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DETECTION OF INTER FRAME DUPLICATION FORGERY USING GAUSSIAN OPTICAL FLOW DISTRIBUTION

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ABSTRACT

Identifying forgery frames in videos is a crucial topic in modern digital world. In this paper, a new method of video forging based on Gaussian Mixture Model (GMM) and Optical Flow approach has been presented. There are mainly two important steps like background and foreground updating and separation. The advantage of both GMM and optical flow has been combined in this work. These two methods can complement each other and image filtering results in the successful tracking of objects. It has variety of uses such as video communication and compression, traffic control, medical imaging and video editing.

KEYWORDS: *Inter-Frame Duplication, Videos Surveillance, Optical Flow, Gaussian Model.*

1. INTRODUCTION

Earlier videos were used as the source of evidence. But, by the development of digital videos and video modifying applications, they were not as reliable as before for basic applications, for example, evidences of crimes in courts, and so on [1]. All things considered, for security purposes, video surveillance frameworks have ended up well known and keep on growing [2]. In addition, Affordable camera recorders and cell telephones with good quality cameras are enlarging. Because of advanced nature of current videos and accessibility of video editing tools, even to common individuals, these digital videos are liable to malignant controls [3].

Video forging alludes to modifying a video in a manner that progressions its contents perceptually. Video forgery techniques are divided into frame-forgery and intraframe forgery [4]. In intra-frame forgery strategies, a few sections of frame's content are expelled from or modified inside the same frame, while in inter-frame method content of other frame is being replaced [5].

Few of the work has been done in this work. There are two primary ways to deal with this issue: active and passive. In active method, for the most part a watermark is inserted into the video at the recording time. If any change will happen then the relating watermark is liable to change too. The verifier can find the watermark with a specific end goal to uncover conceivable imitations made to the video. In passive method, nothing is added or watermarked during recording [6].

In this research work, this issue will be solved by using Gaussian and optical flow combination in MPEG format videos.

This paper is organized as follows. In section 2 an overview of previous techniques description. Section 3 covers some basic concepts of the MPEG standard, Gaussian model and the optical flow. The proposed method is described in sections 4 and our experimental results are presented and discussed in section 5. Section 6 concludes the paper.

2. METHODS FOR VIDEO TEMPERING

Table 1. Previous Techniques

Author	**Technique**	**Advantage**	**Disadvantage**
Chih-Chung Hsu et. al, IEEE, 2008 [7]	Bayesian classifier	Good precision rate	Not robust for high quality videos.
Weihong Wang et. al,IEEE, 2007 [8]	Correlation coefficient	Reliable for noise	Not good for detection of small videos
Qiong Dong et. al, Elsevier, 2012 [9]	Compensated Edge Artifact	Robust in Frame based tempering.	Only some video detection is done.
Weihong Wang, Hany Farid, IEEE, 2012 [10]	Histogram	Applicable on 80% videos	Vulnerable.
Richaochen, Qiong Dong, Information technology Journal , 2012 [11]	Contourlet transform	Accuracy =95%	Complex method
Guo-Shiang Lin, Jie-Fan Chang, ICCSE, 2011 [12]	Spatio temporal analysis	Reliable	Complex
Paolo Bestagini, Simone Milani, IEEE, 2013 [13]	Video residual feature	90% accuracy	Time consuming
A. Gironi, M. Fontani, IEEE, 2014 [14]	Variation Prediction Footprint	Strong encoding method	Low reliability.

3. PROPOSED ARCHITECTURE

3.1 MPEG Standard

In 1988, ISO formed the MPEG format abbreviated as Motion Picture Experts Group with the main goal of developing high quality videos. Basically, there are four types of MPEG formats are available: MPEG-2, MPEG-4, MPEG-7, MPEG-21.

There are three types of frames available in MPEG format like I-frame (intra), P-Frame (Predictive) and B-Frame (Bidirectional-Predictive).

MPEG= $I + P + B$

Basic principles of MPEG:

- Wide array of database.
- Good abstraction level
- Object oriented

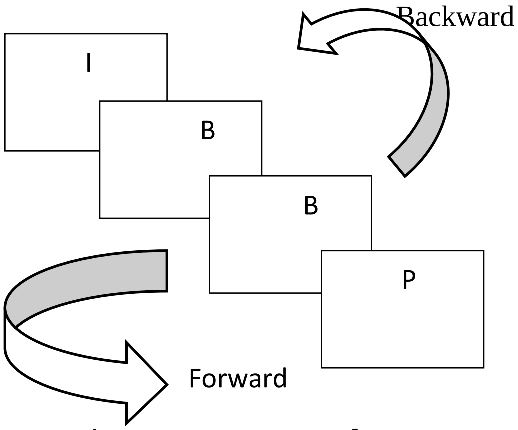

Figure 1. Movement of Frames

3.2 Optical Flow

It very important concept in video processing as well in computer vision [15]. The resultant optical flows for video motion are:vx and vy for x and y dimensions and can be represented as:

$$Vx = \frac{tz*x-tx*f}{Z} \text{ and}$$

$$Vy = \frac{tz*y-ty*f}{Z}$$

Where (x, y) tells about pixel location in a video.

F is focal length and Z is observed point.

The optical flow orientations are:

F (t, x, y) and $(tz * x - tx * f\ , tz * y - ty * f)$

3.3 Gaussian Mixture Model

It is the sum of the N components Gaussian densities and can be represented below [16]:

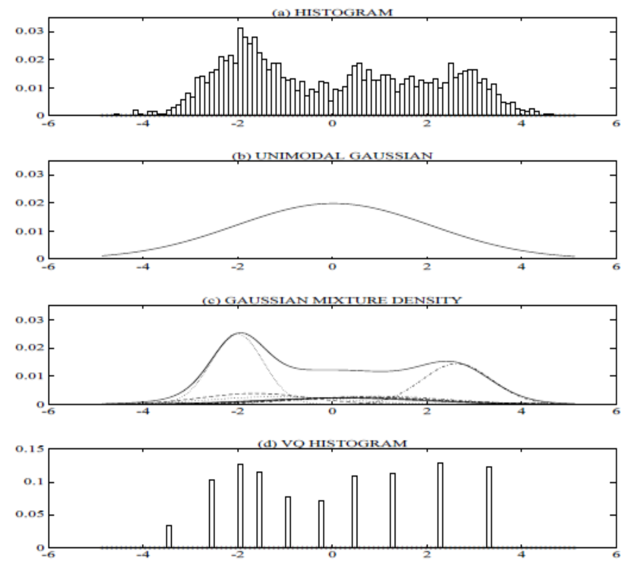

Figure 3. GMM comparison distribution model

P(c/U) = $\sum_{j=1}^{N} wj\ h(c|ij, \Sigma j)$

Where c= data vector,

N is weights,

There are several variants of GMM. GMM can also be used in biometric systems to detect forgery.

4. PROPOSED METHOD

Combine the GMM with the Optical Flow method we can obtain the results of video forgery. We have to combine the advantages of GMM and Optical Flow. One of the key tasks in a tracking system is to update the object model. In most of the tracking scenarios, the underlying image data, the object, and the scene, evolve over time in a temporal sequence. In such scenarios, the assumption of a constant object or background model over the entire sequence will lead to an impoverished tracker which cannot handle photometric differences and occlusions.

Step: 1 Select the original video.

Step: 2 Divide video in frames.

Step: 3 Analyse video using optical flow consistency and propose technique Gaussian optical flow distribution.

Step: 4 Extract the features related to the video and store it in database. Features will include frame deletion, frame insertion, frame duplication, colour consistency, change in size of video.

Step: 5 Comparison of both the techniques will be done on the basis of

1) No. of deleted video frames susceptible to be forged or deleted.
2) Accuracy on type of duplication.
3) Time required for detection.
4) Response time.

4.1 Flowchart

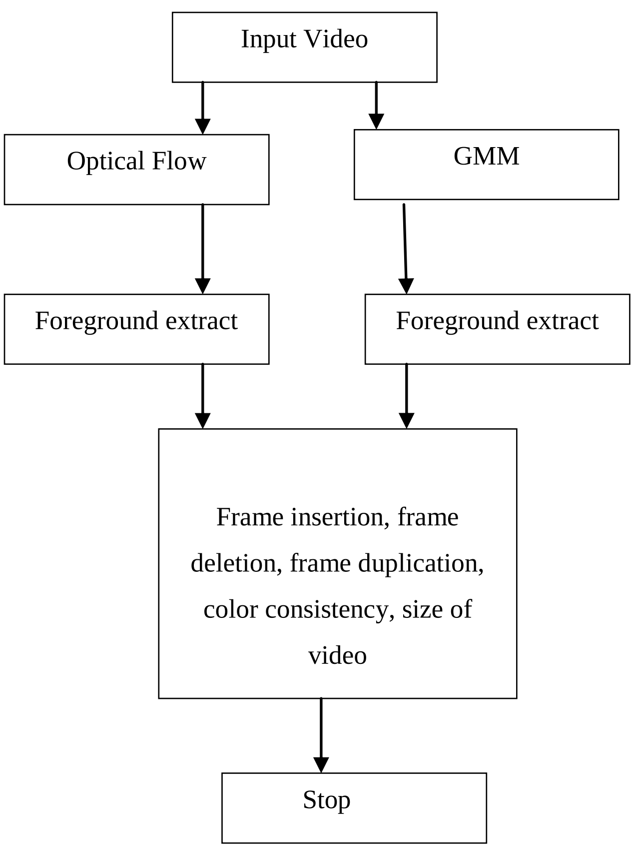

Figure 4. Proposed Work Model

Algorithm

Input: Video Frames,

Output: Video is forged or genuine?

Step 1. Divide into N video frames.

Step 2. Analyze optical flow between each two adjacent frames

Step 3. Analyze Gaussian model between each two adjacent frames

Step 4. Extract features.

Step 5. Evaluate results on basis of coefficient

Step 6. Check the video is "forged"; otherwise it is "genuine"

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5. RESULTS AND IMPLEMENTATION

In this section, we will show the experiment results.

Figure 5. Match Accuracy using Base Algorithm

The above bar graph shows the matching accuracy based on features extracted using base algorithm was .68.

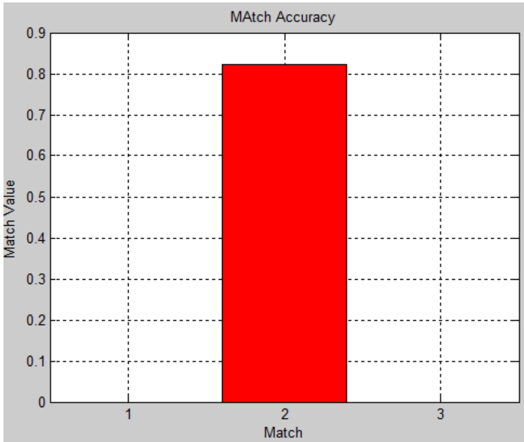

Figure 6. Match accuracy using proposed algorithm

Similarly, the above bar graph shows the matching accuracy based on features extracted using optical Gaussian algorithm is .84 that is better than base algorithm.

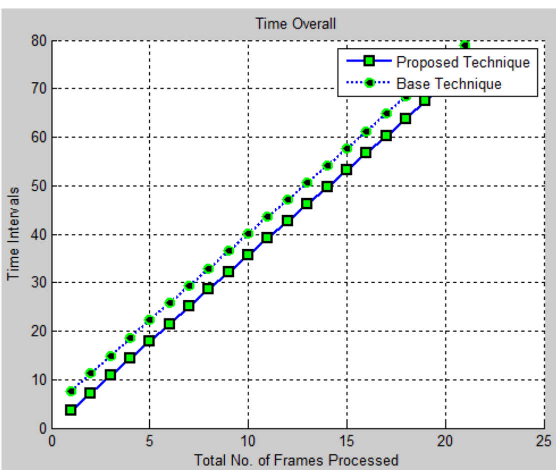

Figure 7. Overall time for proposed versus base algorithm

Above graph shows that overall time consumption to detect video forgery for base algorithm is 80ms, on the other side for proposed algorithm is 75 ms.So proposed algorithm has better results.

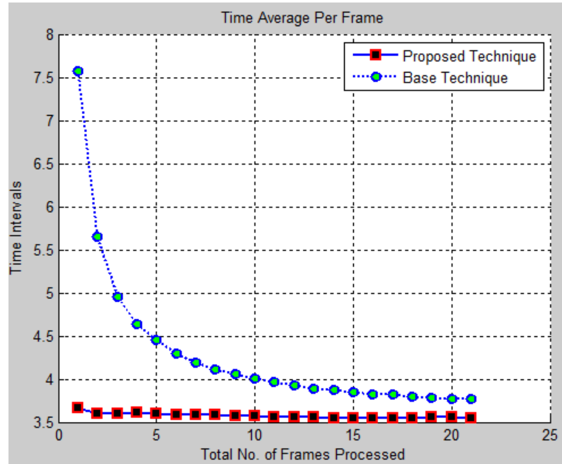

Figure 8. Average time for proposed versus base algorithm

In above graph red color is for proposed method and blue color is for base method. Above graph shows that average time consumption to detect video forgery for base algorithm is 7.5 ms, on the other side for proposed algorithm is 3.5 ms.So proposed algorithm has better results.

Table 2. Comparison Table

Parameters	*Proposed*	*Base*
Accuracy	.84	.68
Overall Time	75	80
Average Time	7.5	3.5

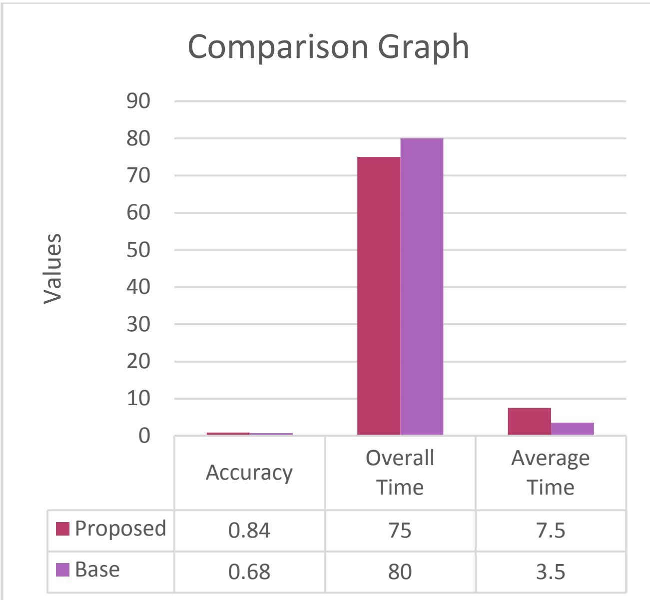

Figure 9. Comparison between proposed and base algorithm

6. CONCLUSION

Video techniques regarding duplication have been studied. All the techniques required some type of video data depending like in optical flow we require the scene change variation. Such techniques are dependent on visual similarity and structural change frame to frame but have not been tested for change in scale (change in size) and change in colour, odour for RGB videos. So we have purposed a new technique Gaussian distribution of optical flow through this I will hybridised the optical flow technique and enhance the number of feature used for referencing the duplication detection.

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