Efficient Video Copy Detection Using Simple and Effective Extraction of Color Features

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Abstract. In the present Multimedia era, the exponential growth of illegal videos and huge piracy issues increased the importance of Content Based video Copy Detection (CBCD) techniques. CBCD systems require compact and computationally efficient descriptors for detecting video copies. In this paper, we propose a simple and efficient video signature scheme using Dominant Color Descriptors of MPEG-7 standard in order to implement the proposed CBCD task. Experimental results show that the proposed approach yields better detection rates when compared to that of existing approaches, against common transformations like Contrast change, Noise addition, Rotation, Zooming, Blurring etc. Further, evaluation results also prove that our scheme is computationally efficient by supporting substantial reduction in the total computational cost up to the extent of 65% when compared to that of existing schemes.

Keywords: Content-Based Video Copy Detection, MPEG -7, Dominant Color Descriptor.

1 Introduction

The massive media consumption in terms of media streaming has increased the presence of enormous amount of video copies, which leads to huge piracy issues. Controlling the copyright of the huge number of videos uploaded everyday is a critical challenge for the owner of the popular video web servers. For example, latest survey says that users upload 65,000 new videos each day on video sharing websites like YouTube and also on an average, a viewer watches more than 70 videos online in a month [1] and the number is expected to keep growing.

In general, a video copy is defined as,a transformed video sequence, which is visually less similar and does not contain any new and important information, compared to the source video. There are two general approaches for detecting copies of a digital media: digital watermarking and Content Based video Copy Detection (CBCD). The primary idea of CBCD technique is, detecting video copies using the media itself which contains enough unique information. The purpose of any CBCD system is, when a query video is given, to find out

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the original video from which the query is taken, even if the query is modified by means various transformations. CBCD techniques can be classified into two major categories Global descriptor and Local descriptor techniques. Global descriptors like Ordinal measure [2], Color histograms [3] are compact and easy to extract, but they are less robust against region based attacks. Local descriptors like SIFT [4], SURF [5], PCA-SIFT [6] etc., use local interest points for feature extraction. The main drawback of local descriptors is generation of several hundreds of features for a single video frame, resulting in high computational cost.

Since color is one of the dominant and distinguishing visual feature of an image, in this paper, we employed a color descriptor of MPEG-7 standard [7], called as Dominant color descriptor (DCD), which extracts the representative colors of an image. The Generalized Lloyd algorithm (GLA) is the most extensively used algorithm to extract the dominant colors of an image [8]. However, GLA suffers due to following drawbacks: 1) It needs expensive computational cost, 2) It is time consuming, and 3) It mainly depends upon initial specifications like distance, number of clusters, centroid etc. In most of the CBCD systems, major challenging problem is computational cost of feature extraction and matching, because a huge video databases need to be checked. So, the main focus of this paper is to provide easily extractable and compact feature descriptors with low computational cost.The main contributions of this paper are as follows:

1. We use a new DCD extraction technique, which is easy to extract and compact (on average 12 to 20 numbers), when compared with existing color clustering techniques.
2. We present an adaptive video signature pruning method, by which the total number of video signatures of a given video are reduced by greater extent (up to 58 %).

The rest of the paper is organized as follows: Section 2 introduces the framework of the proposed scheme along with signature extraction and matching techniques; Section 3 shows the experimental results of proposed scheme, followed by the conclusion in Section 4.

2 Proposed Scheme

Figure 1 describes the framework of the proposed scheme, in which key frames are extracted from master video using the sampling method. Then for each key frame, Frequency image [9],representing the distribution of same feature pixels is calculated.Selecting R, G and B colors as three features of an image, for each pixel,the frequency of the same color pixels is calculated.Then, Dominant color descriptors of each frame are calculated by making use of frequency images. By applying simple pruning strategy to the extracted feature vectors, final set of representative dominant colors of an image are calculated and stored in feature database of video files. Whenever user presents a query video, frequency image generation and DCD extraction is performed.Finally the feature vectors are compared and the result of copy detection task is reported.