A Motion Detection Approach to Generate the differential Time Lapse Video in Real Time Application

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ABSTRACT
Most of video recording posses the redundant information which does not require to be recorded, actual information to be record is very less as compared to information present in normal video. A differential time-lapse technique allows us to remove the unnecessary data from the normal video, in order to save the time to visualization and storage space. Differential Time Lapse Video is non-periodic time lapse technique. In differential time lapse video, each frame are compared with previously last stored frame, If some information/movement is found in the frame than frame is stored and considered as last stored frame, else frame is discarded. The differential time lapse video can be generated by pixel-to-pixel bit mapping technique, motion detection technique, edge comparison technique etc. In this paper we implement the motion detection criterion as frame selection criterion to generate differential time lapse video in real time application. The analysis of moving objects is done by detection of variations in intensity over time in the environment Here we are concerned with determinist modeling that is images difference, to detect the moving objects masks. The MATLAB based algorithm is used to generate differential time lapse video where frame selection criterion is motion detection technique.

Keywords
Differential Time Lapse Video, motion Detection, image difference,

1. INTRODUCTION
Time-Lapse is an effective tool for visualizing motions and processes that evolve too slowly to be perceived in real-time. Time-Lapse videos are regularly used to capture natural phenomena and to provide artistic cinematic effects. Time lapse technique is a cinematography technique whereby frames are captured at a rate much slower than it will be played back [1]. The live streams of frames are captured, by the camera connected to the system. MATLAB directly can access these live streams of frames. Periodic Time Lapse Video can be generated by sampling the live frames at regular rate. Periodic Time Lapse Videos are useful to show effectively natural phenomenon only. In order to show non-natural phenomena effectively, a special type of non periodic time lapse Video, namely differential time lapse video can be used.

A differential time lapse video can be generated by the arranging the different frames/photograph in specific order, captured by the capturing device in the video file [1][3]. Previously the work has been done on the pixel to pixel bit mapping technique and edge detection algorithm to generate the differential time lapse video. The pixel to pixel bit mapping algorithm have the drawback that the effect of brightness and contrast is also considered for the frame selection because it changes the intensity of the pixels at the same time change in brightness and contrast does not provide any useful information above the motion of the object. This limitation can be overcome by the edge detection algorithm in which the frame selection is solely depends on the difference in the edges of the successive frames and it is clear that change in the brightness and contrast can not affect the edges of the frames. But the in terms of processing time the edge detection algorithm is slow because detecting and comparing the edges will consume more time.

In this paper the motion detection approach is consider to generate the differential time lapse video. In this the first frame captured is stored in the video file. The next frame is captured and difference between these two frames is calculated. If the no of pixel having intensity value greater than the particular threshold exceeds the predefined threshold than that frame is considered to be stored in to the video file otherwise it will be discarded. The selected frames are date and time stamped using visual lossless watermarking technique [1] [6].

The motion segmentation of image sequences is based on visual motion perception. This does not depend on prior interpretation or recognition of shape and form. However, it does depend on motion information (spatiotemporal object-environment relations) [2].

There are different methods for the estimation of the motion parameters these methods are like images difference, maximum likelihood detector and Markov random field model In this paper we considered image difference method to find out the whether the motion is present or not in the successive frame

2. MOTION DETECTION TECHNIQUES
The motion can be detected by the three different techniques explain below

A) Detection by image difference: To be able to detect the temporal change of the intensity I at the pixel (p, t), we must be interested in the temporal difference or we can say the frame difference (FD) between two images at the time t and t-dt where dt is the temporal sampling step [2];

$$\forall p FD(p,t) = I(p,t) - I(p,t-dt) \dots\dots\dots\dots (1)$$

We can detect the changes as moving areas generally called the masque by the simple thresholding define by

$$\forall p\ CT(P) = \begin{cases} 1, & si\ FD(p) \geq \lambda \\ 0, & Other\ wise \end{cases} \dots\dots\dots (2)$$

Where λ the fixed threshold is follows the thresholding procedure which depends upon the type of application.

3. DETECTION BY IMAGE DIFFERENCE

The technique of motion detection by frame difference is represented by the two basic equations that is equation 1 and 2. To easily understand this method we will apply it to the non real time video. Performance of this technique is evaluated with the help of already available rhinos video file, which is in non compressed avi format, have frame size of 240x320 and total no. of frames is equal to 114. To obtain the better result here the frames are first captured and converted in gray scale image than the motion detection technique is applied. Consider 1st and 10th frame of the video which are shown in the figure 1 and 2 respectively. Figure 3 shows the difference between these two frames, obtained by applying the image difference technique.

This result contains type of Gaussian noise and has to be removed to achieve the better results. It can be remove by filtering process. The filter used here is the adaptive filter.

From the figure 4 we can easily interpret that the area encircled by the red line is the difference found in between the frame no.1 and 10. From figure we can see that intensity of the pixels present in encircled area is higher than the pixel present out of this area. Let's define these pixels as a HP (high intensity pixel), these pixels represents the motion. Define the pixels present out of these area as LP low intensity pixels which are having same information as the previous frame.

If we take the average of intensity value of these high intensity pixels, we can easily define one threshold, Let's define that threshold as the PIT (pixel intensity threshold). It simply means that the pixel is considered as the informative if it exceeds PIT. If the intensity of the pixel is above or equal to the PIT then only that pixel is consider as having the relevant information otherwise that pixel is discarded. If the no. pixel of difference frame having intensity value greater than the PIT exceeds some predefine threshold than the present frame is considered as containing the difference in motion. Let's consider that predefine threshold as the FST frame selection threshold.

The value of the PIT and FST is totally depends upon the type of application for which we are applying this method. For example the value of thresholds are high for the crowded area and while values are less for the opposite case. In method proposed in this paper, considers change in motion of object as well as change in surrounding / environment as the information.

4. GENERATION OF DIFFERENTIAL TIME LAPSE VIDEO

The figure 5 shows the simplified algorithm to generate the differential time lapse video using the motion detection technique. In this the first frame is captured and stored in to the video file also it's converted in to the gray scale image. Then the next frame is captured and converted in to the gray scale image. In the third step the motion is detected in between these two frames by the frame difference method. In fourth step we will find out the how many no. of pixels exceeds the pixel intensity threshold and define that pixel as the HP.

If the total no. of HP exceeds the FST frame selection threshold then only the present frame is considered to store in to the video file else discarded. Ones the frame get selected it will be send for the date and time stamping because the differential time lapse video is non periodic technique it does not provide any information about time at which the frame is captured.

Figure 1: 1st frame of the video.

Figure 2: 10th frame of the video.

Figure 3:difference frame

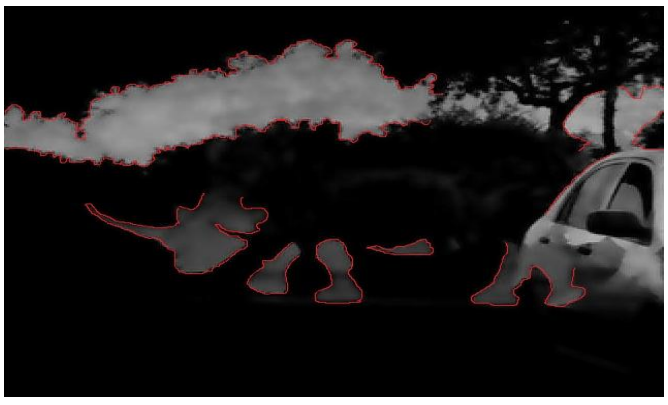

Figure 4: difference frame after removing noise

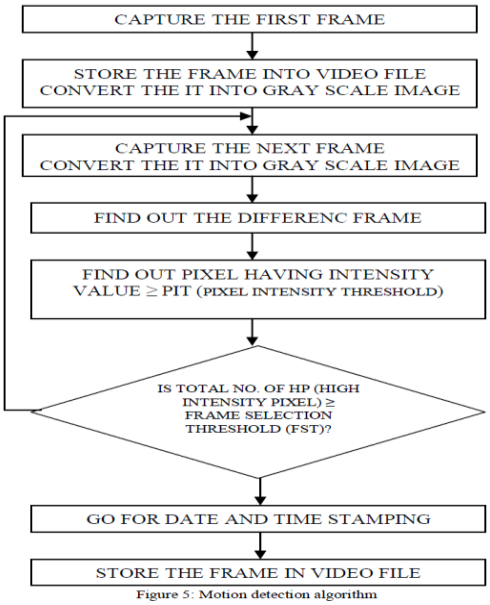

Figure 5: Motion detection algorithm

5. RESULT

The no of frame selected will totally depends upon the value of the PIT and the FST. To illustrate this we apply the same technique in non real time. Here rhinos video file, which is in non compressed avi format, have frame size of 240x320 and total no. of frames is equal to 114

Here frame selection ratio is

F.S.R = No. of selected frames / Total no. frames

TABLE NO.1
CASE-I KEPING VALUE OF PIT CONSTANT=100

FST	NO. OF FRAME SELECTED	FRAME SELECTION RATIO (%)
1000	100	87.71929825
1500	86	75.43859649
2000	66	57.89473684

TABLE NO.2
CASE-II KEPING VALUE OF FST CONSTANT=1000

PIT	NO. OF FRAME SELECTED	FRAME SELECTION RATIO (%)
75	114	100
100	100	87.71929825
125	39	34.21052632

From table no. 1 and 2 it is clear that as we increases the values of PIT and FST the no. of frame selected will be less. In real time the values of these two threshold will be depends upon the application for which we are using this technique. For real time application value of PIT should be kept near about 98 to avoid the selection of the non informative pixels and value of FST will depends upon the how large motion we want to detect.

6. COMPARISION WITH EDGE DETECTION ALGORITHM

The comparison of both algorithms can be possible in non real time only so again we consider the same rhino avi discussed earlier. Here for the edge detection canny operator is used, reason is it uses the double thresholding method hence the weak edges can also be detected. The comparison of the algorithm should be done on parameter, processing time.

It can be seen from table no. 3 and 4 that the processing time required to select the same no. of frames in edge detection technique is more as compare to the motion detection (detection by frame difference).

7. CONCLUSION

The quality of the differential time lapse video file generated in real time depends on the two major criterions:

TABLE NO.3 EDGE DETECTION TECHNIQUE

OPERATOR	THRESHOLD	NO. OF FRAME SELECTED	FRAME SELECTION RATIO (%)	PROCESSING TIME (SECONDS)
CANNY	1000	114	100	12.890207

TABLE NO.4 MOTION DETECTION TECHNIQUE

PIT	FST	NO. OF FRAME SELECTED	FRAME SELECTION RATIO (%)	PROCESSING TIME (SECONDS)
75	1000	114	100	11.523476

1) Frame selection and 2) processing time for frame selection and process to store or discard.

The limitation of edge detection technique is processing time, it requires more processing time because to detect and compare the edges is the complex function. This limitation can be overcome by the motion detection technique. Hence to generate the differential time lapse video motion detection technique should be preferred as compare to pixel to pixel bit mapping and edge detection technique.

The detection by frame difference method is good in the computing time but gives the noisy masks of the moving area. However the major portion of this noise can be removed by the filtering process.

8. REFERENCES

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