifts and applying bhattacharya co-efficients. Bhattacharrya coefficient which is a measure of the amount of overlap between two statistical samples or populations. Specifically, it is an attempt to attend the challenges of detecting gradual shots and extracting appropriate spatiotemporal features that affect the ability of algorithms to efficiently detect shot boundaries. The algorithm extracts a block-wise probability function that illustrates the probability of video frames to be in shot transitions. The probability function has abrupt changes in hard cut transitions, and semi-Gaussian behavior in gradual transitions. The algorithm detects these transitions by analyzing the probability function. Finally, we will report the results of the experiments using video of 15 minutes this algorithm may provide accurate assessments for hard cut and gradual shot boundary detection. The proposed algorithm will give better results than the Video Shot Boundary Detection Using QR-Decomposition and Gaussian Transition Detection [1].

Key words: QR with shifts, block, hardcut, gradual transition, threshold

1. INTRODUCTION
The advances in digital video technology and the ever increasing availability of computing resources have resulted in the last few years in an explosion of digital video data, especially on the Internet. However, the increasing availability of digital video has not been accompanied by an increase in its accessibility. This is due to the nature of video data, which is unsuitable for traditional forms of data access, indexing, search and retrieval, which are either text-based or based on the query-by-example paradigm. Therefore, techniques have been sought that organize video data into more compact forms or extract semantically meaningful information. Video applications, currently expanding at a considerable rate, have initiated an increasing demand for innovative technologies and tools to index, browse, and retrieve video data efficiently. Developed for automatic indexing, retrieval, and management of video, content-based video retrieval has become the subject of much research throughout the last decade [2,3]. Structural analysis of video is a fundamental stage in analyzing video content and developing techniques for efficient access, classification, retrieval, and browsing of vast video databases. Among the several structural levels (i.e.frame, shot, scene, etc.), shot level organization has been deemed suitable for browsing and content-based retrieval[4].

2. RELATED WORKS
In this section, we study some existing techniques concerning video shot transition detection and some common approaches for shot detection, particularly for those works that are connected with our proposed approach. SBD, also known as temporal video segmentation, is the process of detecting the transitions between the adjoining shots [9]. Beginning in the early 1990s, several organizations had already initiated projects such as QBIC [10], Columbia Video (object-oriented search engine) [11] and the Virage [12], that have linked to digital video libraries to intelligently manipulate video content. During that period, research attempts were mainly centered on video processing, such as SBD, video retrieval, video object detection, and video summarization. In recent times, SBD has become a more efficient component for all video retrieval and video summarization systems. There are numerous approaches have been put forward for the detection of shot boundaries, and have produced highly acceptable results. After studying the literature regarding these methods, we found that these methods could be classified into two categories: compressed domain methods and uncompressed domain methods.

In compressed domain methods, the only data obtained from the videos are those directly accessible from the MPEG streams that are Discrete Cosine Transform (DCT) coefficients, motion vectors, and prediction directions for each block. Without the decoding process the computation will be much faster, but less reliable, particularly when high motion is at work. An example is the work of Pei and Chou [13]. Early research on shot detection was primarily centered on uncompressed domain methods. These methods are compared in [4, 15]. Many of these methods have been put forward for use in the detection of abrupt transitions. In some of these approaches, an abrupt transition is identified when a particular difference measure between successive frames surpasses a threshold. The difference measure is calculated at either a pixel level or the block level. Considering the
limitation of pixel difference algorithms (high sensitivity to object and camera motions), a lot of researchers recommended using some alternative measures that were on basis of global information, such as intensity histograms or color histograms [15–18]. The standard color histogram-based algorithm and its variations are now vastly employed to identify abrupt transitions. The authors of [19] have studied the RGB color histograms for shot transition detection. They have applied the singular value decomposition to analyze the histograms. Histograms do not clearly display the image difference produced due to large camera motion, and therefore are unable to distinguish between smooth camera motion/parameter changes and gradual scene transitions. Using more intricate features, such as image edges, histograms, or motion vectors makes the situation better; it will alleviate but not resolve this problem [21]. The authors of [5] have developed a solution to this issue by calculating information changes between adjoining images, quantized by mutual information (MI) in gray-scale areas of the images. This results in an approach with much more complex computations. Also, an efficient approach that is based on measures of information theory has been proposed in [7]. The disadvantage of this method is that it is susceptible to large camera panning and zooming as well as flashlights. Hence, the principal challenge in gradual transition detection is that the comparison which is on the basis of spatial features, such as color histogram, edge, motion vectors, is not suitable without modeling the temporal relation between frames. In order to overcome this problem, several approaches explore large windows of frames. Contrary to popular belief, these methods are not easy to do because the EURASIP Journal on Advances in Signal Processing 3 variation between two different shots can be mixed up with the object motion variation in those shots.

In [22], Vasconcelos and Lippman evolved a Bayesian formulation for the problem and expanded the standard thresholding model in an adaptive and intuitive way. In [25], Xu et al. propose an SBD method for news video based on object segmentation and tracking. They combine three main techniques: partitioned histogram comparison, object segmentation, and tracking based on wavelet analysis. The authors of [26] have built a neural network classifier for detecting transitions. The classifier is trained with a dissolve synthesizer that produces synthetic dissolves. The algorithm applies to contrast-based features, and color based features, and has provided satisfactory results in comparison with standard techniques that are based on edge change ratios. In [28], the authors suggested co histograms to be used for video analysis, which is a statistic graph created by counting the matching pixel pairs of two images. However, their algorithm is insensitive to camera zooming. We suggest the QR-with shift threshold based SBD demonstrate its efficiency through a theoretical and practical analysis. As opposed to the aforementioned approaches, we hope our solution is capable of detecting various types of gradual shots and is insensitive to camera zooming and motion, object motions, and illumination changes. Finally, we test our algorithm on the video file.

3. PROPOSED ALGORITHM: AN IMPROVED SHOT BOUNDARY DETECTION

Our new algorithm is based on the framework of the threshold selection that is able to detect both abrupt and gradual transition, such as dissolve and wipe, in video. To partition the video, we should first define suitable metrics, so that a shot boundary is declared whenever that metric exceeds a given threshold. The algorithm extracts a block-wise probability function that illustrates the probability of video frames to be in shot transitions. The probability function has abrupt changes in hard cut transitions, and semi-Gaussian behavior in gradual transitions. The algorithm detects these transitions by analyzing the probability function. We use histogram difference as the first metric in our algorithm because histogram is less sensitive to object motion than other metrics, shown in equation (1). Histogram is converted to vector, then QR algorithm & Bhattacharya coefficients are applied to detect these transitions by analyzing the probability function.

Algorithm & Fig 3.1 Flowchart explains Steps to find hardcut & gradual transition of SBD

```plaintext
1. Di=Hi(j)-Hi-1(j)
2. Histograms are converted to vector
3. Apply QR with shift, then use Bhattacharya coefficients to relate the images
4. Based on probability and threshold selection classify it as hardcut / gradual transition
5. [Q,R]=qr(V);
   d=bhattacharyya(Q,R);
   val=(1-R(1))*c;
   if p>HurdCuttThreshold
     fprintf(‘HurdCuttThreshold ‘);
   else
     if p>GradualTransitionThreshold
       fprintf(‘GradualTransitionThreshold ‘);
```

Above code shows how to implement the proposed algorithm for shot boundary detection.
CONCLUSION AND FUTURE WORK
This paper has presented an effective shot detection algorithm, which focus on threshold selection. The main contributions of the presented work are to build two models and an adaptive threshold selection algorithm. However, the automatic video partition is still a very challenging research problem especially for detecting gradual transitions. Further work is still needed.

REFERENCES
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