COMPARATIVE PERFORMANCE EVALUTION OF VIDEO ANALYTICS TECHNIQUES

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Abstract **:** Video processing is critical and demanding task since computations could be heavy and consume time. To tackle the issue, strategies have been scattered over the literature discussed in this paper. The propose work conducts comprehensive analysis of techniques used for video processing and provides faster results. The advantages and disadvantages of each technique is presented through comparative table. In addition, comparison of video drawn from static and moving cameras drawn through discriminating analysis. Thus propose work is threefold:1) Video processing algorithm analysis 2) Advantage and disadvantage of video processing algorithm and 3) Comparison of static and motion video capturing mechanisms. From the integrated consideration, evaluation of shortcoming and need for the modification to active research is discovered.

KEYWORDS: Video processing, static, motion videos

1. INTRODUCTION

Video processing although complex yet useful in applications like noise handling, anomaly detection. Traffic prediction, route prediction etc. Chien and Chen 2011 [1] proposed a reconfigurable morphological operation for video processing. Video involve frames and these frames almost remain the same during the scene. In case some frame goes missing, then it can be replaced by the known frame without mush distortion to the existing video. This cannot be done to the still photograph. Young and Jargstorff 2017 [2] proposed video processing mechanism using CUDA software. This software can be used in order to process video frame at great rate. Videos could be still like newscaster where motion in the frame is negligible and such videos could be processed by extracting frames without any trajectory analysis mechanism. Motion analysis within videos is much more complex. In such situations, trajectory analysis using motion estimators must be done. Figure 1 shows the processing of motion and non-motion video processing mechanism

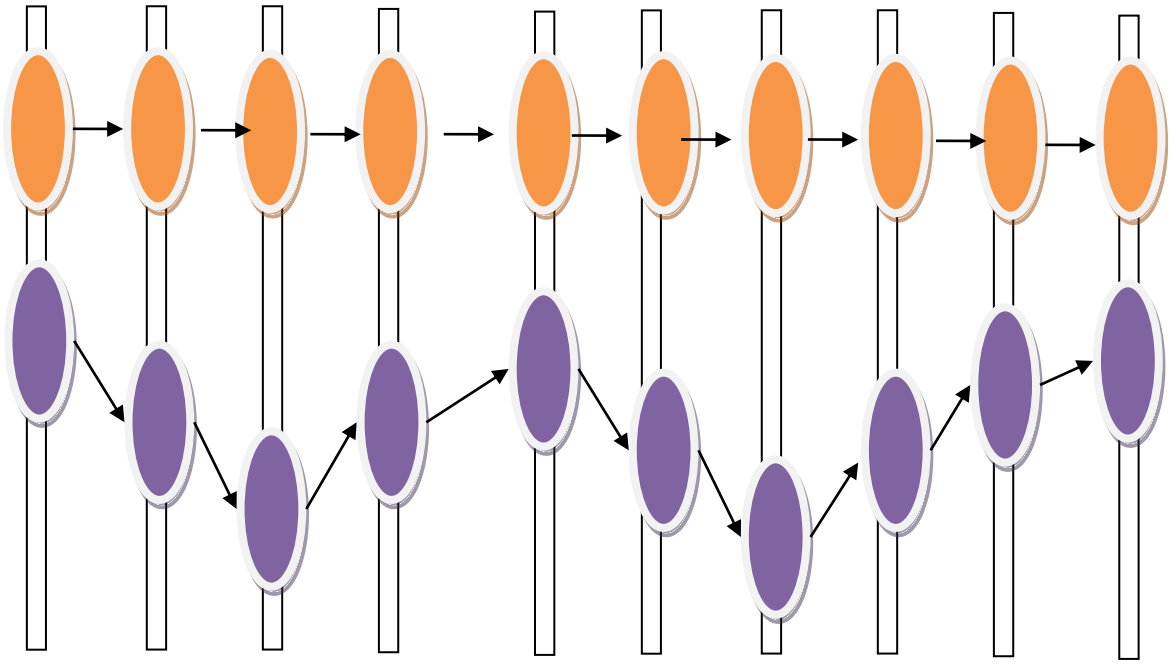

Figure 1: '1' labelled figure indicates the static video processing and '2' labelled figure indicates motion video processing based on trajectories.

Almost all the videos processing mechanisms exploit the temporal redundancy present within the video frames discussed by Mahadev A. Bandi 2016 [3]. The overall process of video processing is hampered by the motion present within the video. '1' labelled figure indicates that the pixels extracted from frames has relationship with each other but '2' labelled indicates as the motion object passes through then the relationship between the pixels is destroyed. In order to process such videos trajectory analysis mechanisms is followed.

Rest of the paper is organised as under: section 2 presents the literature of techniques used for video processing, section 3 gives the comparative analysis of all the techniques along with advantages and disadvantages of each, section 4 gives the conclusion and section 5 gives the references.

2. TECHNIQUES ASSOCIATED WITH VIDEO PROCESSING

Video processing is complex due to presence of lot of frames and information extraction requires distinct mechanisms to be collaborated along with processing mechanism. Video capturing process could cause noise propagation due to different reasons. Singh 2014 [4], Zhang et al [5] and Wang et al. 2010[6] discussed noise handling from the images. This noise could be due to transmission channel or due to the capturing mechanism. Video processing mechanism could be considered effective in case noise handling mechanism is present. This section highlight video processing mechanisms that are efficient can be used for enhancement to improve capturing result further.

2.1 Mean Framing

Ghutke 2016 [7] proposed temporal frame extraction mechanism for video processing. This mechanism is useful for motion video in which motion compensation is absent. This mechanism is capable of tackling noise from the video. Noise degradation model is listed as under:

$$G_n(x,y) = I_n(x,y) + \partial_n(x,y)$$

Equation 1: Noise degradation model

'G' indicates the observed frame gray-scale levels at distinct 'x' and 'y' positions. 'I' is the actual non degraded signals. Noise is represented with '∂'.

This mechanism is simple yet quite effective in capturing the video and eliminates noise from the image frame from video. June 2014 and Vyas et al. 2016 [8], [9]Suggested pixel intensity levels from the image vary from 0 to 255. In case this intensity intervals are violated then noisy pixel are detected and mechanism of mean framing is applied. Mean F=framing mechanism employ neighbourhood analysis to determine the intensity levels. The corrupted pixel intensity levels are replaced with the average of neighbour pixel intensity levels to eliminate the noisy section of the frame. The implementation of Mean framing mechanism is usually of the form

$$U(x,y) = \frac{1}{m}[(m-1)U(x,y) + G_n(x,y)]$$

Equation 2: Noise handling model employed in Mean framing

'U' indicates the current image frame extracted from video, 'G' indicates the current noisy image, 'm' indicates the number of pixels requires replacement to obtain corrected video frame. Problem with this approach is too much motion blurring affect introduced within the captured video.

2.2.Motion Adaptive Video Capturing

Hsia et al. 2015 [10] proposed high performance motion adaptive video capturing mechanism This mechanism is recursive in nature. Video capturing is done frame by frame in this case. Captured frames are compared against each other to obtain error if any. In case error is high, this will indicate motion. Recursive frame handling mechanism uses following equation

$$G(x,y) = G(x,y) + a\big(G(x,y) - I(x,y)\big)$$

Equation 3: Motion Adaptive video capturing mechanism

The 'a' indicates the frame size which is reciprocal of the total size of the extracted video frame. 'G' indicates the noisy frame. Error rate identify the type of frame extracted. In case this error rate is high motion video frame is extracted and value of 'a' is set close to '1'. In case high motion video frame is extracted then filtering is turned off. This mechanism hence process the video at must faster rate as compared to Mean framing mechanism. Motion detection is inbuilt into the adaption coefficient 'a'.

A small value of error rate indicates static frame and value of 'a' can be set to smaller values to allow filtering. This technique performs better in case of static video frame but shows anomalies during high motion videos.

2.3 Motion Handling Temporal Mechanism

N.Dey 2016[11] proposed motion adaptive mechanism for video processing. Motion adaptive mechanism can handle static video frame but motion handling mechanism incorporated with motion adaptive mechanism is termed as Motion handling temporal mechanism. Trajectory handling mechanism is employed in this mechanism to handle motion and filtering mechanism is included to tackle noise within the video frame. This filter is capable of handling occlusion effect. Noise levels are observed by varying the values of 'a'. Motion estimation with varying values of 'a' is given through the following equation.

$$a = f(x) = \begin{cases} -x, & DFD < \Delta \\ x, & DFD \geq \Delta \end{cases}$$

'DFD' is the displaced frame difference. This is obtained by observing the pattern of video frame along the trajectory. Values of 'DFD' is obtained using the following equation

$$DFD = G(x,y) - I\big(x + dx(x,y), y + dy(x,y)\big)$$

Equation 4: Displaced frame difference equation

In this video capturing mechanism, once motion is detected, filtering is applied. In other-words motion is handled along with noise. Image detail preservation is obtained using the said mechanism. Motion should be uniform in this approach to be estimated accurately.

2.4 Kurtosis Based Video Processing

Snehkunj et. Al [12] proposed a mechanism to tackle abnormalities form the extracted MRI image. Kurtosis based mechanism is the optical flow analyser that could be further processed in order to obtain accurate video processing model. Active pixel regions could be obtained accurately by including clipping procedure within this mechanism. True motion within each pixel could cause distortion that could be handled by using filtering and framing. Equation used for same is given as under

$$H_0 : b_k(r) = z_k(r)$$
$$H_1 : b_k(r) = u_k(r) + z_k(r)$$

Equation 5: Kurtosis based analysis model

Kurtosis is obtained by subtracting the current frame from the existing frames obtained from video. The peak value gives the value of kurtosis. In other words higher the deviation more kurtosis there will be. Kurtosis hence has to be reduced which is accomplished using varying window size. Window size is varied and adjusted according to noise level desired within captured frame sequence.

2.5 Candidate Selection Motion Estimation

Best-Rowden et. Al [13] proposed a candidate selection mechanism for face recognition. This algorithm is novel local motion based algorithm to determine the static and motion within the video frame. Candidate selection algorithm strictly employs candidate vectors at each site where motion detection is desired. This algorithm was formed under Bayesian framework to yield minimum possible estimation error. Naraei [14] proposed a mechanism to handle healthcare issues. Propagation mechanism is employed to tackle the problem of mean square error. Propagation mechanism adjusts the input vectors in order to obtain modified input in order to obtain the output which lies between the threshold limits.

Although this procedure is capable of handling motion based videos but it is slow in nature. Overhead involved in the propagation model is exceedingly high.

2.6 Local and Global Motion detection

Flevaris et. Al [15] and S. Afric [16]proposed a local and global feature extraction mechanism from videos integrated with machine learning mechanisms. Local motion detection mechanism employs local valuators and vectors that checks for the motion of object within the scene. This detection mechanism uses the static motion detector since frame changes to small extent using this model. Global detection includes detection of motion due to the camera movement. The noise handling mechanism must be integrated within such model to eliminate noise that could be present due to capturing mechanism. Temporal redundancy is explored using this modeling process.

The techniques discussed in this section correspond to static and motion video capturing mechanisms. It is discovered that motion based video capturing is more complex and requires compression mechanisms to be included to reduce complexity of operation. noise handling mechanisms must be integrated with the capturing mechanism to perform accurate estimates in case of applications like traffic prediction. Next section presents the comparative analysis of techniques for video capturing along with advantages and disadvantages of each.

.3. COMPARATIVE ANALYSIS OF TECHNQIUES USED FOR VIDEO PROCESSING

This section provides comparison of static and motion based video capturing mechanisms. Advantages and disadvantages of techniques has been disclosed that can be used to select best possible techniques for future enhancements.

Author	Technique	Parameter	Advantages	Disadvantages
Prasad et al. 2012[17]	Object detection in video processing	Noise handling	Review of techniques used to detect object from the video frame.	Motion based object detection is not conducted hence area interlacing mechanisms with noise handling is missing
Alvey et al. 2008[18]	Image quality with gated and non-gated motion based MRI image extraction	Noise handling and feature extraction from motion based image extraction	Gated and non gated environment with feature extraction of tongue motion presents unique and interactive concept	Static motion with less stress on dynamic motion thus present less accuracy in case of motion videos processing
Yeh and Semi 2015[19]	High performance processor for Video processing	Accuracy in processing of videos	High performance processor lead to faster processing of videos	Overall process of video processing is expensive
Figueroa 2016[20]	Low cost video processing mechanism using both hardware and software systems	Video processing rate	High performance processor and video processing of static video frames with noise filtering	Motion video processing with camera motion is not considered in this approach
Zlokolica et al. 2015[21]	Non linear filter for video processing	Frame processing accuracy	Non linear filter can process complex video frame	Noise handling parametric window is required to be closed in order increase the frame detection rate
Avgerinakis et al.	Video processing	Accuracy	Applications of	Only static frames

2009[22]	for judicial application	Error rate	video processing in the area of judiciary is highlighted using this literature	can be expressed and problem of camera motion is never discussed in this literature
Ikbal et al. 2016[23]	Video Watermarking using discrete wavelet mechanism	Accuracy	Security achieved through video watermarking is described through this literature	No filtering mechanism to tackle noise within the video frames is discussed
Moss et al. 2016[24]	Modern Video content monitoring system	Content monitoring rate	Modern video content monitoring that could be used to block certain contents could be useful for children	Monitoring does not includes any filtering mechanism that could improve overall process of content monitoring
Wee et al. 2015[25]	Compressed domain video processing	Compression ratio	Video processing could be complex due to length of the video. This literature simplify the approach by compressing the videos and then performing analysis	Compression may lead to loss of useful information from the video itself.
Chauhan and Tarar 2016[26]	Video analysis for traffic monitoring	Prediction Accuracy	Traffic monitoring using video processing could lead to low congestion	Filtering mechanism is missing in the discussed literature
Seth 2017[27]	Rosenfeld equivalence table algorithm	Position identification	Object identification with great accuracy is achieved	Filtering mechanism if collaborated with this approach, then markers can be placed with great accuracy
Kelly 2006[28]	Fast processing mechanism using GPU	Processing speed	Video processing with great speed using GPU is achieved	This procedure is expensive and cannot be employed for simple applications
Murray et al [29]	Automated video processing for visual analysis	Accuracy	Analysis of cracked region of surface is accurately done using this mechanism	Filtering mechanism description along with motion video processing is not given
Lim 2015[30]	High performance video processing using CMOS	Speed of video processing	Complementary metal oxide semiconductor used for high performance video extraction	This mechanism could have been better in case noise handling mechanism is collaborated with this mechanism

Table 1: Comparison of techniques used for video processing

The pie chart demonstrating the distinct techniques used within background analysis are given as under

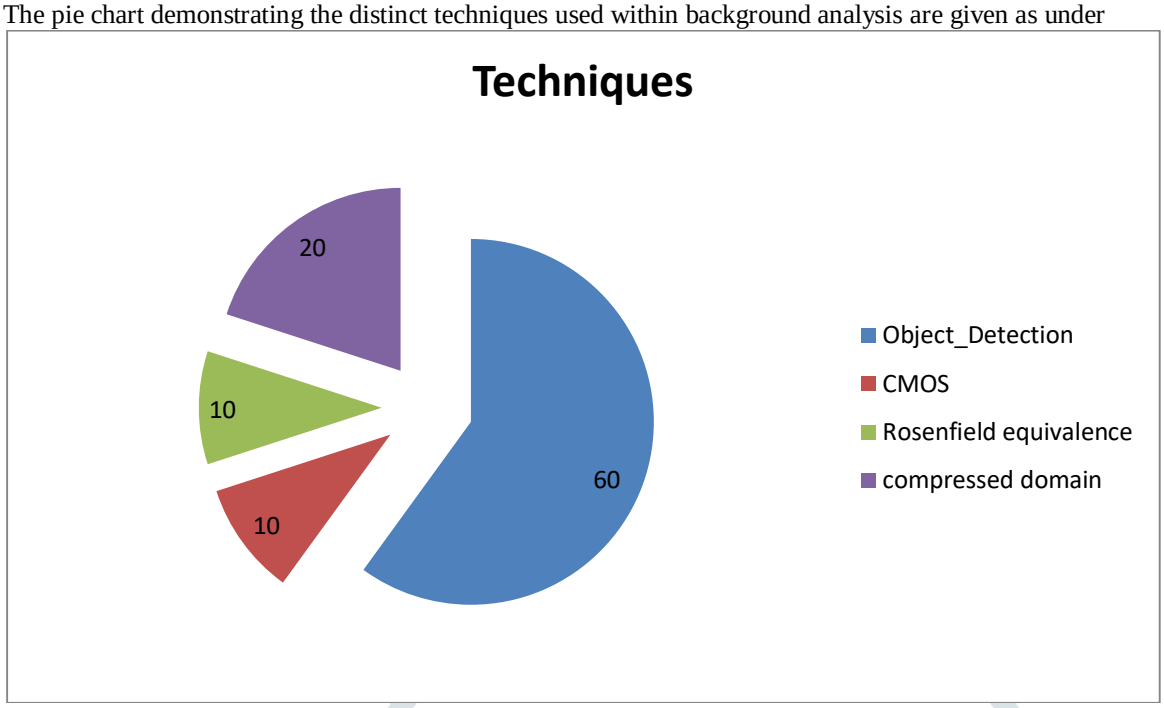

Figure 1: techniques used within background analysis

3. CONCLUSION AND FUTURE SCOPE

The proposed work extract the information from the literature studied about the techniques used for video processing. Static video processing mechanisms are analyzed along with motion based video processing mechanism. It is concluded that static mechanisms used for video processing are simplified since frames does not show much deviation and even in case of missing frames accuracy can be achieved by replacing the absent frame with neighboring frame. In motion based video processing mechanism, trajectory has to be analyzed. This is much more complex as compared to static video frame processing mechanism. In studied literature with motion based video processing, filtering mechanism is missing.
In future, filtering mechanism with motion based filtering to achieve better quality of extracted frame can be proposed.

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