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Detection of Abrupt and Gradual Transitions in Digital Video Sequences

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In this paper, we propose a new approach for the detection and identification of shot boundaries using the HSV dominant color features and Least Square Approximation method. We have used chi-square test metric and statistical based threshold calculation algorithm for cut identification. After detection of cuts, the remaining frames are extracted and are used for gradual transition detection process. In order to calculate the similarity between the extracted frames, block based Yakimovsky Likelihood Ratio (YLR) test metric is used. To reduce the impact of motion influences in the detection process, a novel idea, Least Square Polynomial Approximation is used that performs approximation of the discontinuity value obtained from YLR test. Later, the gradual transition identification algorithm is employed that identifies the fade and dissolve regions correctly. Experiments are carried out on various video data sets taken from TRECVid and publically available data sets. Test results indicate that better precision and recall are achieved for the test videos by our proposed method than the other existing methods.

Keywords : Shot Boundary Detection, Dominant Color Feature, Similarity Metric.

1. INTRODUCTION

In the recent years, there is an amazing growth in the amount of digital video data. This growth has created new challenges for storage and access of video data. The basic step to manage these large video data is the segmentation of these video sequences into its basic components, the shots. A shot is a series of inter related consecutive frames captured by a single camera for a series of time and space. A video sequence normally contains large number of shots, which are connected to each other by using different video editing procedures.

There are two different shot transition categories of video editing namely abrupt and gradual transitions. The process of identifying the different shot transition within a video is known as video shot detection or shot based video segmentation or video partitioning. This detection plays an imperative role in video analysis, video indexing, video summarization, systematizing the Digital Video Library as a networked Internet application set aside for storing, categorizing, retrieving and uni-casting the video sequences. An abrupt shot transition is a sudden change from one video shot to another and is simply referred as hard cuts or cuts. A soft cut represents a gradual transition between two shots which means a sequence of video frames that belongs to the first and the second video shots. The shots are assembled during the editing phases using varieties of techniques like fade in, fade out, dissolve and wipe and these are considered as gradual transition effects in the video sequences.

The key issues of the shot boundary detection techniques are (i) choice of the feature for representation of video frames (ii) choice of similarity / distance metrics (iii) algorithm for detecting abrupt and gradual transitions. The visual content difference between consecutive frames within the same shot is mainly caused by two factors: motion influence and lighting changes. The easiest way of obtaining good discrimination is to use features and metrics that are insensitive to motion and lighting

for twin comparison method. For fade and dissolve detection, our method yields 99.3 and 89.4, respectively. On the whole for all transition our method provides 97 percent which is better than other methods discussed so far.

5. CONCLUSIONS

We propose a new method for detecting abrupt cuts and gradual transition like fade and dissolve using the dominant color feature, chi-square test for cut detection and block based Yakimovsky Likelihood ratio test for gradual transition detection. For gradual transition identification process, a novel method, least square polynomial approximation is employed which yields better performance. Experiments illustrate that the proposed method can efficiently identify the boundary regions like cut, fade and dissolve. The accuracy of our approach was tabulated and its performance is comparatively higher than other methods.

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Table 5
Comparative results for All Transitions

Methods All transition	Precision (P)	Recall (V)	 (F1)
Proposed method	97.01	97.01	97.0
Edge Change ratio	85.8	83.9	84.9
Information Theory	95.04	71.7	81.7
Twin comparison	67.9	38.5	49.1
Localized edge blocks	89.4	54.01	67.3

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