International Journal of Modern Trends in Engineering and Research
www.ijmter.com
e-ISSN No.:2349-9745, Date: 2-4 July, 2015

Analysis of Content Based Video Copy Detection using different Wavelet Transforms

Dhruva Patil[1], Vishal Rajapure[2],Sanket Shete[3] ,Dipak Thoke[4]
[1]*Department of Computer Engineering, Sinhgad College of Engineering,patil.dhruva@gmail.com*
[2]*Department of Computer Engineering, Sinhgad College of Engineering,vishalrajapure@gmail.com*
[3]*Department of Computer Engineering, Sinhgad College of Engineering,sanketshete2012@gmail.com*
[4]*Department of Computer Engineering, Sinhgad College of Engineering,dipakthoke07@gmail.com*

Abstract- With rapid advancements in digital videos, preservation and protection of the content from its misuse has become essential. The proposed system aims at a content based video copy detection, in the field of multimedia copyright issues. The experimental evaluation uses discrete wavelet transforms (DWT) as a tool based on global descriptors to obtain feature descriptors from video frames. A comparative analysis of different wavelets by using Euclidean and Canberra distance formulae for similarity search is studied for the performance of the proposed system. The detection system is validated using MUSCLE-VCD 2007.

Keywords-Content Based Video Copy Detection (CBVCD); Discrete Wavelet Transform (DWT); Feature Extraction; Global Descriptor; Similarity Search

I. INTRODUCTION

Multimedia data is burgeoning with advancements and finding an image or a video has become very easy. Such easy resource is susceptible to attacks and transformations. A video is said to be transformed if it is distorted from its original content by employing one or more alterations like blurring, flipping, resizing, color encoding, etc. Distribution of this transformed video into the public domain is a violation of the copyright of the original content's owners. The motivation behind the design of the proposed system is to accurately detect the copies of the videos from the original [1]. The current systems employ one of the two methods: Watermarking and Content Based Copy Detection for achieving the distinction of the original and transformed video[8]. As watermarking embeds extra information on the available content, it distorts the original content. As a solution to this limitation, the concept of content based copy detection is proposed. This method can be used post distribution of the video or image content. For effective copy detection in videos, a very essential concept of descriptors is used. The two approaches to descriptors are local descriptors and global descriptors[10]. The local descriptors are aimed at region specific computations of the frames of the video. The algorithms used in it are very complex in computations, require a lot of processing data and are slower in performance. The most commonly adopted local descriptors are SIFT and SURF. Global descriptors work on the entire content of the frame.

Global descriptors offer a trade-off performance and time complexity. The commonly adopted global descriptors are color histograms and ordinal measurements (OM) [7].

Discrete Wavelet Transform (DWT) has been used for the extraction of features from the video frames[6]. DWT has a key advantage of capturing information in frequency as well as time domain. It offers faster computation of data while achieving variable degrees of detail of the experimental video frames[3]. Similarity Search is adopted to identify the winning fingerprint signature from the range of the database fingerprint signatures [2]. A comparative study of the performances of different

wavelets like Daubechies, Haar, Symlet and Coiflet with Euclidean and Canberra distance formula for similarity search is aimed at understanding multiple methods to optimize the accuracy of the detection system [9].

Figure 1: Examples of database and transformation applied query videos from the MUSCLE-VCD 2007 video copy detection database. Transformations are flip, blurring and color re-encoding and frontal cam cording.

II. METHODOLOGY

2.1 Overview

Content Based Video Copy Detection (CBVCD) relies on two different tasks: Feature Extraction and Similarity Search for detection of the copies[1],[2],[5].

In Feature Extraction, the video frames are preprocessed to a grayscale format. These undergo Multi Resolution Analysis, in order to obtain feature vector of each video frame[4]. A feature vector with six feature vector components is obtained by calculating the mean and variance of the horizontal, vertical and diagonal details of the three level decomposition of each frame using the wavelet under consideration[4]. The mean and variance are estimated using (1) and (2):

$$mean, \mu = \frac{\sum_{k=1}^{n}(x_k)}{\mathrm{n}} \qquad (1)$$

$$variance, \sigma^2 = \frac{\sum_{k=1}^{n}(x_k - \mu)^2}{\mathrm{n}} \qquad (2)$$

where, *xk* is the *kth* feature component and *n* is the total number of feature components.A segment constitutes 25 frames. Representative feature vector is computed from each feature vector of a video frame in a segment. The fingerprint signature is extracted for the video from the representative feature vectors. In Similarity Search, the distance between the fingerprint signature of the query and the database side is calculated.

The distance is calculated using Euclidean distance given as (3).

$$\delta_{q,r} = \sqrt{\sum_{i=1}^{n}(q_i - r_i)^2} \qquad (3)$$

where *qi* is the fingerprint signature of the query video and r is the one from the video dataset.

Similarly Canberra distance is given as (4):

$$d(q,r) = \sum_{i=1}^{n} \frac{|q_i - r_i|}{|q_i| + |r_i|} \qquad (4)$$

where *qi* is the fingerprint signature of the query video and r is the one from the video dataset. A distance measure with the least distance occupies the foremost position while the maximum distance is occupied by the bottommost position. The database video with the least distance is returned and the video details are displayed.

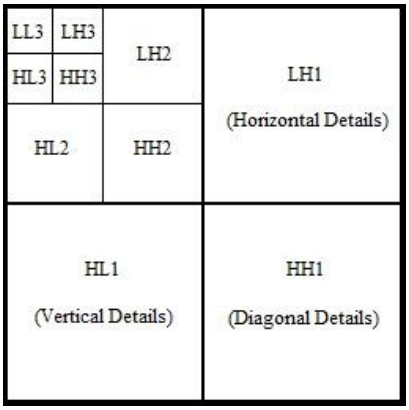

Figure 2. Three Level Decomposition

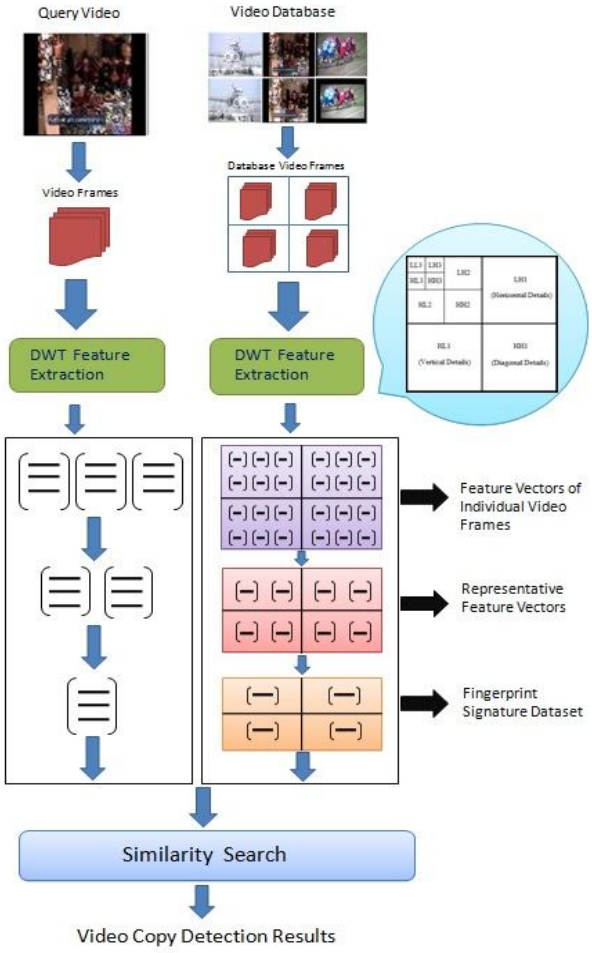

Figure 3. Block diagram of the video copy detection system

2.1.1 Evaluation Measure

The measure used to evaluate the effectiveness of the video copy detection system is given as:

a) Detection Rate (DR): It is the ratio of the total number of copied videos accurately detected to the total number of query videos.

$$DR = \frac{\text{No.of copy videos accurately detected}}{\text{Total no.of query videos}} X100 \qquad (5)$$

A 100% Detection Rate denotes the best performance of the system wherein all the video copies are detected by the system. 0% is the worst performance of the system when it fails to detect a single video copy [1].

III. RESULTS AND DISCUSSIONS

3.1 Experimental Database

MUSCLE-VCD 2007, a publicly available video copy detection database is used for the experimental evaluation. It is a video database designed for research purposes and consists of 100 hours of video data. The available videos are in the MPG format, covering an extensive range of movies, sports events, TV shows, documentaries, etc. The transformations are presented into two divisions ST1 and ST2, with a wide range of transformations like blurring, color re-encoding, resizing, flip, etc. ST1 consists of 15 queries with near duplicate copies of original videos in the database by applying one or more of the stated transformations. Total length of the ST1 videos is 2hrs 30mins. ST2 consists of excerpts of the database videos with transformations. As the principle focus of the proposed detection system is to identify videos from the database alone, only ST1 is used in the evaluation. The system is said to have detected the original video if the video from the query matches the video from the database. While the maximum Detection Rate is found to be 60%, it is obtained by using Daubechies wavelet with Euclidean distance, as well as by using Symlet wavelet with Canberra Distance formula.

Table 1.Detection Rates With Euclidean and Canberra Distance Formulae

Movie	**Wavelet Types**							
	Db4		**Haar**		**Sym8**		**Coif4**	
	Euclidean	**Canberra**	**Euclidean**	**Canberra**	**Euclidean**	**Canberra**	**Euclidean**	**Canberra**
ST1Q1	Correct	Incorrect	Correct	Incorrect	Correct	Correct	Correct	Correct
ST1Q3	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect
ST1Q5	Correct	Incorrect	Correct	Correct	Incorrect	Incorrect	Incorrect	Incorrect
ST1Q6	Correct	Correct	Correct	Correct	Incorrect	Correct	Incorrect	Incorrect
ST1Q9	Correct	Correct	Incorrect	Incorrect	Correct	Correct	Incorrect	Correct
ST1Q10	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect
ST1Q11	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect
ST1Q13	Incorrect	Correct	Correct	Correct	Correct	Correct	Correct	Incorrect
ST1Q14	Correct	Correct	Correct	Correct	Correct	Correct	Incorrect	Correct
ST1Q15	Correct	Correct	Incorrect	Incorrect	Correct	Correct	Incorrect	Incorrect
DR	**60%**	**50%**	**50%**	**40%**	**50%**	**60%**	**20%**	**30%**

CONCLUSION

Blurring and color adjustment in a video is detected by all wavelets by using Euclidean distance formula, while resizing and subtitle transformations in a video are most efficiently detected by all wavelets using Canberra distance formula. Transformations like cam cording and cropping pose a challenge to the system[1]. While the system cannot detect flip when using Euclidean distance, it is accounted for by Canberra distance formula. Thus, the results of this wavelet based video copy detection are better than the result obtained for OM9 and is equal to the result obtained for EH5 in [2].

ACKNOWLEDGMENTS

We would also like to express our deepest and sincerest gratitude to Prof. G. G. Chiddarwar, our internal guide for her dynamic and valuable guidance and keen interest in our project work. We are grateful to her for her constant encouragement in the fulfillment of the project work.

REFERENCES

[1] G.G Thampi,D.A.Chandy," Content-Based Video Copy Detection Using Discrete Wavelet Transform ",Proceedings of 2013 IEEE Conference on Information and Communication Technologies (ICT 2013)
[2] Juan Manuel Barrios, Benjamin Bustos, "Competitive content-based video copy detection using global descriptors", multimedia tools and applications-Springer, 2011.
[3] A.Kaur,J.Kaur,"Comparison of DCT and DWT of Image Compression Techniques", International Journal of Engineering Research and Development ISSN: 2278-067X, Volume 1, Issue 4 (June 2012), PP.49-52
[4] F.Arnia,A.Ifan,K.Munadi,M.Fujiyoshi,H.Kiya," Content Based Image Copy Detection On Sign Of Wavelet Coefficients", International Workshop on Advanced Image Technology 2011
[5] Hui Zhang, Zhicheng Zhao, Anni Cai, Xiaohui Xie, "A Novel Framework For Content-Based Video Copy Detection ",Proceedings of IC-NIDC2010
[6] Robles, Oscar D., et al. "Towards a content-based video retrieval system using wavelet-based signatures," 7th IASTED International Conference on Computer Graphics and Imaging-CGIM, 2004.
[7] Chen, Li, and F. W. M. Stentiford. "Video sequence matching based on temporal ordinal measurement," Pattern Recognition Letters 29.13 (2008): 1824-1831.
[8] J. Law-To, A. Joly, L. Chen, O. Buisson, I. Laptev, F. Stentiford, N. Boujemaa, V. Gouet-Brunet, "Video copy detection: A comparative study," Proc. ACM Int. Conf. Image and Video Retrieval, New York, 371–378, 2007.
[9] Sonam Malik, Vikram Verma, "Comparative analysis of DCT, Haar and Daubechies Wavelet for Image Compression,"International Journal of Applied Engineering Research, Vol.7 No.11, 2012.
[10] Xiaoguang Gu, Dongming Zhang,Yongdong Zhang,Jintao Li,Lei Zhang," A Video Copy Detection Algorithm Combining Local Feature's Robustness And Global Feature's Speed", ICASSP 2013

